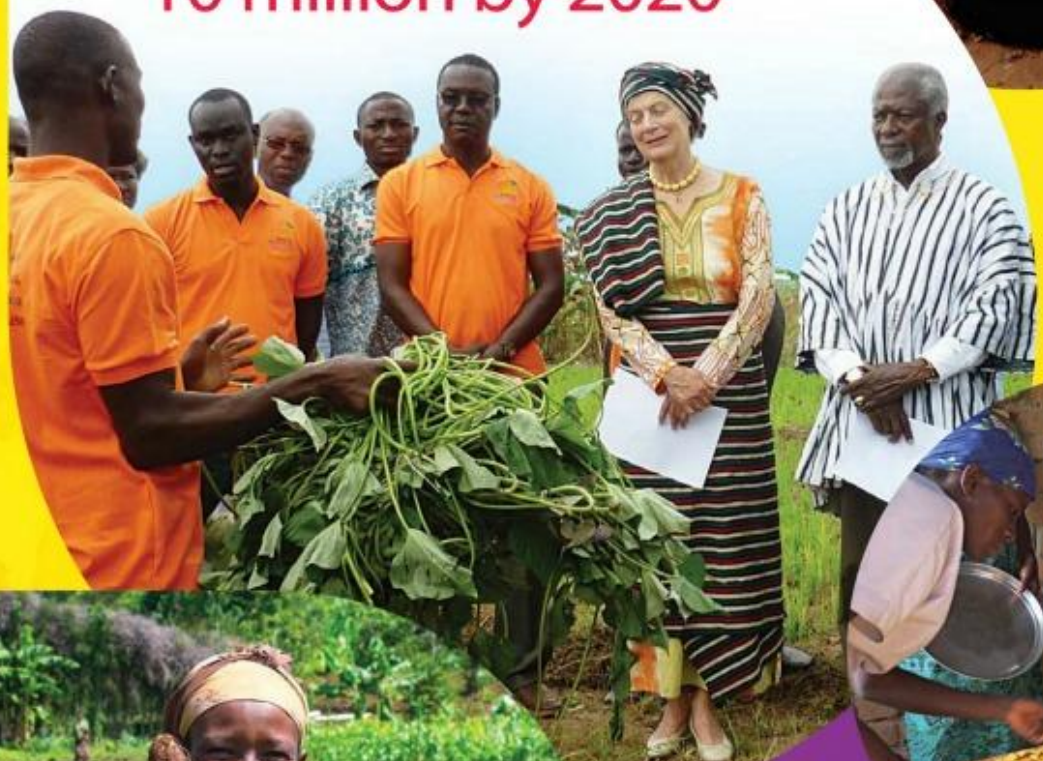
SPHI

Together...
10 million by 2020

2015



MEETING REPORT

TABLE OF CONTENTS

LIST OF TABLES

TABLE OF FIGURES

Acronyms

ABS	Accelerated Breeding Scheme
AGRA	Alliance for a Green Revolution
ANC	Antenatal Clinic
ARSIS	Agricultural Remote Sensing Information System
ARSP	Agricultural Remote Sensing Platform
AYR	All Year Round
BMGF	Bill & Melinda Gates Foundation
CBO	Community-Based Organizations
CHW	Community Health Worker
CIP	International Potato Center
CoPs	Communities of Practice
COVA	Nested Cohort Study
CPPDM	Crop production, pest and disease management
CRI	Crops Research Institute
CRS	Catholic Relief Services
CSIR-SARI	Council for Scientific and Industrial Research-Savanna Agricultural Research Institute
DEFRA	Department for Environment, Food and Rural Affairs
DFID	Department for International Development
DVMs	Decentralized Vine Multipliers
FARA	Forum for Agricultural Research in Africa
FBO	Faith Based Organizations
FCI	Farm Concern International
FGDs	Focus Group Discussions
HKI	Helen Keller International
INERA	Institut de l'Environnement et Recherches Agricoles
IYCF	IYCF
KEBS	Kenya Bureau of Standards
LZARDI	Lake Zone Agricultural Research and Development Institute
MET	Multi-environmental trial
MLE	Monitoring, Learning and Evaluation
MPU	Marketing, Processing and Utilization
NCSU	North Carolina State University
NDVI	Normalized Difference Vegetation Index
NIRS	Near Infrared Spectrometer
NRCRI	National Root Crop Research Institute
NRI	National Resources Institute
OFSP	Orange-fleshed Sweetpotato
PAC	Project Advisory Committee
PCD	Partnership for Child Development
PCR	Polymerase Chain Reaction
PD/H	Positive Deviance Health
RAB	Rwanda Agricultural Board
REFSO	Rural Energy and Food Security Organisation
SASHA	Sweetpotato Action for Security and Health in Africa

SARI	Southern Agricultural Research Institute
SeFaMaCo	Seed Farmer Market Consumer
SEM	Scanning Electron Microscopy
SEMaD	Seed Marketing Enterprise Development
SHF	SEMaD
SME	Small and Medium Enterprises
SPCSV	Sweetpotato Chlorotic Stunt Virus
SPHI	Sweetpotato for Profit and Health Initiative
SPMMV	Sweet Potato Mild Mottle Virus
SPVD	Sweet potato virus disease
SSCM	Seed Systems and Crop Management
TARI	Tigray Agricultural Research Institute
TEM	Transmission Electron Microscopy
TOR	Terms of Reference
UAV	Unmanned Aerial Vehicle
UDS	University for Development Studies
USA	United States of America
USAID	United States Agency for International Development
YWCA	Young Women Christian Association
ZARI	Zambia Agricultural Research Institute

Extended Summary

The **6th Annual Sweetpotato for Profit and Health Initiative SPHI) meeting** took place from 29 September and 1 October 2015 in Kigali Rwanda. The theme of the 2015 meeting was 'Together, 10 million by 2020'. This refers to the overall goal of the Sweetpotato for Profit and Health Initiative which is to reduce malnutrition and increase incomes among at least 10 million sub-Saharan African households through improved varieties of sweetpotato and their diversified use by 2020. The meeting was attended by 104 participants (scientists and experts, government representatives, academics and donors from the agriculture, nutrition and development communities) from across sub-Saharan Africa, Latin America and North America. They presented and discussed progress in sweetpotato science and delivery along the entire sweetpotato value chain, showcased innovations and impact case studies in agriculture, nutrition and health innovations and outlined the state of sweetpotato investment in sub-Saharan Africa.

Welcome remarks and introductions: In his welcome, **Hans Adu-Dapaah**, the outgoing Interim Sweetpotato for Profit and Health Initiative (SPHI) Steering Committee Chairperson gave a brief introduction of the initiative and introduced SPHI committee and the Sweetpotato Action for Security and Health in Africa (SASHA) Project Advisory Committee (PAC) members.

Measuring genetic gains in applied sweetpotato breeding programs: More than one way to peel a sweetpotato: Maria Andrade's presentation on genetic gains took participants through the meaning, basis and implications of genetic gains, ways to increase genetic gains, and recurrent selection in Accelerated Breeding Scheme (ABS) adapted in Mozambique. She outlined the achievements that Mozambique has made in variety releases, and the approaches taken at the platforms in Mozambique, Uganda, Ghana and CIP headquarters to predict and measure genetic gains for key attributes in breeding. She also presented results of the proof of concept for heterosis and outlined some perspectives for the future of sweetpotato breeding.

Practical approaches to the systematic exploitation of heterosis in sweetpotato breeding – how far? Robert Mwanga explained the meaning of heterosis and heterotic increments and outlined some of the work that has already been published on this subject. He briefly reviewed heterosis breeding studies at CIP over the past 10 years, and presented current thinking on strategies for the way forward. He described in detail the activities that have been undertaken to separate populations into heterotic groups for practical exploitation of heterosis in African breeding populations at the regional sweetpotato breeding support platforms in Uganda, Mozambique, and Ghana.

Factors affecting women's participation in sweetpotato vine marketing, marketing of fresh sweetpotato roots and processed products in Phalombe and Chikwawa districts in Malawi: Netsayi Mudege presented findings of the abovementioned study that used a social relations approach, to determine factors that affect women's participation in sweetpotato vine marketing. The study was undertaken under the umbrella of the Irish Aid funded Rooting Out Hunger in Malawi with Nutritious Orange-Fleshed Sweetpotato Project. Her presentation examined the commercialization of sweetpotato vines, sweetpotato fresh root markets and marketing of sweet potato processed products in Malawi from a gender perspective.

Rwanda Super Foods Project: Key findings from the endline survey: Kirimi Sindi made a presentation on the Rwanda Super Foods project, which was a four-year proof-of-concept project implemented in Gakenke, Rulindo, Muhanga and Kamonyi districts of Rwanda with the support of the Bill & Melinda Gates Foundation. This presentation focused specifically on the findings of the endline survey of the project, which was carried out in September, 2014, as well as the major lessons learnt and how they have influenced the design of similar projects.

Performance of the OFSP chain in Mukono District, Uganda: Sarah Mayanja made a presentation of a study that sought to analyse the dynamics that influence the performance of the OFSP chain in Mukono district, Uganda. Specifically, it aimed to: characterize the chain, assess factors that influence farmers' decision to

participate in the market and evaluate constraints faced by OFSP farmers. A cross-sectional study was done and data were collected from 123 farmers, 37 traders, 24 consumers, and nine key informants.

Sweetpotato value chain and market analysis in Burkina Faso: Ibrahim Koara presented the work that is being undertaken by iDE Burkina Faso and Institut de l'Environnement et Recherches Agricoles (INERA), in partnership with CIP's Jumpstarting OFSP in West Africa through Diversified Markets project. INERA focuses on developing sustainable commercial seed system, while iDE's activities focus on market development and drip irrigation for vine multiplication. iDE, is working on sweetpotato and there was the need to first understand the market through a value chain and market analysis. Koara's presentation focused on this analysis that was undertaken in Kénédougou province, where the project is being implemented.

Engineering weevil resistance in sweetpotato to benefit farmers in Africa: **Marc Ghislain** updated participants on the progress made in engineering weevil resistance in sweetpotato, and detailed specifically the progress that is being made towards a situation where a combination of *Bt* and *RNAi* technology could be successful and durable to engineer weevil resistance into sweetpotato. He also raised awareness on the findings of research that showed that consumption of undamaged parts of damaged storage roots exposed consumers to a highly toxic compound.

The Genomic Tools for Sweetpotato Improvement Project - GT4SP: According to **Craig Yencho's** presentation, if yield was improved in the sweetpotato growing areas, then the SPHI goal of 10 million by 2020 could be very realistic. Yencho presented the development of sweetpotato production in USA and Africa, highlighted the ongoing work to improve production and the challenges that still have to be addressed. He highlighted the focus areas, goals and progress in breeding work in sub-Saharan Africa and introduced the Genomic Tools for Sweetpotato Improvement Project, which is an ambitious project to sequence sweetpotato and develop modern breeding tools for the food crop.

DNA viruses of sweetpotato: Harmless co-inhabitants or unseen ravagers: **Jan Kreuze** presented some results from a study on next generation sequencing (frequency of viruses). The team screened for begomoviruses (329 genotypes from Latin America and 65 genotypes that came through Uganda). 92% of all material collected was affected by one or more viruses. He explained the need for further investigation into begomoviruses, which could cause high yield losses, as well as badnaviruses, which occur in extremely low titres and do not seem to have any impact on yield, but which could be academically interesting to investigate.

Assessing virus degeneration of clean sweetpotato planting materials multiplied in insect-proof net tunnels under farmer management: The Kinga Marando project, whose work **Kwame Ogero** presented, is piloting the use of low cost net tunnels to help protect vines from whiteflies and aphids, the disease vectors. The project is implemented in Kagera, Mwanza and Geita regions in the Lake Zone, Unguja in Zanzibar and in Uganda. The study seeks to determine the rate of virus degeneration of clean sweetpotato planting materials multiplied in insect-proof net tunnels as compared to planting material multiplied in open fields over a period of two years under farmer management. Ogero presented the methodology, timelines and results of the study.

Chitosan improved *in vitro* growth, leaf ultrastructure and acclimatization of micropropagated sweetpotato: This study was presented by **H.C. Mihiretu.** The objectives of the study are to explore the different bioactivity of *in vitro* applied chitosan on i*n vitro* growth performance, leaf ultrastructure, and contamination rates and outside acclimatization of sweetpotato plant. Mihiretu detailed the design and findings of the study, and concluded with recommendations to supplement 15 to 30 mg l^{-1} of chitosan in the growth media for improved production of sweetpotato planting material through tissue culture techniques.

Developing good post-harvest practice and storage facilities to facilitate the all-year round supply of OFSP: **Andrew Marchant** spoke about a study of the value chain and post-harvest operations to determine the economic constraints to effective All Year Round (AYR) supply, the post-harvest handling issues that affect storage, and storage trials. He presented a review of the supply situation in Kenya, the benefits of storage, work undertaken on harvesting, post-harvest losses and current progress on storage.

The effect of different storage conditions, packaging and preservative treatment on the OFSP puree quality: **Tawanda Muzhingi** highlighted the case against OFSP flour and presented highlights of ongoing research on OFSP puree storage, which is being undertaken in Kenya. The study considers factors such as packaging (normal and vacuum packaging); preservatives (chemical preservatives *potassium sorbate and sodium benzoate*); MaySa (a*ntifungal and antibacterial natural preservatives);* genotype (Vita and Kabode) and temperature: Room (Nairobi, Kenya - 15-25°C). He presented preliminary findings and emphasized that the research was in progress, and advanced statistical analysis would determine the differences in beta-carotene content by preservation treatment and packaging.

Sweetpotato research at the Natural Resources Institute (NRI): NRI has worked on sweetpotato for several decades. **Andrew Westby** presented the ongoing work. The electronic sweetpotato is a device that resembles a sweetpotato and has a sensor that is supposed to look at where the damage occurs during marketing. He also shared experiences of OFSP Marketing in Mozambique and Uganda; work to commercialize clean sweetpotato seed production in areas with a long dry season; a project investigating and promoting the role of mobile phones in vine selling; and research to develop sweetpotato varieties that are resistant to sweetpotato weevil.

UAV-based remote sensing as a monitoring tool for smallholder farming: The potential of satellite remote sensing in gathering crop statistics data has been demonstrated, but associated costs are also prohibitively high and the data quality is often negatively affected by clouds. **Elijah Cheruiyot** presented the Agricultural Remote Sensing Information System (ARSIS) "proof of concept" project, whose objective of this project is to use Unmanned Aerial Vehicle (UAV)-based remote sensing technologies to provide a lower cost means of gathering, processing and interpreting adequately accurate and timely crop statistics data at a large scale with minimal effect of clouds. He highlighted that whereas the fusion of fine resolution UAV data with lower resolution satellite data had the potential of increasing availability of data, the method was yet to be tested with crop distribution.

Maternal nutrition outcomes in an integrated agriculture, health and nutrition program in western Kenya: Mama SASHA was a 5 year integrated program that sought to answer the question "can linking vitamin A rich sweet potato to existing health services improve maternal and child nutrition? The project was implemented in eight facilities which were purposively drawn from the larger pool of health facilities in Busia and Bungoma counties and randomly allocated to either control or facility. **Frederick Grant** presented the findings of the evaluation of this project which looked at population level on child nutrition, individual level impacts on maternal and child nutrition, and cost-effectiveness of the intervention.

Orange sweetpotato feeding the future: HarvestPlus Uganda has a challenge to harmonize the M&E systems of the three main partners: USAID, HarvestPlus Global and Feed the Future . **Ignatius Abaijuka** explained how HarvestPlus Uganda has developed its M&E system to ensure generation of high quality M&E data for decision making. He outlined the core components of the M&E process, the data collection and analysis tools, types of stakeholders, current challenges in harmonizing M&E and the future plans to address these challenges.

Orange-fleshed sweetpotato in the school feeding program of Osun State, Nigeria: conception, inception and inclusion: Sweetpotato for health and wealth in Nigeria and Jumpstarting OFSP in West Africa for diversified markets are two projects that focus on development of the value chain for health and wealth of the rural households in Nigeria, working in Osun and Kwara states. Out of search for OFSP demand at the formal sector, inclusion in the school feeding menu was conceived. **Olapeju Phorbee** presented the stages of inception, advocacy and sensitization that resulted in the inclusion of OFSP in the School Feeding Program in Osun State. She gave highlights of the results of the rapid assessment surveys that were carried out in some of the pilot and control schools on acceptance of the meal.

Community of practice panel discussion: Within the SPHI, there are four communities of practice on (i) breeding and genomics; (ii) seed systems and crop management; (iii) monitoring, evaluation and learning; and (iv) marketing, processing and utilization. Almost all participants of the SPHI 2015 are members of one or

more CoPs. The discussion was facilitated by **Margaret McEwan**. It had two rounds of questions and distributions from the leaders of the CoPs, based on contributions from their members. This was followed by plenary contributions from participants, and a knowledge management perspective. Finally a wrap-up was done, in which the leaders stated what they would take back to their CoPs.

Commercial sweetpotato production methods in South Africa: **Jacobus Risseeuw** and his brothers_run a commercial sweetpotato production business called Risseeuw Boerdery in Limpopo South Africa. Based on his experience, he outlined the principles of running a successful business, and then shared his experiences and factors that influence successful sweetpotato production. This included an outline of all the stages that are taken from soil preparation, right up to marketing, and post-sales analysis to improve management practices. He also gave examples of the challenges encountered in large-scale sweetpotato production and how his company was addressing them.

Seed Farmer Market Consumer, SeFaMaCo: **Antony Masinde** explained the SeFaMaCo model that is meant to connect the players from the seed level to the farmer, market and consumer level. He outlined the progress made by the project, which is entitled 'Integrated value chain development and smallholder farmer commercialization of banana and sweetpotato for Tanzania, Uganda & Ethiopia based on a Seed-Farmer-Market-Consumer Model'. The presentation focussed on work done in breeding to develop improved varieties and access to clean planting material; move smallholder farmers from subsistence to commercial production; create efficiency in informal markets and other markets; and promote an agri-investment network.

Integrating orange in Zambia: Farmer-to-farmer linkages to sustain access to a vitamin A rich food that earns income: **Felistus Chipungu** presented the objectives and achievements of the project that was implemented by CIP in Zambia from 2011-2015 and funded by the USAID-Feed the Future initiative. The general purpose of the project was to (a) contribute to increased frequency of intake of vitamin A rich foods, especially of women and children under five years of age; and (b) improve overall household food security and diet diversification through dissemination of OFSP. Activities included variety development and release, and vine dissemination. She concluded by outlining the way forward after the project's end.

Participatory radio: specific style of radio that goes over a 4 month period: Farm Radio International (FRI) uses participatory radio campaign methodology, that **Karen Hampson** explained**,** is a proven concept that when used has shown that people in listening communities are five times more likely to take up a practice featured in the campaign. Apart from elaborating on the methodology, she gave an example of two recent projects that FRI has been undertaking (a) using radio mini-drama to contribute to increasing knowledge and consumption of OFSP in Uganda; and (b) promoting the production and consumption of sweet Potato in Ghana, Uganda, Tanzania, and Burkina Faso through participatory radio campaigns.

Jumpstarting orange-fleshed sweetpotato in West Africa through diversified markets: **Erna Abidin** made a presentation about this three-year pilot project for West Africa known as Jumpstarting OFSP. The vision of the project is sustainable and inclusive market-driven approaches for OFSP to increase incomes, and improve health through consumption of vitamin A rich OFSP, especially in women and children in Ghana, Nigeria and Burkina Faso. Her presentation comprised of the following: actors/partners and outcomes of Jumpstarting project; progress made in promoting vine multiplication and root production in Ghana and Burkina Faso; overview seed flow with reference to 1-2-3 system, and linkage of seed and breeding programs; elements required for a functioning seed systems and the current focus of the project.

Scaling out sweetpotato and potato-led interventions to improve nutrition and food security in Tigray and SNNPR, Ethiopia: **Haile Tesfaye** made a presentation about this project, whose goal is to contribute to improved nutrition and food security in vulnerable households with young children in Tigray and SNNPR through increased production and consumption of micronutrient-rich sweetpotato and potato varieties as part of diversified diets. He explained the progress in implementing project activities, which include supply chain development, creating awareness through awareness and behaviour change communication, creating market linkages and institutionalizing activities within government institutions.

Scaling-Up OFSP Through Agriculture and Nutrition – Panel Discussion: Scaling Up OFSP Through Agriculture and Nutrition (SUSTAIN) is one of the projects implemented by CIP. In this panel, **Tom Remington**, the country manager for SUSTAIN in Malawi, facilitated the discussion of different scaling up efforts by the SUSTAIN project. Four countries (Malawi, Mozambique, Kenya and Rwanda) were each represented by a SUSTAIN staff, who interviewed a staff from a partner organization. They shared their views, an overview of their organizations and activities to scale up OFSP.

Experiences in implementing Triple S method in Uganda: Emerging issues and implications to seed systems research: **Sam Namanda** explained the use of Triple S as a potential alternative to keep vines alive during the prolonged dry season. He explained key Triple S technology protocols and the implementation approach that was used in Uganda. Namanda provided some results from ongoing trials as well as the challenges and how they were being addressed.

Integrating OFSP as part of Enhanced Homestead Food Production: **Mette Kinoti** made a presentation about the Enhanced Homestead Food Production (EHFP) approach, which seeks to improve the nutritional status of children under five years of age, women of reproductive age, breastfeeding and pregnant women. She highlighted the achievements, constraints and recommendations of the CHANGE project - a multiple country project that aims to (i) improve nutritional status of women and children under two years of age; (ii) promote women's empowerment and (iii) collect evidence of the technical efficacy of the intervention on nutrition and women's empowerment (among others). The project promotes nutritious crop production all year-round and animal production for income and home consumption.

With orange-fleshed sweetpotato, CRS and partners are improving the living conditions of vulnerable populations: Currently CRS promotes OFSP in two districts (Karongi and Muhanga) through the project that provides support in reducing the stunting of children under two years of age, funded by the Dutch Government. **Zacharie Manirarora** described the integrated approach combining interventions related to agriculture (using farmer field school approach and bio-intensive agriculture system); nutrition and sanitation (using Positive Deviance Health approach); and economic strengthening (using Saving and Internal Lending Communities approach-SILC).

Half of the "1,000 Days" depends on the Mother's Health: **Katherine Dennison** from USAID talked about the critical function of Vitamin A in the development of the foetus. She explained how stunting occurs, and how it can be mitigated and gave highlights of nutrition interventions such as mass fortification, supplementation, and biofortification as well as their pros and cons.

Poster competition: A poster competition was held as part of the SPHI Annual Meeting. There were 23 posters entered into the competition across a range of science and research topics. The posters were on display during the SPHI meeting. On September 29 2015, official judging was conducted. The first round of judging saw each poster author provide a 3- minute oral presentation about the poster to a panel of three judges. Six finalists were announced and a second round of judging was held including a 3-minute oral presentation from each author. The top four were awarded prizes.

I Love Sweetpotato Exhibition: The 'I Love Sweetpotato' exhibition was held on 1 October 2015 at Hotel Villa Portofino in Kigali, Rwanda as part of the week long 6th Annual Sweetpotato for Profit and Health Initiative meeting led by the International Potato Center. It was a public event where 29 exhibitors (Table 17) displayed their work on orange fleshed sweetpotato. Each booth was evaluated by two different judges and the top three exhibitors were awarded prizes.

Meeting evaluation: The 2015 SPHI annual meeting participants were requested to fill out a questionnaire to evaluate the organization, components and content of the meeting. 70 participants responded. These participants range from 22 to 55 years of age, with the average participant age being 37. They evaluated the content, different formats used in the sessions, the level to which the meeting met participants' expectations and general organization and administration.

1 Introduction

The **6th Annual Sweetpotato for Profit and Health Initiative (SPHI) meeting** took place from 29 September and 1 October 2015 in Kigali, Rwanda. The theme of the 2015 meeting was 'Together, 10 million by 2020'. This refers to the overall goal of the Sweetpotato for Profit and Health Initiative which is to reduce malnutrition and increase incomes among at least 10 million sub-Saharan African households through access to improved varieties of sweetpotato and their diversified use by 2020.

The meeting was attended by 104 participants (scientists and experts, government representatives, academics and donors from the agriculture, nutrition and development communities) from 14 sub-Saharan Africa (SSA), Latin America and North America. They presented and discussed progress in sweetpotato science and delivery along the entire sweetpotato value chain, showcased innovations and impact case studies in agriculture, nutrition and health innovations and outlined the state of sweetpotato investment in SSA.

During the meeting, both the new SPHI Steering Committee (SSC) and the Sweetpotato Action for Security and Health in Africa (SASHA) Project Advisory Committee (PAC) held their inaugural meetings. The new-look Sweetpotato Knowledge Portal was re re-launched. The portal is a user-driven online platform that provides an arena where sweetpotato actors meet virtually and is a single access point for discovery, acquisition and sharing of information about sweetpotato research and project activities in SSA. On 1 October 2015, the I Love Sweetpotato - *Nkunda ibijumba* Exhibition was held at Hotel Villa Portofino in Kigali. Highlights of the event, which will be open to the public from 11 am to 4 pm includes a 'Best Booth' competition, delicious sweetpotato products for tasting and a display and demonstration of innovative sweetpotato products and ideas on display.

The following report documents the presentations and proceedings of all the sessions and side events. The full abstracts and presentations can also be downloaded from the Sweetpotato Knowledge Portal at following link: www.sweetpotatoknowledge.org.

2 Welcome remarks and introductions

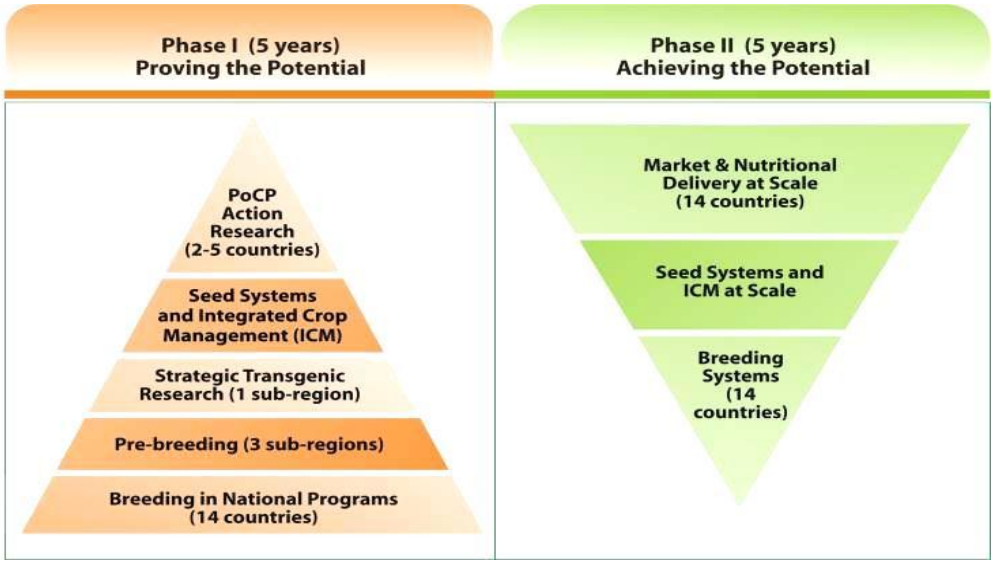
Hans Adu-Dapaah

In his welcome, the Interim SPHI Steering Committee Chairperson gave a brief introduction of the initiative and introduced SPHI committee and the SASHA PAC members.

The SPHI is a multi-partner, multi-donor initiative that seeks to reduce child malnutrition and improve smallholder incomes in 10 million African families by 2020 through the effective production and expanded use of sweetpotato. The SASHA Project, which serves as the foundation for the broader initiative, is a 10-year project led by the International Potato Center (CIP) and over 26 partners that will develop the essential capacities, products and methods to reposition sweetpotato in the food economies of SSA.

Fig. 1 below illustrates the two phases of the SPHI. The first five-year phase (2010-2014) concentrated on proving the potential, placed great emphasis on breeding and seed systems research and testing models of delivery of improved varieties to producers and consumers. The second five-year phase (2015-2019) focuses on achieving the potential, ensuring that effective seed systems are delivering improved planting material to 10 million SSA households.

Fig. 1 Areas of focus of the two phases of SPHI



To guide implementation of Phase 1, the SPHI Executive Steering Committee was established with the mandate to provide advice to the SPHI Senior Management Team concerning the scientific components of the SASHA project and organizational components of the overall SPHI; identify research gaps; and serve as advocates. However, as the initiative continued to grow, it was deemed important to develop a new governance structure that would be inclusive of the varied interests and organizations involved in sweetpotato. Key among these changes was to separate the SASHA Project oversight from the SPHI governance structure.

2.1 SASHA Project Advisory Committee: Terms of Reference and Members

Based on the changes, the new Terms of Reference (TOR) for the SASHA PAC is as follows:

- Provide advice to the SASHA Phase 2 project management team
- Participate in SASHA PAC meetings
- Advocate for sweetpotato integration and alignment with other relevant agriculture and nutrition initiatives on the continent
- Comment on any project reports and external reviews of the SASHA project
- Comment on team function and suggest how to improve it
- Review and evaluate emerging risks, threats and opportunities and provide relevant recommendations

The table below shows the details of the new members of the SASHA PAC:

Table 1: Members of the SASHA Project Advisory Committee

Position on the PAC	Name (gender in parentheses)	Current Position
Breeding & Genomics	Christiane Gebhardt (F)	Senior scientist and research group leader at the Max-Planck Institute for Plant Breeding Research.
Seed Systems	George Bigirwa (M)	Senior Program Officer, Program for Africa's Seed System for the Alliance for a Green Revolution
Postharvest & Nutrition	Ibok Oduro (F)	Head of Department of Food Science & Technology, Kwame Nkrumah University of Science and Technology
Business Marketing	Stanley Karichu Mwangi (M)	Associate Director; Business Models, Farm Concern International
Support to SPHI	Anna-Marie Ball (F)	Manager of Partnerships & Strategic Alliances for Africa, HarvestPlus
CIP representative	Barbara Wells (F)	Director General, International Potato Center
BMGF representative	Jim Lorenzen (M)	Senior Program Officer, Bill & Melinda Gates Foundation (BMGF)

2.2 SPHI Steering Committee: Terms of Reference and Members

The new TOR for the SPHI Steering Committee is as follows:

- Strategic Guidance on progress toward target, based on the annual report on *Status of Sweetpotato in SSA*
- High level advocacy and resource mobilization for SPHI agenda
- Review of and guidance of functioning of Communities of Practice (CoPs)
- Review and guidance on impact of regional technical backstopping.
- Support the broadening of SPHI membership.

As illustrated by the members' code outlined below, the SPHI Steering Committee is committed to partnership for collective impact. Each member:

- Is committed to the SPHI vision of reaching at least 10 million African households by 2020, with knowledge, improved varieties and diversified use of sweetpotato, for improved incomes and health.

- Will demonstrate commitment of human and financial resources to sweetpotato-related activities.
- Will regularly share knowledge gained through its activities and interactions on the Sweetpotato Knowledge Portal
- Will share information about SPHI activities with its networks and so contribute to building the network of actors working on sweetpotato in Africa
- Will share progress on the reach and impact of its sweetpotato-related activities on a regular basis
- Will participate actively in annual meetings of the SPHI, covering its own attendance costs
- Will participate in relevant CoPs and contribute to the growth and development of these communities

The committee will be co-led by CIP, represented by Jan Low and Forum for Agricultural Research in Africa (FARA), represented by Yemi Akinbamijo. The following table provides details of the members of the SPHI Steering Committee.

Table 2: Members of the SPHI Steering Committee

Organizations	**Name**
CIP	Adiel Mbabu, Regional Director – SSA
HarvestPlus	Anna-Marie Ball, Strategic Alliances for Africa
Farm Concern	Antony Masinde Kilwaki, Senior Programme Manager
Helen Keller International (HKI)	Mette Kjaer Kinoti, Vice President for Africa
PATH	Allison Bingham, Program Advisor
Natural Resources Institute	Andrew Westby, Director
Roots, Tubers & Bananas	Dagmar Wittine, Program Manager
North Carolina State University	Craig Yencho, Leader of Sweetpotato & Potato Breeding
Donors	**Name**
BMGF	Jim Lorenzen
USAID	Katherine Dennison
DFID/UKAID	Mark Davies
Irish Aid	Not able to attend
Alliance for a Green Revolution in Africa	Not able to attend

3 SESSION ONE: BREEDING

3.1 Measuring genetic gains in applied sweetpotato breeding programs: More than one way to peel a sweetpotato!

Maria Andrade, Wolfgang Grüneberg, Godwill Makunde, Jose Ricardo, Raul Eyzaguirre, Robert Mwanga, Federico Diaz, Charles Wasonga, & Edward Carey

Genetic gain is the predicted change in the mean value of a trait within a population that occurs with selection. A breeder makes genetic gain when the selected individual(s) has a better combination of genes that control the traits of interest than the unselected individual(s). Measurement of genetic gain allows critical analysis of efficiency of a particular breeding approach, planning of new actions and strategies and wise allocation of resources.

Genetic gain (ΔG) = response to selection minus original population mean
The expected genetic gain, (ΔG) is given by the formula:
$\Delta G = h^2$ x (Selection Differential)
Heritability h^2 is the general term that describes the proportion of the genetic variance to the total variance
Selection differential = New mean of the selected population minus mean of the original population.
There are two types of heritability:

1. The narrow-sense heritability: the ratio of additive genetic variance to the total phenotypic variance: $\mathbf{h^2 = V_A/V_P}$
2. The broad-sense heritability is the ratio of total genetic variance to total phenotypic variance: $\mathbf{H^2 = V_G/V_P}$

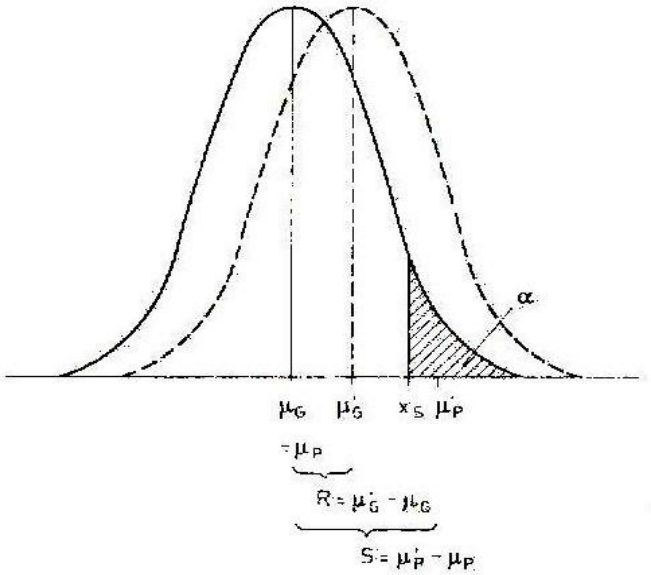
When estimating genetic gain:

- Both generations must be evaluated in the same environment so that environmental effects do not cause a bias
- The same formula can be used to estimate heritability after several generations of selection have been completed
- The estimated genetic gain must be divided by the number of generations of selection so that the genetic gain is the average gain per generation of selection
- The value of the selection differential is the average value across the multiple generations of selection

3.1.1 Ways to increase the genetic gains

A breeder can increase the expected genetic gain either by increasing the heritability or by increasing the selection differential (new mean of selected population minus original population mean). One approach to increasing heritability is reducing the environmental variance; another approach to increasing heritability is to choose or create a population that is extremely variable (*i.e.*, large genetic variance). A breeder can increase the selection differential by selecting fewer individuals. Selection, which is the basis of genetic gains can be done on early breeding cycles of clonally propagated crops (ABS adopted in sweetpotato); later in the breeding cycle; and on parents to develop new populations. Selection of parents for new populations occurs via (i) poly-cross versus controlled cross breeding and (ii) selection of parents on off-spring performance (heterosis). The index selection in *Fig. 2* below should be followed to get parents with multiple traits.

Fig. 2: Genetic gains or response to selection



3.1.2 Achievements – the case of Mozambique variety releases

The table below shows the achievements in variety release in Mozambique.

Table 3: Achievements - Variety Releases in Mozambique

Trait	Farmer varieties	1st release	Gain (%)	2nd release	Gain (%)	3rd release	Gain (%)
	1999	2000		2011		2015	
Total root yield (dry weight, t/ha)	1.9	3.5	84	5.6	60	5.75	2.7
Variation in total root yield	2.1 - 12.6	13.6 -16.1		14.9 -27.1		14.4 - 29.0	
Dry matter content (%)	33.0	23.5		27.6	17	30.2	9
Variation in dry matter content				23.6 -33.5		24.6 -36.6	
Beta-carotene (mg/100g/DW)				21.3		24.8	16
Variation in BC				16.4 -42.9		17.2-36.3	
Iron content (mg/100g/DW)				1.8		1.9	6
Variation in Fe				1.4 -1.9		1.67-2.44	
Zinc content (mg/100g/DW)				1.1		1.3	18
Variation in Zn				0.95 -1.2		1.12-1.75	

Several approaches at the platforms: Various approaches were implemented in Mozambique, Uganda, Ghana, and CIP headquarters to predict and measure genetic gains for key attributes in breeding. Key attributes include yield (through approaches of ABS and exploitation of heterosis, sweet potato virus disease (SPVD) resistance, drought tolerance, beta-carotene, iron and zinc, and reduced sweetness, perishability). Large genetic variation and expected genetic gains for yield, drought, beta-carotene, and sweetness were exhibited. Iron and zinc appeared to exhibit low genetic variation. SPVD resistance is a tricky trait, due to its GXE and mode of inheritance. Another approach was by comparison of means of selected clones with parents, comparison of means in sets of variety release trials and demonstration trials including new and old varieties, or comparison of means of selected clones to those of standard checks. Findings showed high yield increases, gains for dry matter content, beta carotene and resistance. Gains for iron and zinc were low.

Genetic gain under farm practice: A series of multi-environmental trials (METs) usually over 2 to 3 years were undertaken. For example, during the five years of SASHA Phase 1, three MET sets were possible, and these can serve variance component estimations in later breeding stages; (b) the genetic gains (development of the mean in these METs) during this time period. This is still a small section of the long term genetic gain that takes place over 10 or 20 years). In practice, 10 to 20 years of METs from variety release time using 8 to 18 METs allows for the estimation of long-term yield trends and changes in long term yield trends including gain components due to better practice.

Technology revolution by use of molecular markers to enhance genetic gains: The study in Peru shows that molecular markers are useful to identify heterotic gene pools in sweetpotato, but that the identification of best combiners among gene pools (prediction of heterosis on basis of molecular distances) is not possible or is associated with a very large error in sweetpotato. In Uganda, markers defined two distinct sweetpotato populations (A & B). These were utilized in heterosis studies for SPVD resistance in Uganda and drought tolerance in Mozambique. Three populations were generated; intra-gene population A, intra-gene population B and inter-gene population A x B. Molecular markers have accelerated and improved efficiency of selection.

Heterosis in Mozambique: From the preliminary results, the inter_A x B population had higher root yield than intra_A population under the two treatments. The inter_A x B population had some clones with higher root yield under drought than highest yield clones from intra_B and A populations. Results for proof-of-concept for heterosis show that the observed mid parent – mid offspring heterosis for fresh storage root yield, dry matter storage root yield and total dry matter biomass yield were 115.3%, 122.9%, and 107.9%. On average, a hybrid storage root yield advantage of 15.3% on fresh weight basis and 22.9% on dry weight basis was observed, and the best offspring clone within each family was observed to have a storage root yield advantage of 119.8% on fresh weight basis and 136.6% on dry weight basis compared to his parents. Yield advantages in offspring and heterotic effects of 2 to 4 times higher than the parental mean are not rare events. They could be a reflection of the contribution of heterosis to yield performance in sweetpotato.

3.1.3 Conclusions and perspectives

Based on the work undertaken in Mozambique, use of molecular markers can increase genetic gains. Scientific and institutional capacities play a role in genetic gains and therefore it needs strengthening. Simulating testing environments and target environment is important during experiments.

There will be efforts to continue to refine approaches for tracking progress in the breeding programs in the coming years. More emphasis will be placed on the use of demonstration trials comparing newly-released and older varieties over years, as well as the use of data from national variety release trials to monitor genetic gains in released varieties over time. There is need to disaggregate genetic gains from cultural practices and to continue monitoring observed genetic gains and genetic variability in breeding populations, particularly in partially inbred and mutually heterotic populations to aggressively improve specific attributes, including SPVD, micronutrient mineral content, earliness, quality attributes and reduced perishability.

3.1.4 Questions and answers

Is there a negative correlation between yield and dry matter?

This is certainly true with regard to fresh yield. However, high dry matter clones tend to be a bit more stable.

Hybrids are as a result of having inbred lines? Is it comfortable for someone to state they have developed hybrids in vegetatively propagated crops?

It is correct to call these varieties hybrids as they are a result of crossing (hybridization).

Development of processing equipment is a challenge because of shape. What are breeders doing with regard to shape?

As more varieties are released chances are that some will have a shape that can go commercial. It is also clear that breeding programs will be more driven by market objectives, but breeders also need clear guidance from the industry about desirable traits.

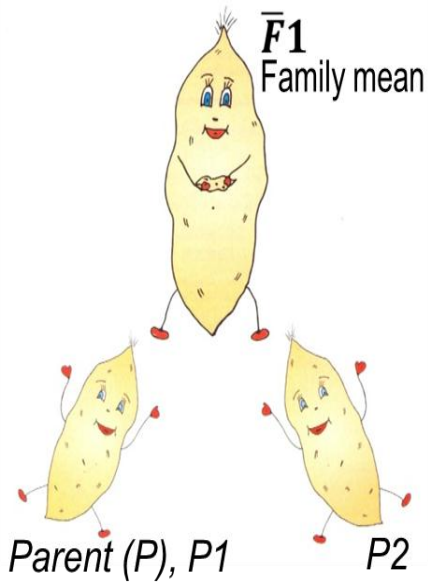
In the breeding program in North Carolina State University (NCSU), shape is the most important thing. The processing industry is very sensitive to shape in the United States of America (USA), as this influences the amount of wastage that occurs during processing. Including a poorly shaped parent into the breeding program can drag down the performance of the progeny for a number of generations.

3.2 Practical approaches to the systematic exploitation of heterosis in sweetpotato breeding – how far?

Robert Mwanga, Wolfgang Grüneberg, Charles Wasonga, Gorrettie Ssemakula, Benard Yada, Jose Ricardo, Maria Andrade, Godwill Makunde

Heterosis, also called hybrid vigour, is the improvement in the mean performance of any attribute in offspring relative to the mean of the parents, and the term heterosis increment is used when parents are heterozygous. Heterotic gains are when offspring is superior to mid-parent performance (see *Fig. 3*).

Fig. 3: Heterosis [parental performance (P1, P2), & F1 offspring]



The process of inbreeding was first used by maize breeders leading to great progress with regard to breeding for yield. The experience of maize breeders is the basis of sweetpotato breeding; the question is whether sweetpotato can make the same achievements. For sweetpotato, we can look at inbreeding routes e.g. iron, zinc, and disease. Especially with disease, which is controlled by a recessive gene, addressing it through conventional breeding may take a longer time.

In Uganda the main problem faced is disease, in Mozambique it is drought. The conditions are different and caution must therefore be exercised when using a similar approach.

3.2.1 Heterosis increment studies in sweetpotato

The following are highlights of heterosis increment studies in sweetpotato presented at the SPHI 2015 meeting:

1) Mega-clones (important clones across regions) – 4 x 12 crosses (48 families) – no separation of gene pools, no selection of recombining ability, no inbreeding (up 60% heterosis increment)

2) PJ1 x PZ1 population (two populations at CIP developed independently since 2004) - 231 families (49 PJ parents and 31 PZ parents) - no separation of gene pools, no selection of recombining ability, no inbreeding (up to 80% heterosis increment.)

3) A x B population with 8 x 8 parents (64 families, 20 genotypes per family) from Namulonge tested at Namulonge) - gene pools separated, no selection of recombining ability, no inbreeding (>100% heterosis increment; across all crosses still quite small).

4) A x B population with 8 x 8 parents (64 families) from Namulonge tested at Umbelusi / Mozambique) – gene pools separated, no selection of recombining ability, no inbreeding (>100% heterosis increment, across all crosses still quite small). => A and B are not much mutually heterotic, but this can developed)

5) PJ and PZ populations (tracing back to 49 PJ parents and 31 PZ parents – gene pools separated, selection of recombining ability, with inbreeding, and now in cross " PJ x PZ" *to determine gains after one complete reciprocal recurrent selection cycle for various purposes* (West Africa & East Africa, Non-sweet (NS), high iron (HI), wide adaptation & earliness) => three hybrid populations)

3.2.2 Question and answers

The challenge of marketing driven characteristics such as higher shelf-life and can be used for processing chips. Is this something that breeders are working on?

Breeding programs are not neglecting consumers and the market. But priority is placed on eliminating the most important bottlenecks, such as developing resistance to SPVD.

4 SESSION TWO: VALUE CHAIN FINDINGS

4.1 Factors affecting women's participation in sweetpotato vine marketing, marketing of fresh sweetpotato roots and processed products in Phalombe and Chikwawa districts in Malawi

Netsayi N. Mudege, Putri E. Abidin and Gordon Prain

The study was undertaken under the umbrella of the Irish Aid funded Rooting Out Hunger in Malawi with Nutritious Orange-Fleshed Sweetpotato Project. Her presentation examined the commercialization of sweetpotato vines, sweetpotato fresh root markets and marketing of sweetpotato processed products in Malawi from a gender perspective. The purpose was to create an understanding among participants about gender-related opportunities and obstacles related to the sweetpotato chain in Malawi and spur reflection on how to make market led agricultural interventions gender-responsive.

4.1.1 Specific objectives

- Understand how sweetpotato markets work
- Examine how social and other values (e.g. gender norms) in communities affect the performance of markets
- Examine how gender relations shape men and women's experiences of agricultural markets and benefits
- Provide recommendations for sweetpotato interventions and Irish Aid funded sweetpotato projects in Malawi to ensure the design of sweetpotato value chains that will benefit both men and women.

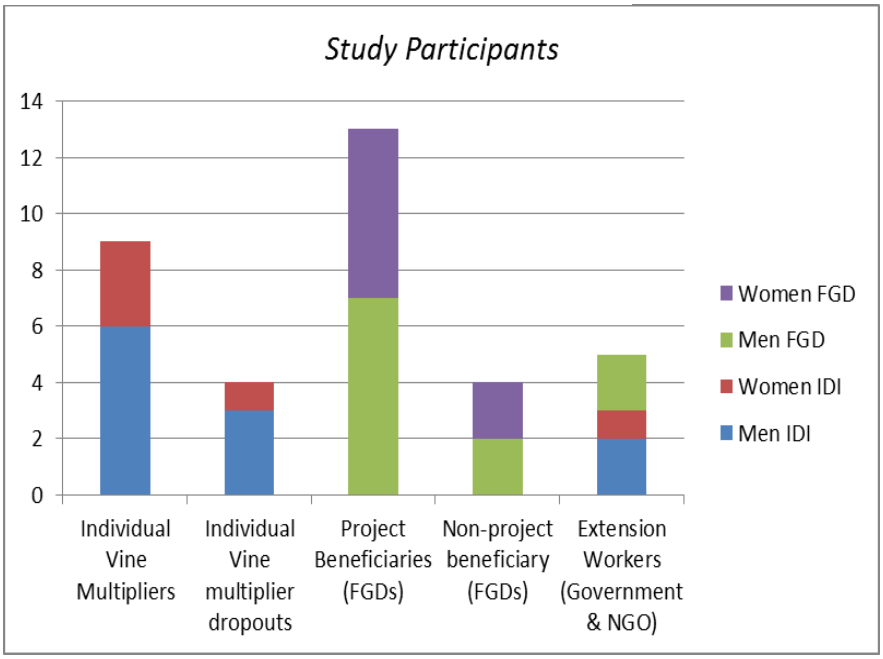
4.1.2 Methodology

The study used the social relations approach to markets (real markets approach). This is because markets are social institutions that have gender dimensions in terms of the way men and women come to the market. It is an approach that also looks at the interaction of cultural, structural, and economic factors as well as power and inequality.

The approach was also selected to cater for certain shortcomings in similar types of analyses: first, current economic analysis focus on price analysis but lacks attention to institutional and political factors underlying market development; secondly, market analysis is not able to perceive other signals except price and profitability.

In total 19 Focus Group Discussions (FGDs) were conducted, 8 with women farmers, 9 with men farmers, 2 with extension officers; and 15 Individual interviews, 9 with men Decentralized Vine Multipliers (DVMs), 3 with women vine multipliers or wives of men DVMs and 2 with extension officers. *Fig. 4* shows the breakdown of study participants.

Fig. 4: Breakdown of study participants



4.1.3 How institutions shape men and women's participation

In contrast to men, women did not have a diverse set of institutional buyers. This was due to institutional bias against recruiting female DVMs. Research organizations, NGOs and extension services often chose to work with the heads of the household, which are often men. Family rules designating men as household heads meant that men could make decisions related to participation in vine markets. None of the male DVMs sold vines by the bundle. They sold to institutional buyers and had been trained, unlike women who sold mostly to local buyers and had little training.

Many more women engaged in barter trade. Women vine beneficiaries formed groups to multiply vines but they mentioned lack of markets as a major obstacle to vine multiplication. Women sell in 50 kg burlap bags (bags expand due to age and can disadvantage the seller). Men mentioned lack of knowledge among women as a reason why husbands did not allow them to sell vines. This is also linked to lack of access to training.

We can say that we need assurance that we will have markets when we grow the vines, and if that assurance is there every woman will start a nursery at her home because we know it will bring developments to our houses, but the problem is that we may grow the vines but not get any market at all (Women, FGD)

…when it comes to vines women don't know how to weigh the vines and they don't know when the vines are not enough, they may sell too much or sell less (Participant in Men FGD)

He [my husband] says he is the one who can sell vines, he says that' I will be the one who will be selling'…He will insist on going to sell the vines, ….Because he says you cannot sell the vines well but I can do it better as man and your job as a woman should be to stay at home. So as women we don't argue we stay just at home (Wife of DVM2, Chikwawa

4.1.4 Pricing of vines

Pricing of vines is influenced by the following factors:

- Type of buyer: Higher prices are given for institutional buyers and lower prices for individual buyers. Local buyers may also buy smaller bundles which are cheaper.
- Demand and supply: When demand is high prices increase to even about 500MK per 4 kg bundle. Prices are determined by the buyer. Institutional buyers like CADECOM state that there is no room for negotiation because vines are perishable.
- Trait preference: Disease resistant sweetpotato varieties fetch more, and farmers sometimes pay for overpriced OFSP higher yielding vines (1000MK in East Bank, Nakondwe and Chikwawa)

4.1.5 Fresh roots markets

Where sweetpotato was a major cash crop men were more involved. However, when it was cooked, women dominated because it was sold in small quantities at local markets. Furthermore, where the woman was involved in sweetpotato root production, it was considered hers and therefore, she had more power to make decisions. Respondents also stated that men were not involved in root production because it is labour intensive, (digging and carrying to the market); it is mostly bartered and they would prefer cash; it takes longer to sell it in the market; and the money is received in smaller quantities as compared to vines, which makes it difficult to invest. This is also perpetuated by the general perception that men know how to sell vines and women do not. Whereas these factors increased women's decision making power with regard to the sale of sweetpotato roots, they tended to limit their participation in sweetpotato markets because of mobility.

4.1.6 Processed sweetpotato products

Men dominate in the processing of sweetpotato fries while women process mandazi and samosas. This is because sweetpotato fries are easy to make and sell and need less inputs/ingredients while mandazi are expensive to make and not profitable. Because of limited mobility, women cannot sell fries by the roadside. If processing is not at industrial scale farmers may not benefit economically

4.1.7 Conclusion and recommendations

Institutions involved in research and extension need to reform, as they shape the gender dynamics of markets and ability of men and women to benefit. Women bear the cost of imperfect markets, e.g. the cost of transportation of roots to local markets, lack of access to information and market networks, therefore, dominated barter trade characterized by small quantities of vines. The market is not a neutral space but one structured by power and inequality. As a result, interventions need to take consider why sweetpotato vine marketing is dominated by men even in communities where sweetpotato had traditionally been a woman's crop. There is need for research to understand how so called non-market institutions influence the operation of markets.

The way DVMs were recruited and linked to markets limited women's access to extension support for vine multiplication and ultimately to the markets. Men were able to link much more with formal information channels which gave them more advantages than women. If women are able to be targeted as vine multipliers and marketers either in groups or as individuals, this will increase their voice in decision making since the vine multiplication and sweetpotato production will be regarded 'as their office'.

> *We have tried to substitute but it is not easy especially when it comes to making cakes, they need their own ingredients to make them soft, we cannot make samosas without meat, we really need the meat. We use sweetpotato leaves to make tea and juice but for other products there are no substitutes (Women beneficiary FGD, Chimwemwe, Chikwawa)*

Developing markets for industrial processing of sweetpotato may benefit both male and female farmers if they have access to the markets, rather than local processing which is often not profitable and usually for home consumption. Finally, both men and women's voices matter in designing gender equitable and efficient sweetpotato value chains.

4.1.8 Questions and answers

It looked like the study described the Malawi situation. How can we all participate in a transformative process that changes an entrenched social structure?

We need to understand the context in which we are working. In a way, we may have made mistakes in Malawi because we didn't build on the matrilineal system. We won't actually make any difference if we don't change ourselves. We need to choose partners who are interested in this change right along the line.

There is need to have gender lens, and to have a training for frontline staff who are in charge of recruiting and working with the participants. We should seek expertise where it is not available within CGIAR.

4.2 Rwanda Super Foods Project: Key findings from the endline survey

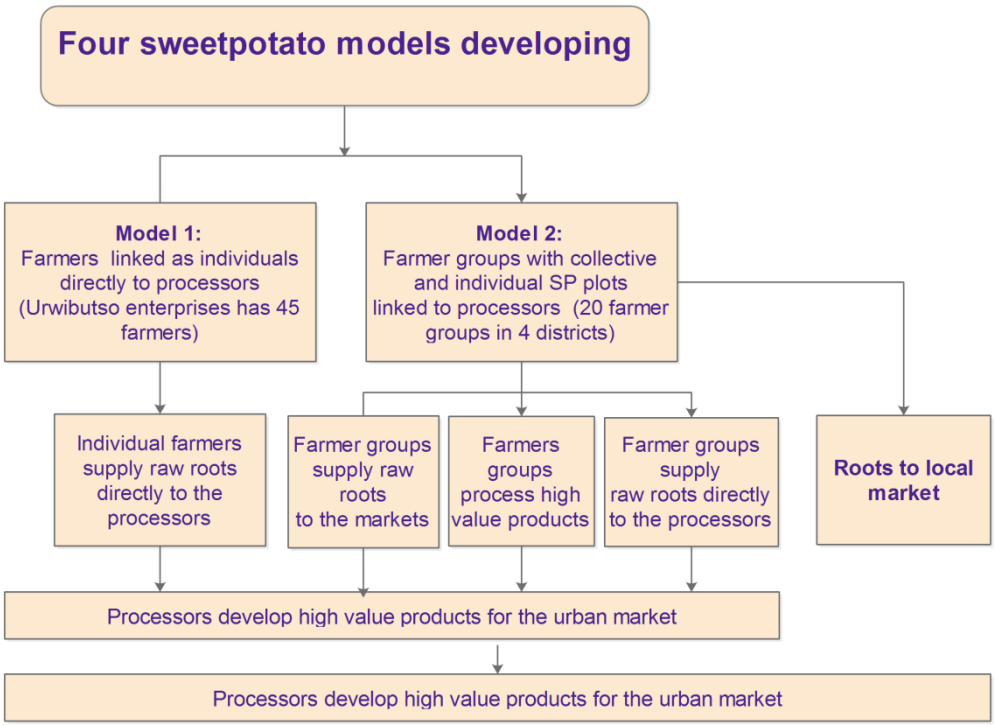
Kirimi Sindi, Temesgen Bocher, Jean Ndirigwe and Jan Low

The objectives of the Rwanda Super Foods project were: (1) to develop, compare, and evaluate the relative efficiency of two sweetpotato product value chains and their potential to increase farmer income with gender equity; and (2) to re-position white-fleshed sweetpotato and OFSP and its products in the rural, urban and semi-urban consumer markets.

A value chain was built, linking sweetpotato farmers with a private sector player, who transforms the sweetpotato into products for sale. In the northern districts of Gakenke and Rulindo, the project promoted better production conditions and linked with a private sector partner called *Urwibutso* Enterprises, based in Rulindo. Urwibutso has 11 stores in 8 districts, and 4 stores in Kigali. In the southern districts, the project worked in Muhanga and Kamonyi districts.

Therefore, the value chain was not an institution-based project. Farmer groups were supported by agencies to produce vines for sale to root producers. Some of these groups also produced roots for sale in the normal fresh food market, while others processed the products and sold them. *Fig. 5* shows the development of the individual and group models.

Fig. 5: The development of individual and group based sweetpotato models



4.2.1 Monitoring and Survey Work

Formative research was undertaken to determine whether OFSP purée products were more economically viable than OFSP flour products. Sweetpotato root yields were monitored annually and root and product sales monthly. In 2012, a baseline survey involving 596 households (279 in Northern Districts and 317 in Southern Districts was undertaken. In September 2014, 852 households participated in the endline survey. Out of these, 213 belonged to the control group, i.e. they did not participate in project activities; 327 were participants linked directly to project activities and 312 were spill-overs who obtained vines from project multipliers but had no direct access to market opportunities. The findings are as follows:

Test 1: Is it possible to develop economically-viable sweetpotato processed products, acceptable to Rwandan consumers?

For a long time people had tried to transform commercially viable sweetpotato products with consumer acceptability without NGO intervention. The project started at a low level and developed high value products through a targeted company (Sina Gerard). Products were developed for both low level and high level markets. The project launched the Golden Power Biscuit product in November 2012 and by June 2014, the company had earned USD 364,410 in OFSP product sales. From July 2014 to July 2015, after the project had ended, the company made USD 403,559. Fried doughnuts/mandazi and Golden Power biscuits proved to be the most popular products, with 81% and 19% sales respectively. Mandazi, the lower level product targeted to the low level market, is the one that made the company the most sales.

Questions have often arisen as to whether it is sustainable to assist local enterprises, and what level of support would ensure sustainability. In the case of Sina Gerard, which was using low level technology to produce biscuits without sweetpotato, the Rwanda Super Foods project facilitated the links with a product development expert who provided access to modern equipment, improved the products and worked on packaging of the products. This process, which resulted in an increase in productivity and sales for the company, is depicted in the *Fig. 6* below.

Test 2: If a value chain for processed products linked to a private sector actor leads to better returns for male and female producers than just accessing the local market

From the endline survey, 80% of direct participants, and 60% of the spill-over, and 50% of the control group were selling OFSP in 2013/2014. Although it is not conclusive, one can already observe high participation of direct and neighbouring participants. Female participants accounted for 42.5% of total sweetpotato sales transactions, compared to 11.5% for male participants. Both participant female and male SP growers received higher average prices (145 and 149 Rf/kg, respectively) if they sold to Sina Gerard than if they sold to traders (111 Rwf/kg) or directly to consumers (103 and 88 Rf/kg, respectively). This is partly because Sina was encouraged to pay slightly above going market price.

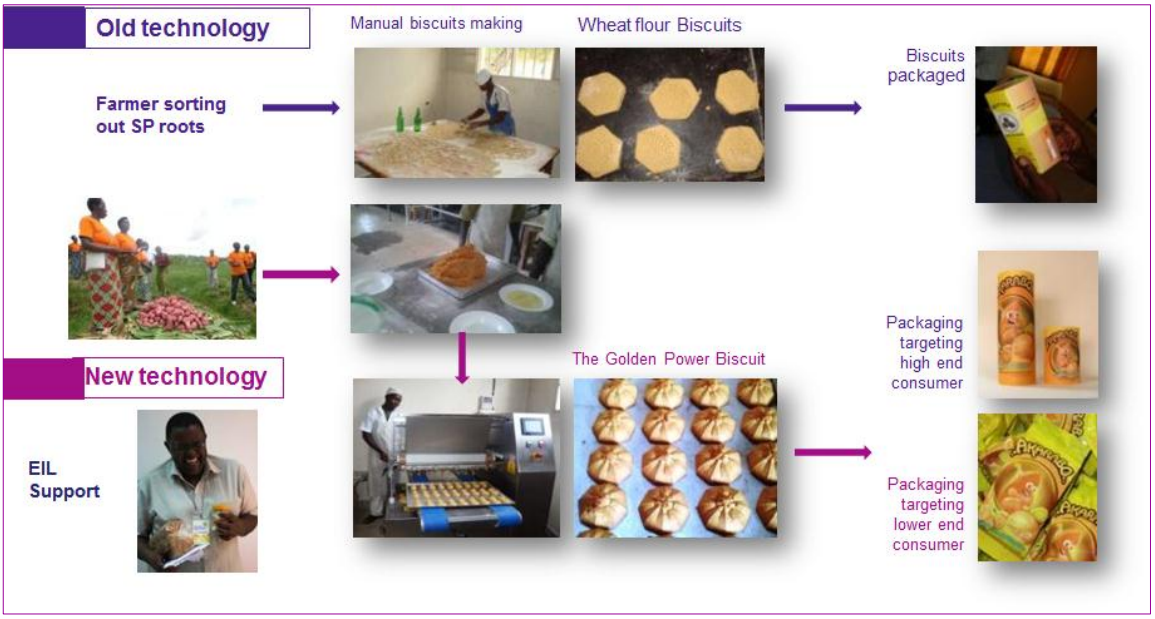


Fig. 6 Biscuit development required substantial investment and training

Economic efficiency for most of the participants was 2.49 while the spill-over was 1.34. The direct beneficiaries received vines through their groups or project sources while the spill-over households sought out vines from project participants or DVMs. Participant males had the highest profits and economic efficiency (see *Table 4*).

Table 4: Sweetpotato Revenue, Profit and Efficiency by Gender of the Principle OFSP Grower across Categories

	Control		Participant		Spillover	
Variables	Female (N=119)	Male (N=88)	Female (N=247)	Male (N=80)	Female (N=220)	Male (N=92)
Sweetpotato output value ($/ha)	137	69	223	463	205	233
Variable cost ($/ha)+	120	121	142	146	104	139
Profit ($/ha)	104	31	134	365	139	144
Profit margin++	75%	45%	60%	79%	68%	62%
Economic efficiency*	**0.86**	0.25	0.94	**2.49**	**1.33**	1.04
Profit efficiency**	47%	35%	**55%**	42%	56%	43%

Source: Rwanda Super Foods Endline Survey, September 2014.
+ Variable costs to not include an attributed value for family labor.
++ Profit margin: profit as a percentage of the revenue (output value).
*Economic efficiency= profit per hectare/ variable cost per hectare. It is the profit made from unit cost of production; for instance 1.8 indicates a 1 dollar investment in sweetpotato production system generates a 1.8 dollars net profit.
**Profit efficiency (PE) is computed by using stochastic profit frontier function, which combines technical, allocative and scale efficiency in profit function. PE is defined as the ability of farmer to achieve highest profit given the output price and cost of inputs used and profit gained from potential.

Many ask whether a value chain approach would not reduce food availability in the household because of increased commercialization. Results show that an average of 31% was sold to the private sector company, while 30% was used in the home and the rest was sold in the local fresh food market (See *Table 5*).

Table 5: Quantity of Sweetpotato Produced and Sold by Gender of Principle Grower across Categories

Group	*Sample Size*	Total produced (kg/HH)	Sold (kg/HH)	% Production sold	Value of Sales ($/HH)
Control Female	119	409	116	28%	174
Control Male	88	333	147	44%	181
Participant Female	247	**1118**	364	33%	277
Participant Male	80	**1099**	321	29%	143
Spillover Female	220	487	134	28%	110
Spillover Male	92	750	206	28%	109
Total	846	731	226	**31%**	187

*Source: Reported production and sales by plot by season for 2013-2014 from Rwanda Endline Survey.

Test 3: Did men and women farmers benefit more by being in groups backstopped by NGOs, than by being linked as individuals to the agro-processors?

Looking at economic efficiency, especially for those that were led by NGO interventions, Imbaraga had the highest efficiency, at 1.8, followed by the spill-overs at 1.2 and YWCA at 1.1. The individual farmers linked to SINA had an economic efficiency of 0.8. In terms of output value (USD$) per hectare, Imbaraga supported farmers earned the highest at $357; followed by SINA supported individuals at $249/ha; then YWCA farmers at $209/ha. This clearly indicates that farmers backstopped by the NGO Imbaraga did better than individuals

linked to SINA, and that the poor farmers supported by YWCA did not do as well as those helped by Imbaraga but were more economically efficient than the SINA supported individuals.

The project set target that 75% of beneficiaries should be women. There were two systems in which the project worked with groups who had group farms as well as individual farms. Analysis shows that most of the benefit was from the personal plot and not the group farm. Land is scarce and majority use less than a hectare for total production. Group land has to be hired and all group members provide labour, making it less economically efficient. However, women saw groups as platforms for sharing technical and personal information.

Test 4: Did children under 5 years of age in beneficiary households show increased diet diversity and OFSP intake in a marketing focused intervention?

There was no specific community level nutrition education component: we did an analysis to find out if the OFSP entered into the diet of the beneficiaries. There was a seven-day recall at endline that showed that direct participants ate sweetpotato 1.2 days in a week, as compared to the spill-over at 1.05 and the control at 0.22. The analysis was done during the dry period in September when there was less sweetpotato availability. OFSP got into young child diet, but probably at lower levels than if had been a nutrition education component. However, there was no significant effect on young child diet diversity and frequency of intake of vitamin A rich foods (*see Table 6*). This points to the need for a specific nutrition education component at the community level if we want to see impact on young child vitamin A intakes.

Table 6: Dietary Diversity Scores and Consumption of Vitamin A Rich Foods

Group	Child Diet Diversity Score		Weight score of days/week at vitamin A rich foods	
	N	Mean	N	Mean
Control	93	4.05	94	3.86
Beneficiary	97	4.10	99	4.42
Spillover	116	4.16	83	5.69
Total		**4.05**		**4.66**
Control vs Beneficiary		-0.26		-1.21
Control vs Spillover		-0.56		-3.19**
Beneficiary vs. Spillover		-0.30		-2.20*

Note: CDDS child dietary diversity score (0-8); Weight vitamin A (plant + animal source)- less than 6 at risk of vitamin A deficiency

Test 5: Did the communication strategy change the image of sweetpotato in Rwanda?

One of the major lessons learnt was that if mass media and behaviour change communication is vital if a project is to make an impact. Rwanda Super Foods did a lot of communication through the media, exhibitions, awareness days, signposts, newsletters and social media. The project's communication strategy resulted in a change in people's attitudes. Sweetpotato has long been referred to as 'local defence', the food of last resort in times of hardship. Based on the responses during the endline survey, this attitude has changed significantly (*see Table 7*).

Table 7: Farmers Attitudes towards Sweetpotato

Group	Control	Beneficiary	Spillover	Total
1. Sweetpotatoes that are orange inside are healthier than ones that are white inside				
Strongly agree	20%	63%	44%	**45%**
Agree	28%	34%	47%	**37%**
Not know or no opinion	46%	3%	7%	**15%**
Disagree	6%	0%	2%	**2%**
Strongly disagree	0%	0%	0%	**0%**
2. Sweetpotato is the most reliable food crop for our family during times of food shortage				
Strongly agree	54%	66%	54%	**59%**
Agree	42%	33%	43%	**39%**
Not know or no opinion	0%	0%	1%	**1%**
Disagree	3%	1%	2%	**2%**
Strongly disagree	1%	0%	0%	**0%**
#. Sweetpotato should be included as part of the Crop Intensification Program in my District				
Strongly agree	38%	48%	37%	**41%**
Agree	48%	45%	50%	**48%**
Not know or no opinion	6%	5%	7%	**6%**
Disagree	5%	2%	3%	**3%**
Strongly disagree	3%	0%	3%	**2%**

Although sweetpotato is not considered a priority crop in the country's strategy, three districts (Rulindo, Gakenke, Muhanga) have declared it a priority crop and began permitting it to be grown in valley bottoms during the dry season where there had been some restrictions. Two districts have included it in the performance contracts of their mayors.

Four processed products are produced with one company, two farmer cooperatives and a new company is being set up in next 2 months processing OFSP generally, and another to produce macaroni and spaghetti in Muhanga, several bakeries also want to incorporate OFSP in their production. No research has been done on attitude change among urban dwellers, but awareness creation activities have been done.

4.2.2 Conclusion

The project demonstrated that OFSP puree based products are economically viable and are either superior or equally good in terms of taste. Also to make an impact on women, it is important to target female participation right from the beginning of a value chain project. By starting with high quality planting material and continuously flushing out disease, production increased by 200-300%. It was also concluded that a value chain approach without a nutrition component, may not have a major impact on young children vitamin A intakes. Most other projects of CIP have put nutrition at the forefront so this was an opportunity to test if OFSP would end up in the young child diet without significant promotion and training of caregivers.

Partners

- International Potato Center (CIP)
- Rwanda Agricultural Board (RAB)
- Catholic Relief Services (CRS-Rwanda)
- Young Women Christian Association (YWCA)
- IMBARAGA
- SINA GERARD/URWIBUTSO enterprises
- Kigali Institute of Science and Technology University
- Rwanda Bureau of Standards
- Rwanda Environment Management Authority
- Jomo Kenyatta University of Science and Technology

4.2.3 Questions and answers

Do you have samples of the products?

We'll have products to taste at the exhibition. Visitors can also buy Akarabo biscuits at the supermarket.

What informed the implementation of an endline survey?

The survey was to take place earlier, when the crop was being harvested and there was a lot of production, but we had too many surveys going on at the same time, and we ended up postponing it. The advantage was that we were able to learn that sweetpotato was consumed during the dry period.

Preparing sweetpotato flour is very expensive. What proportion of sweetpotato to wheat flour are you using to make it more profitable?

One of the debates at the beginning was what form of sweetpotato would be used in substitution – flour or puree. Flour is more complicated in processing and the beta-carotene degrades very fast. Drying sweetpotato is complicated, and the taste is also dependent on the process; if it ferments, there would be an aftertaste. Studies show that after three months, very little of the beta-carotene is left. The economic analysis at 2010 showed that it cost 1000RWF to produce a kilo of flour and only 300RWF to produce puree. Therefore, CIP promotes OFSP puree. Puree has also been found to be much easier for making dough, so the bakeries have been willing to use it.

SINA buys higher than market price. Don't you think this is a pull factor towards SINA and how will this influence survival rate of the smaller companies?

We decided to start with one large-scale processor to develop the product, market and supply chain. We tried working with small-scale producers, but it requires high investment to get them into the market.

What is the difference in profitability between using OFSP and wheat? I also didn't notice nutritional data?

We did a 7 day and 24 hour recall, and it was shown to be good enough because the nutritional evidence is already out there via HarvestPlus and Mama Sasha. We can share all the results.

How is the market functioning with regard to OFSP juice?

There are issues with the juice developed, especially pasteurization. The private sector must decide to invest in this, and proper packaging. We have to let them invest at their own pace so that their investment can be sustainable. In our case, we help in product development, and we link them to other private sector players who can provide services.

Are there initiatives to help informal processing of sweetpotato?

We have worked with many groups to train them on various aspects of processing. A number of these are making money at the cottage industry level.

It is good that the project also focussed on communications, which is often neglected. What areas did you focus on?

Seed system was the foundation of our additional work. We needed to work with the whole production system, in order to ensure the sustainability of quality seed supply. We also worked on net tunnels and selection, just to mention a few.

4.3 Performance of the OFSP chain in Mukono District, Uganda

Sarah Mayanja

The study sought to analyse the dynamics that influence the performance of the OFSP chain in Mukono district, Uganda. Specifically, it aimed to: characterize the chain, assess factors that influence farmers' decision to participate in the market and evaluate constraints faced by OFSP farmers. A cross-sectional study was done and data were collected from 123 farmers, 37 traders, 24 consumers, and nine key informants.

4.3.1 OFSP production and commercialization in Uganda

Since OFSP was introduced to Uganda, a number of initiatives have been made to popularize it. Mukono district, in central Uganda is a major hub of OFSP promotion initiatives. The district has proximal access to major urban markets and is therefore a good candidate for commercial production. However, OFSP is not easily available in major markets in central Uganda.

The purpose of the study was to analyse the dynamics that influence the performance of the OFSP chain. The objectives were as follows:

- Characterize the OFSP chain in central Uganda
- Assess factors that influence farmers decision to participated in the market
- Evaluate constraints faced by OFSP farmers

4.3.2 Methods

A cross-sectional study was done and data collected from 123 farmers, 37 traders, 26 consumers and 9 key informants. Focus groups discussions were held with 34 farmers. A two-stage model was run to determine factors affecting farmers' participation and extent of participation. Farmers were clustered in three categories: net buyers (n=21), autarkic (n=48) and net sellers (n=54), the latter being the base outcome.

4.3.3 Results

Characterization of the OFSP chain: The chain is disorganized with mistrust amongst actors. 48% of the farmers were commercial root producers, whose major market was rural consumers (plantation workers). OFSP was the least traded variety in urban markets. OFSP scored lowest among consumers with regard to attributes. The longer farmers grow OFSP, the higher the likelihood that they will expand the area under cultivation.

Table 8: Factors influencing the decision to participate - multinomial regression

Independent variables	Autarkic buyers	Net buyers
Years growing OFSP	0.100	0.061*
Labour costs	0.008***	0.200
Fertilizer use	0.000***	0.093*
Rank of OFSP	0.019**	0.776
Constant	0.295	0.035

Table 9: Factors influencing extent of participation in the market: Findings of the analysis using Tobit regression.

independent variables	p - value
Sex of h/head	0.059*
Years growing OFSP	0.045**
Log labour costs	0.000***
Fertilizer use	0.002***
Ranking of OFSP	0.067*
Access to extension SVCS	0.035**
Constant	0

The results revealed that labour costs, fertilizer use, sex of household head, importance of OFSP in the farmers' enterprise portfolio and access to extension services played a significant role in enhancing participation in the market. This means that if the household was headed by a man, or if OFSP was ranked highly as a crop, there would be higher participation.

Evaluation of constraints faced by commercial farmers: Farmers were found to face production constraints such as drought, pests and diseases, and lack of access to inputs (credit); post-harvest related constraints included high perishability, drudgery and bulkiness; and market related constraints were few reliable buyers, price fluctuation, limited access to market intelligence, poor roads and low preference of OFSP by traders and consumers.

4.3.4 Conclusions and recommendations

There was a higher fertilizer use than anticipated. Nearly all vine multipliers used foliar fertilizer, which is an indication that vines are a high value crop. Rural consumers appreciate OFSP. However, to expand the market, there is need to consider using similar strategies to increase urban consumers. In the study area, OFSP is a woman's crop, but women do not feature prominently as commercial farmers. Strategies should be put in place to increase their visibility. There is also need to improve linkages between chain actors and supporters.

4.3.5 Questions and answers

Who is a commercial farmer?

Farmers described what a commercial farmer as one who has ample land, which varies from area to area. In Mukono, they said it must be 5 acres minimum. The farmer should be able to sustain participation in the market regardless of the season.

During the research, you spoke about the challenges of farmers. What did you find out about market actors?

Retailers and wholesalers find it difficult to sustain demand during the tail end of the season. There are problems with the infrastructure, so whereas the market should be 30 minutes away, sometimes it can take over 2 hours. The farmer is therefore not willing to go out to the market and the trader has to go to the farm. Sometimes, farmers and traders agree on the order and price, but when the trader gets to the farm with the truck, they find that the farmer sold produce to someone else because they got a better offer.

Why did you decide to use the Tolen model? This could be confusing your results?

I looked at a truncated model but I did not have a large sample, so it was based on what would work best.

Have you done any analysis comparing the market price of OFSP and yellow-fleshed sweetpotato?

The demand for OFSP is higher in rural areas than urban areas in Uganda. I would imagine that people in urban areas are more informed about health and nutrition and would be more interested in OFSP?

4.4 Sweetpotato value chain and market analysis in Burkina Faso

Ibrahim Koara

Institut de l'Environnement et Recherches Agricoles (INERA) works in partnership with CIP's Jumpstarting OFSP in West Africa through Diversified Markets project. INERA focuses on developing sustainable commercial seed system, while iDE's activities focus on market development and drip irrigation for vine multiplication. The project is only a year old.

IDE is working on sweetpotato and there was the need to first understand the market through a value chain and market analysis. Koara's presentation focused on this analysis that was undertaken in Kénédougou province, where the project is being implemented.

4.4.1 Objectives and methodology

Fig. 7: Value chain and market analysis - target zones

The objectives were to (a) describe and analyse sweetpotato value chain and market; (b) identify suitable process products for the market; and (c) identify partners for commercialization and processing. The study was undertaken in Kénédougou province, which is located in the west and is the largest sweetpotato production area in Burkina Faso. The area is characterized with adequate rainfall and good soils, and a greater proportion of the population is aged below 35 years.

After undertaking a bibliography review, data was collected through interviews with different stakeholders such as producers, wholesalers, retailers, processors, consumers and local development actors. These stakeholders were drawn from main end markets selected were Bobo Dioulasso, Kaya, Dori, Ouagadougou in Burkina Faso, and Sikasso in Mali.

Fig. 8: Value chain and market analysis – selected market places for data collection

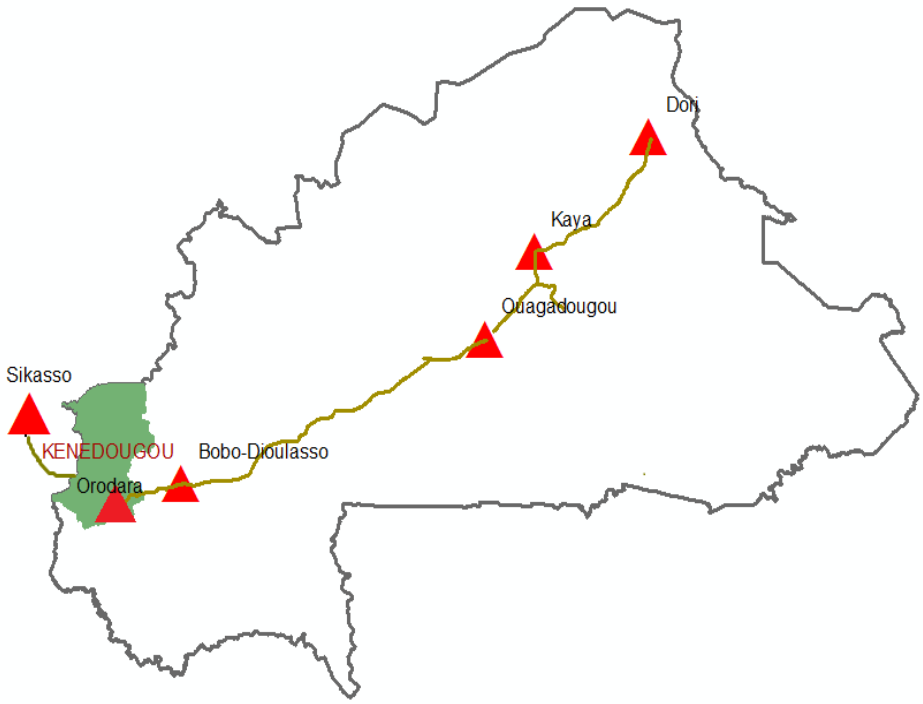
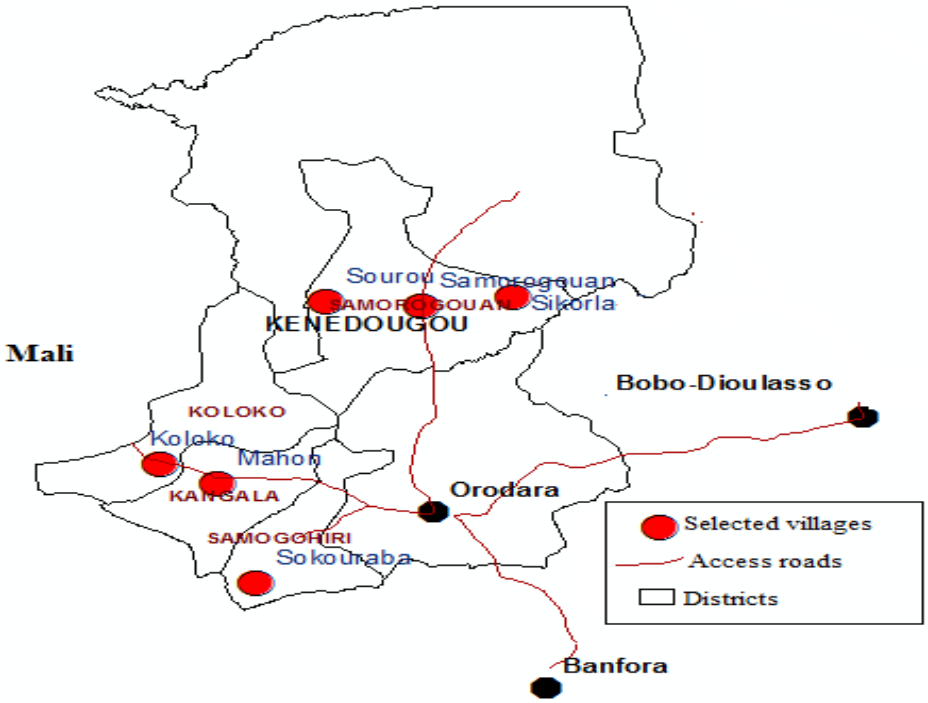


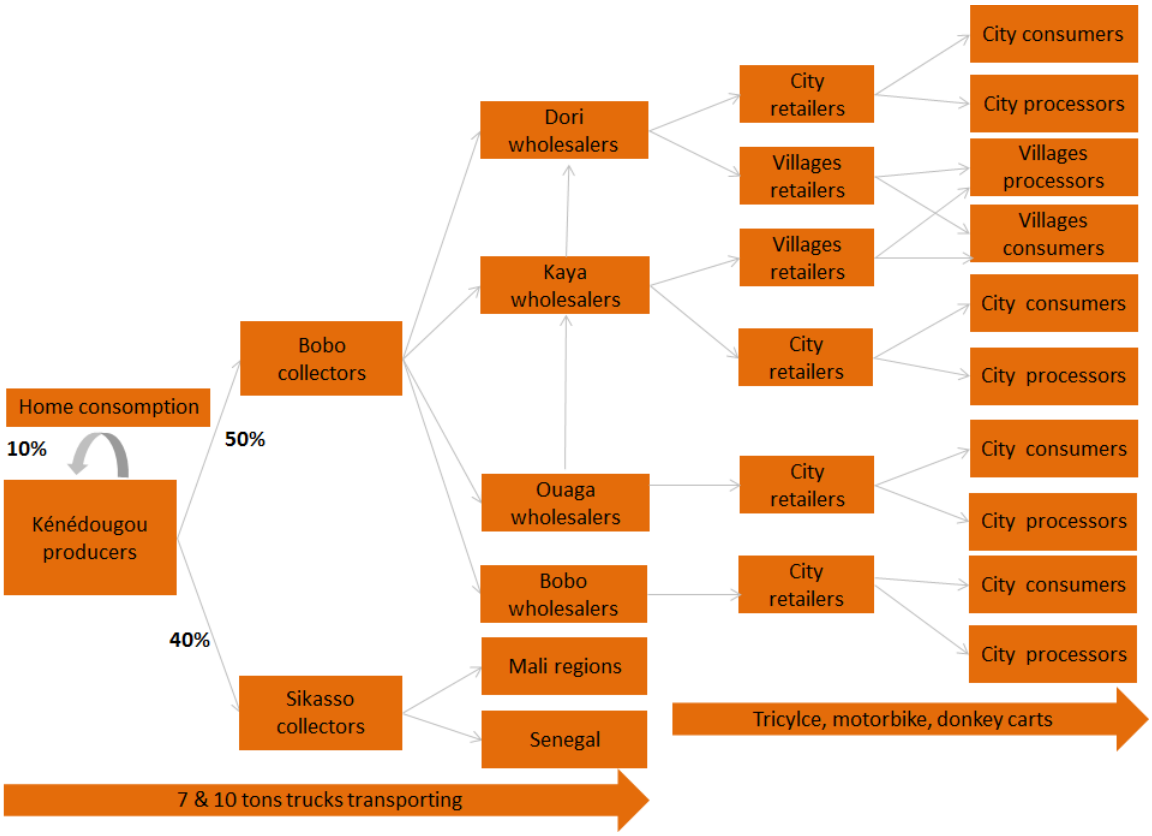
Fig. 9: Value chain and market analysis – selected production villages



4.4.2 Findings

Fig. 10 below shows the sweetpotato value chain. Around 10% of sweetpotato is used for home consumption, 50% is taken by Bobo collectors and 40% by Sikasso collectors.

Fig. 10: Kénédougou sweetpotato market chain



Most of the production is of the white-fleshed variety. Most of the growers are men and most of them engage in the trade as a cash crop. Women and children are mostly involved in weeding and harvesting.

There are three main production systems: from March to May farmers undertake garden sprouting; between June and August, planting and off-season harvesting takes place. On-season harvesting takes place from September to December.

According to the producers who were interviewed, prices fluctuate from year to year. In some years, when the produce is good, farmers get a good harvest and sometimes flood the market, resulting in reduced prices. In the next year, some of these farmers decide not to grow the crop, and those that do then take advantage of the reduced supply and make more returns. Less than 1% of the farmers interviewed grow OFSP. The reasons for this include lack of planting material; farmers are not well organized, poor marketing know-how and low yields.

Wholesalers, who are mostly male, stated that they prefer white fleshed-skinned sweetpotato. They explained that they used to sell to retailers on credit, which limited supply capacity because the retailers had to sell their roots before they could pay back what they owed. They cited storage as an issue. Wholesalers seemed to be much better organized than farmers.

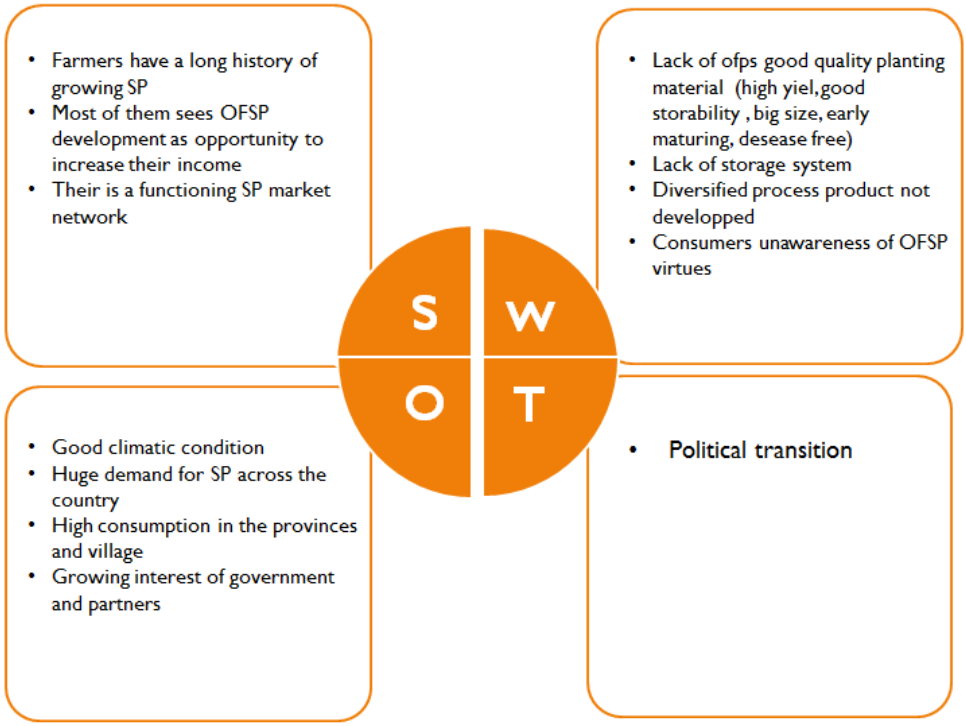
Retailers are mostly women. They get supplies on credit and prefer the white-fleshed and skinned variety. Most of them sell on credit to fryers and boilers. They said that OFSP is well appreciated and is sometimes more expensive than the white-fleshed variety, but OFSP is not easily available.

Processors either fry or boil sweetpotato; others produce infant mix, déguè and couscous for the market, while some others produce biscuits, cakes and chips for fairs. Processed products are not well known apart from fried and boiled.

Sweetpotato is consumed as a staple in the provinces. Most of the consumers do not know other recipes apart from boiled, fried or ragout. They did not have any preference about varieties and were not aware of the positive attributes of OFSP. However, they said that children prefer OFSP because it tastes good. Most said that OFSP is not seen in the market.

Cost and benefit analysis: Structure of the cost and benefit shows that processors and retailers are more profitable, while transport, collecting and wholesaling are less profitable but those actors still make more profit because they handle huge quantities of products.

Fig. 11: SWOT analysis



Suitable product for the market: The study found that fried and boiled sweetpotato is good for the market because it is known by the women, couscous and flour are not very well known and therefore, the demand is less. Potential partners for product development were identified. These include WILIKA TAAMA Cooperative (Chips, couscous and cake); Enterprise BALO GNOUMAN (Infant mix); Enterprise ENTRACEL (Infant mix & Couscous); WEND MANAAGA association (Déguè & couscous); DAFANI for Juice.

Financial access: Credit to sweetpotato producers is very limited but microfinance institutions are ready to scale up if there is some support in terms of collateral or funding.

4.4.3 Conclusions and recommendations

Sweetpotato is a functioning value chain in Burkina Faso because farmers have been able to sell an average of 45,000 tons/year since the last decade. However, the value chain needs to be improved. OFSP should be promoted strongly because currently, it is not represented in the value chain. This could be done through awareness campaigns in production areas to increase OFSP production; marketing campaign in consumption places for OFSP demand creation; integrating OFSP in traditional markets network; promotion of diversified process products (infant mix, dégué, couscous, chips and juice). There is additional need to ensure that producers have access to good quality planting material and their capacity in production and marketing is built to enable them meet the created demand. Farmers and different players have shown interest; the potential is huge but there still exist many constraints.

4.4.4 Questions and answers

Why do you work in rural sections and not urban?

The area in which we are working is where sweetpotato is consumed as a staple therefore it was the most reasonable place for us to start working.

Which marketing processes are you undertaking to promote OFSP?

The first strategy in reaching rural populations was to use farmer promoters. We also spoke with a person working on HIV and health, and she highlighted the opportunity to hold a promotion with stakeholders like doctors and patients, and this is an area that we will have to pursue further.

5 SESSION THREE: BIOTECHNOLOGY, GENOMICS AND VIROLOGY

5.1 Engineering weevil resistance in sweetpotato to benefit farmers in Africa

Marc Ghislain, Lydia Wamalwa, Sandra Manrique, Jan Kreuze, Runyararo Rukarwa, Robert Mwanga, Maria Soto-Aguila[2], Katterinne Prentice, Olivier Christiaens, Ine Pertry, Godelieve Gheysen, Guy Smagghe

Work in engineering weevil resistance in sweetpotato is pursued through the following approaches.

1. Damages caused by weevils on sweetpotato: *Cylas puncticollis* and *Cylas brunneus*; Coleoptera: Brentidae.
2. Accumulation of toxic compound in healthy-looking parts: Lydia Wamalwa, Jesse Machuka, Baldwyn Torto, and Marc Ghislain (CIP / ICIPE / KU).
3. Engineering weevil resistance using *Bt* technology: Lydia Wamalwa, Sandra Manrique, Jan Kreuze, Runyararo Rukarwa, Robert Mwanga, Maria Soto-Aguilar, Marc Ghislain (CIP-ABL & BecA / NARO / DDPSC).
4. RNAi against essential genes of the weevils: Katterinne Prentice, Olivier Christiaens, Ine Pertry, Guy Smagghe (Ghent University).

These efforts are addressing the threat presented by weevils. According to a survey that was completed in Uganda in 2009, weevils cause 28% of crop losses every year. These losses can rise up to 90% during dry periods, and they have a negative impact on food security, marketability of the crop and healthiness.

Integrated pest management practices are difficult and conventional breeding not yet successful. All that farmers are able to do when weevils attack their fields is to try and salvage what they can. Because of that, an aspect of the research looked at what happens to a sweetpotato root when it is affected by a fungus or bacteria. Focus was placed on one compound that is known to be highly toxic. The research found that phytoalexin, ipomeamarone, accumulates in the healthy-looking parts of microbially infected storage roots at levels posing health threat to farmers in SSA who consume the undamaged parts of damaged storage roots. Therefore, a breakthrough in weevil resistance would also reduce this health threat.

5.1.1 *Bt* sweetpotato

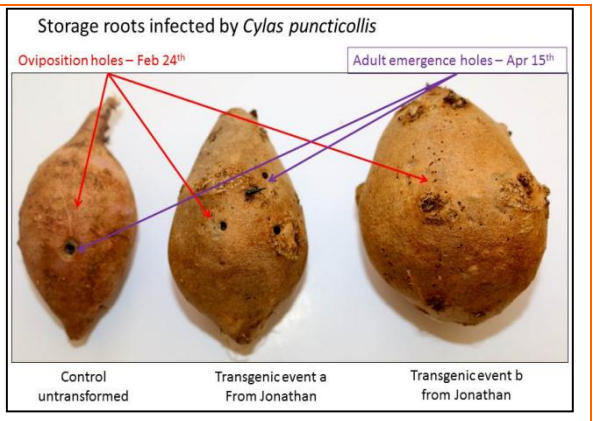
Four years ago, four *cry* proteins were identified that were more active against weevils than others. The idea was then to introduce these *cry* proteins into the sweetpotato storage root. The implementation took some time as sweetpotato is not an easy crop to transform. In the first phase, *cry* genes were meant to look like sweetpotato genes. These transgenic plants were screened for high activator of the cry protein. 117 transgenic events were produced with *cry* genes that resemble sweetpotato genes. For the last three to four years, assays have been done on these events.

In *Fig. 12*, the big holes on the roots showed where the adult emerges after the pupil stage. On the other one, there was no emergence hole into the root, and after it was cut into pieces there was no evidence that it had

been attacked, which could be a sign that the *cry* protein killed the larvae. In another root, there was one dead adult, the pupil went to the last stage and the larvae was trapped.

Fig. 12: Transgenic events

Transgenic event Jewel 12.1 with cry7A and ET33-34



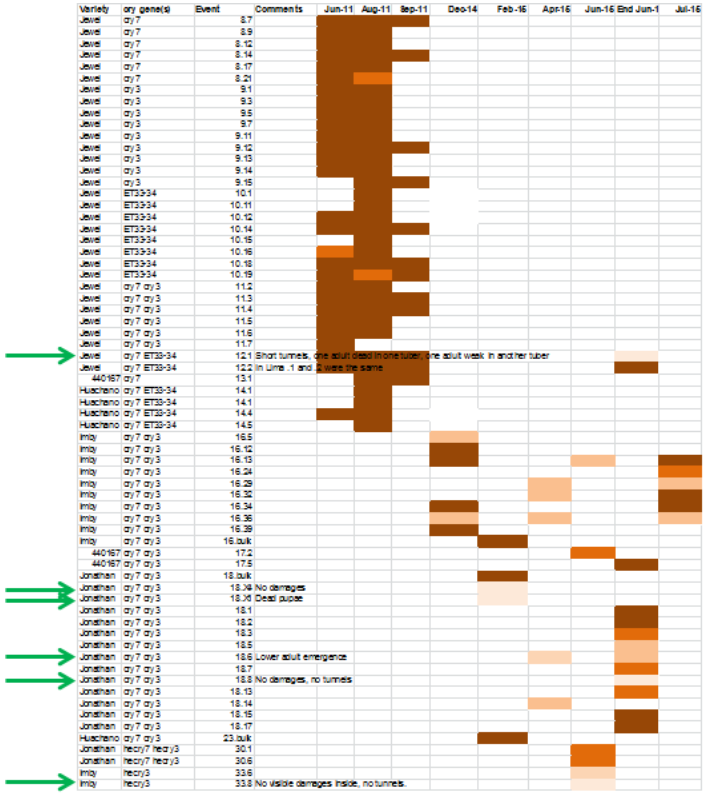
Based on the first results of the 30 events were all negative, a second phase was begun. Today, there are 600 transgenic events, about 100-150 have been screened with antibodies to see which ones have the cry protein. The work is going on in both Peru and BeCA laboratory in Nairobi.

In total, 67 transgenic events that were screened and there was significant difference with the control in six of them (Figure 13 below). This is the first time that such an observation that points to potential resistance has been made, but this has to be reconfirmed before making final conclusions.

5.1.2 RNAi by genetic transformation

Since the first results were not so great, it was decided that Bt would be combined with RNAi. Sequences of 24 essential genes were identified. When screened by injection, it was found that eight of them were as good as the gene used to control root worm. The second part of the work was to see if by ingestion in s3 essential genes repeatedly the best target (soaking, artificial diet with synthtis or bacterial produced dsRNA) would be effective. Data show that all of them reached a level of mortality, but three of them exhibited more mortality (Proteasome 20kD, Ribosomal protein S13e and Snf7). For the next 18 months, five gene constructs that will express the RNAi against (dsSn7 (Cp24) hairpin – C. Puncticollis, dsProt20Kd (Cp12) hairpin– C. puncticollis, dsCp24-Cp12 fusion hairpin– C. puncticollis, dsProt20Kd (Cb12) hairpin – C. brunneus, dsCp24-Cb12 fusion hairpin – C. brunneus) will be developed. In one year's time, the bio-assay will start at BecA.

Fig. 13: 67 transgenic events tested resulted in 6 with significant differences.



- 67 transgenic events tested resulted in 6 with significant differences.
- Under reconfirmation.

5.1.3 Conclusion

Progress is being made towards a situation where a combination of Bt and RNAi will hopefully be successful and durable to engineer weevil resistance into sweetpotato. The expected benefits are yield increase, food security, health benefits.

5.2 The Genomic Tools for Sweetpotato Improvement Project - GT4SP

Craig Yencho

China produces about 70-80 percent of global sweetpotato. All the areas on the map represent acreage under sweetpotato, so if yield is improved in those areas, the SPHI goal to reach 10 million by 2020 is very realistic.

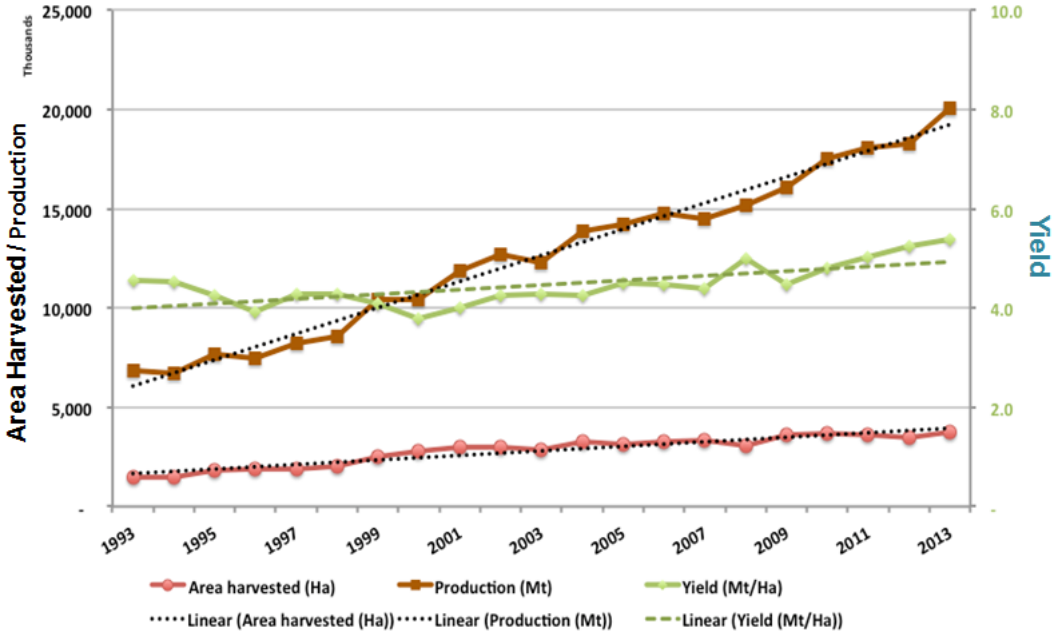
5.2.1 Sweetpotato production trends in the United States of America

What is the ideal sweetpotato shape for the US market? Many companies are going natural, and with that come also the use of natural food colour with nutritional components. The purple-fleshed sweetpotatoes that contain anthocyanin are used not for the taste, but for the colour. Sweetpotato products are expanding, e.g. pet food, beer made of sweetpotato puree, vodka and sweetpotato fries. These developments have led to increased demand and change of breeding focus of the sweetpotato. The breeding program has been influenced greatly to screen and breed for the characteristics that the market demands. 18 sweetpotato varieties that are fully ornamental are being sold to 13 countries in the world. Production started to pick up in 2005. This is a reflection of the scale of production, partly promoted by release of better varieties.

5.2.2 African sweetpotato production trends

Plenty of work being done to increase production in SSA, and the range of sweetpotato projects has expanded tremendously. Some of the ongoing breeding work has resulted into higher yields. Nonetheless, the growth of sweetpotato has remained fairly flat.

Fig. 14: African sweetpotato production trends



Clean seed is what propelled the US market, and Africa is now getting to this point. With the support of BMGF, the SASHA Project (2009-2014) led by International Potato Center is propelling progress in four key areas:

1. Population development and varietal selection
2. Seed systems
3. Delivery systems (proof-of-concept)
4. Management and sweetpotato support platforms

Table 10: Highlights of the focus areas, goals and progress in breeding work in SSA

Focus	Goal	Details
Focus 1: Breeding and Varietal Development - New Populations	GOAL 1: Generate a radically expanded range of sweetpotato varieties that combine different quality characteristics with significant improvements in yielding ability	◉ Generate populations to meet dominant needs of users ◉ All sites: High dry matter ◉ East & Central Africa: virus-resistance, orange-fleshed, dual purpose for animal feed ◉ Southern Africa: drought resistance, orange-fleshed ◉ West Africa: non-sweet sweetpotato, orange & white-fleshed
Focus 2: Breeding and Varietal Development - New Breeding Methods	GOAL 2: Redesign sweetpotato breeding systems in Africa to produce varieties in fewer years (3-4) than currently (7-8 years) - "accelerated breeding"	◉ More sites at the earliest stages of breeding to substitute for fewer sites over more seasons ◉ At least one site being the "tough" selection conditions; for instance, consistently drought stressed ◉ In February 2011, released 15 new, more drought tolerant OFSP in Mozambique ◉ Also released varieties using accelerated breeding in Malawi and Rwanda

Focus 3: Breeding & Varietal Development	GOAL 3: Exploitation of Heterosis – Demonstration that heterosis exists for root and foliage weight… but not for quality traits?	A) Working with two heterotic gene pools, on average for first hybrid population: ◉ 22.9% root yield jump (dry matter basis) ◉ 7.8% more biomass production. B) Potential of further yield jumps by selecting the best "hybrid family parents" ◉ Up to 100% more root yield (dry matter basis) ◉ Up to 85% more biomass production. ◉ These 2nd hybrid populations now underway in Uganda, Mozambique*, and Peru*
Focus 4: Management and Sweetpotato Support Platforms	GOAL 4: Research organized around breeding platforms that integrate and support the work of institutional partners in each sub-region	◉ Provide technical backstopping • Special emphasis on Alliance for a Green Revolution (AGRA) supported national breeding programs and PhD training programs (ACCI & WACCI) ◉ Assure clean germplasm exchange ◉ Assure gender-sensitive design and implementation ◉ Assure comparable data collection between countries engaged in the breeding and germplasm exchange ◉ Facilitate information exchange
	Each Platform with Quality Lab and Clean-up Capacity	◉ Screen houses essential for maintaining stocks of disease free vines as primary foundation material ◉ Near Infrared Spectrometer (NIRS) enables rapid assessment of major macro- and micronutrients

5.2.3 Current Status of Sweetpotato

The advances in the US sweetpotato production were as a result of clean, good quality seed. With the current development of quality labs and cleaning capacity, SSA is set for a potential transformation. The importance and potential of sweetpotato has become widely recognized across the globe. Many public and private organizations recognize the superior nutritional value in sweetpotato compared to many other staple crops and investments are increasing. S ASHA "1" has been very successful – 4-6 new breeding programs, more than 18 new varieties and three region sweetpotato support platforms have been established, NIRS technology was introduced, seed systems, virus studies, and a lot of work has gone into value chains and product development. SASHA "2" and the SPHI have recently been launched.

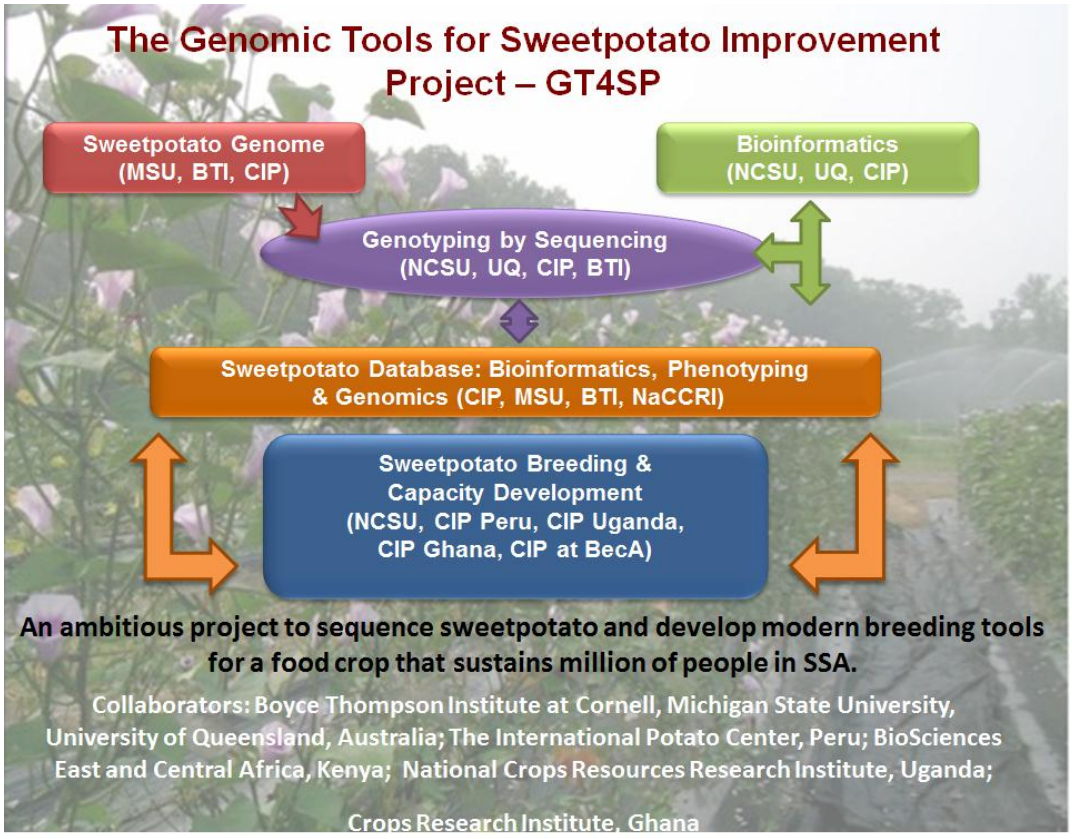
There is greater interest in sweetpotato than ever before, but genomic resources for sweetpotato are noticeably lacking. To fully realize sweetpotato's true long-term potential, there is need to invest in modern breeding tools, and integrate them into applied breeding efforts connected to improved seed systems and market-based value-chains.

5.2.4 The Genomic Tools for Sweetpotato Improvement Project – GT4SP

In 2013, with the support of BMGF, stakeholders developed a vision for sweetpotato development in SSA and brainstormed what would have to be done to achieve this vision. One of the things that came out clearly was that there was need for greater investment in upstream breeding technology.

The breeding pipeline investments should include:

a) Genomic resources – a reference genome; marker development; a robust set of SNP markers and a low-cost genotyping platform; advanced laboratory sequencing linked with developing country phenotyping and breeding activities; and diploid and hexaploid mapping, training and test populations
b) Bioinformatics, analytics and database resources – stand-alone and web-based bioinformatics resources; sweetpotato database, data collection and phenotyping options; new analysis resources
c) Human resources and capacity development - continue to assemble and develop a dynamic team of breeders and allied disciplines; training in the use of traditional and genomic breeding methods; effective communication and collaboration; and multi-institutional training and capacity development. Two PhD students from Ghana and Uganda recently joined the capacity development program.



The GT4SP project will work on the following: Sweetpotato genome sequencing involves sequencing the closely related wild ancestors that are diploid and homozygous and using them as reference genomes; development of high yielding multiple resistant sweetpotato germplasm; work on weevil resistant sweetpotato

The expected outcomes of the project are:

- An marker-assisted breeding pipeline that utilizes up- and down-stream breeding methods
- Genomic selection technologies integrated with the SASHA accelerated breeding program

- A new generation of sweetpotato breeders, and a new cadre of molecular geneticists and bioinformatics scientists interested in using the new tools to study sweetpotato.
- Linkage of genomic-based breeding to address the demand of new varieties and "products" will yield maximum long-term return on investment on current sweetpotato crop improvement investments in SSA.
- This work will not find all the solutions. Conventional breeding will still be the workhorse, but genomics will offer new solutions for difficult traits.

5.2.5 Questions and answers

You mentioned that the production of sweetpotato chips is increasing in USA? How is it being consumed?

The sweetpotato chips are being consumed in place of Irish potatoes. What is driving demand is that they are healthier than the Irish potatoes. They also fill you up quickly. One of the problems is that processors have to use batter coating to give them a crunch. There is now a major drive to eliminate the batter by breeding starchier sweetpotatoes with a natural crunch.

5.3 DNA viruses of sweetpotato: Harmless co-inhabitants or unseen ravagers

Jan Kreuze

Viruses are a big problem in sweetpotato but with longer study, it is possible to isolate what is important and what is not. In the last 15 years there has been an explosion in virus detection and identification. Right now there are 30 viruses affecting sweetpotato, and more than half of them are DNA viruses, most from potyvridae e.g. the SPFMV and sweet potato mild mottle virus (SPMMV) which is common in East Africa. These viruses don't show any symptoms and are low titers. However, the sweet potato chlorotic stunt virus (SPCSV) is like the HIV of sweetpotato, because it renders the plant susceptible to most of the other viruses. It is spread by white flies and aphids. Begomoviruses (also known as sweepoviruses) are not specific to sweetpotato but are quite common. Other viruses include caulimoviridae and badnaviruses that were discovered only a few years ago. Begomo viruses are very diverse. They used to be 17 but they have been reduced by taxonomists. Some results from a study on next generation sequencing (frequency of viruses) found that 92% of all material collected was affected by one or more viruses. The badnaviruses were quite spread and were found in 78% of the sample.

5.3.1 Begomoviruses

Begomoviruses have not received much attention but they were found in 30% of the sample. Also called sweepoviruses are very different from other begomoviruses. They are DNA viruses with very many species. They show no symptoms and yet they result in very high yield losses of between 10 and 80%. The questions that the study wanted to address are (a) how common are they? (b) do all variants behave the same? (c) do they interact with SPCSV?

With the SPCSV, it is clear what causes the exact protein that interacts with RNase 3, causing the breakdown of resistance. The team screened for begomoviruses (329 genotypes from Latin America and 65 genotypes that came through Uganda). They found many that were infected with begomoviruses – they were curling, yellowing or a combination of the two. They sequenced a part of their genome and selected the most diverse 5 isolates. They sequenced the complete genome to see how diverse they were. Virus titres in plants in combination with SPCSV titres were high, but many of them did not show symptoms. This means that it is important to look a little deeper at sweetpotato in the field e.g. yield.

5.3.2 Badnaviruses

Badnaviruses were first discovered through sequencing and assembly of small RNA in 2009. They were named sweet potato *pakakuy* virus. This particular group of viruses is known to integrate in the sweetpotato genome. The PCR results showed that they were everywhere in the germplasm, including those that had gone through thermotherapy. They occur in very low titre which makes them hard to detect, however, they can be detected by PCR. In sweetpotato, they can be transmitted by grafting. Experiments show that they are influenced by co-infection with other viruses, but in very low concentrations.

5.3.3 Conclusions

Due to the high losses in yield that begomoviruses can result to, there needs to be further investigation of the impact of these viruses in sweetpotato production in Africa. On the other hand, badnarivuses occur in extremely low titres and do not seem to have any impact on yield. Academically, and with availability of funds, it would also be interesting to investigate them further.

5.4 Assessing virus degeneration of clean sweetpotato planting materials multiplied in insect-proof net tunnels under farmer management

Kwame Ogero, Margaret McEwan, Jan Kreuze, Simon Jeremiah, Obadiah Mayanja and Nessie Luambano

The Kinga Marando project is piloting the use of low cost net tunnels to help protect vines from whiteflies and aphids, the disease vectors. CIP is a sub-grantee of the project which is led by Lake Zone Agricultural Research and Development Institute (LZARDI). The project is implemented in Kagera, Mwanza and Geita regions in the Lake Zone, Unguja in Zanzibar and in Uganda.

The study seeks to determine the rate of virus degeneration of clean sweetpotato planting materials multiplied in insect-proof net tunnels as compared to planting material multiplied in open fields over a period of two years under farmer management. The study allows comparison between (a) susceptible (Kabode) and less susceptible (Polista) varieties; (b) high virus (Mwasonge) and low virus pressure (Nyasenga) areas; and (c) sprayed tunnels and open field multiplication.

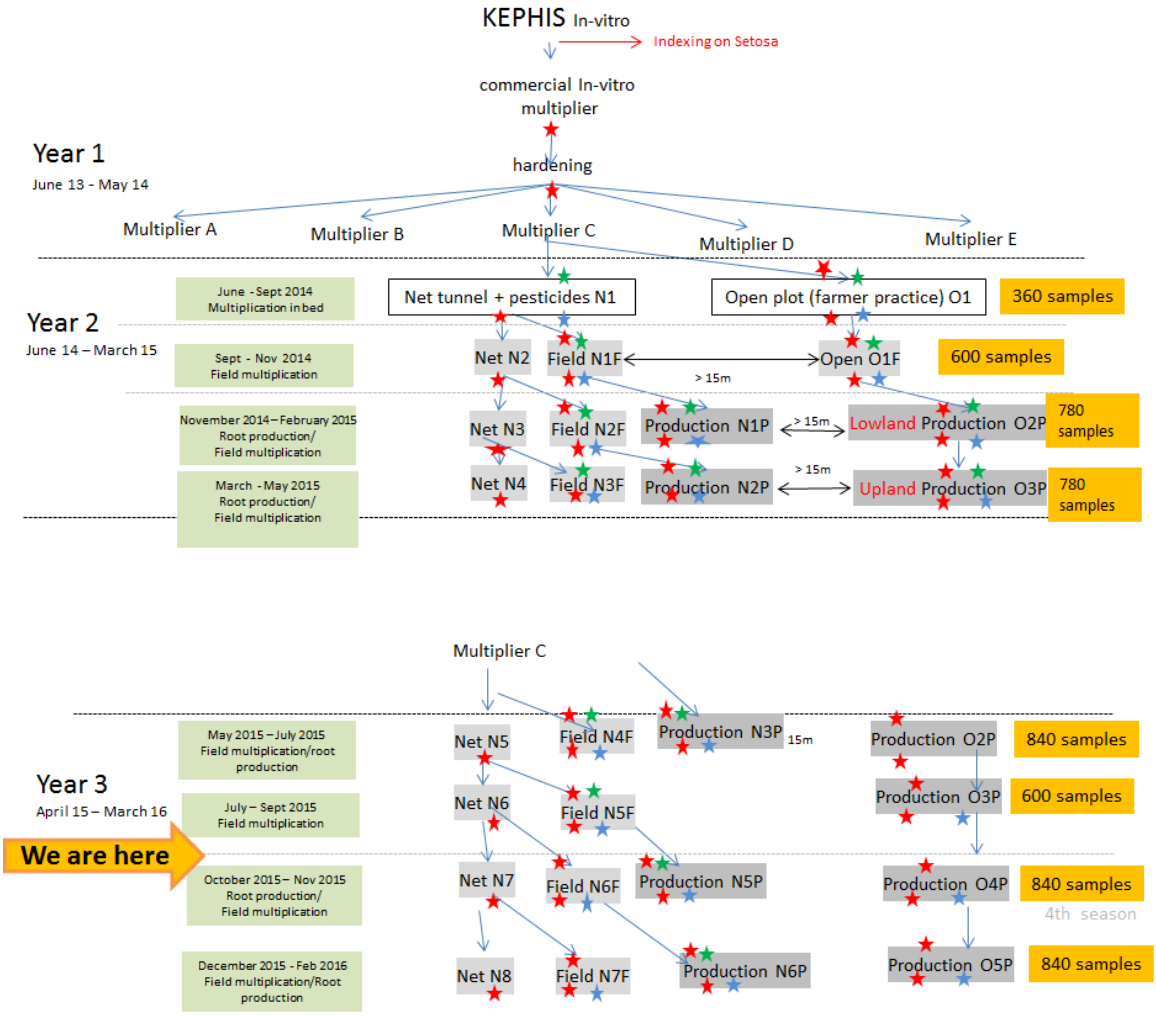
5.4.1 Methodology

VDS site in Mwasonge village: 18 August 2014 (credit K.

Two net tunnels and two open beds were established per site in June 2014 with Kabode and Polista varieties. Initial isolation distance between net tunnels and open beds was 1m; while the distance from sweetpotato plants was 15m. An isolation distance of 15m was maintained during field multiplication and maize was planted as a barrier crop. 10cm X 20cm spacing was used for both establishment and multiplication. Vines were harvested after every 60-80 days and vine yield calculated. Leaf samples were also collected and sent to the laboratory for virus testing through polymerase chain reaction (PCR). A visual

assessment of virus symptoms and whitefly count was done once in each field generation. Additionally, weather data (Rainfall, RH and temperature) was recorded using Onset® data loggers. *Fig. 15* below shows the timeframe of the project.

Fig. 15: Timeline of the Kinga Marando project



5.4.2 Results

a) Vine Yields: Values decrease through generations for the sites and varieties. Net tunnel materials weighing higher compared to open field materials. However, there are no significant differences among the slopes of the curves, which suggest that the reduction in weight is more or less the same in all the sites, varieties, and technologies.

b) Virus testing via PCR: Samples were screened for begomovirus, potyviruses and SPCSV using PCR, reverse transcriptase PCR and real time PCR respectively. All samples from Crop Biosciences Ltd tissue culture lab tested negative for all the viruses. Batch 1 – 4 samples from Mwasonge and Nyasenga also tested negative for potyviruses and begomoviruses. Testing of field samples for SPCSV via real time PCR were not successful because of low quality DNA and the exercise is set to be repeated.

c) Trend in weather conditions: Drought affected the production.

e) Root yield: The first generation of root production was adversely affected by dry conditions. No marketable roots were produced on both sites. In generation 2, more roots (both marketable and non-marketable) were produced in Nyasenga compared to Mwasonge for both varieties. Poor root production in Mwasonge was affected by high amount of manure in the soil which favoured vine production at the expense of roots. The next root harvest will be on October 9, 2015.

5.4.3 Challenges

Weed management: A mulch of rice husks was applied during establishment in order to suppress weeds. It was assumed that this would suffice for the entire project period, but this was not the case as weeds emerged after the first harvest.

Caterpillar infestation after harvesting: Net tunnels are sprayed after harvesting before closing. However, it has been observed that butterflies fly into the tunnels when they are open and lay eggs there. Pesticide is not effective during this stage of the life cycle.

Mealy bug infestation: These are not sweetpotato pests but are common greenhouse pests. The pest problem was addressed by spraying with pesticides when spotted.

5.4.4 Conclusion

There is a reduction in weight and vines through time. However, this trend is not significant for both sites and varieties. Open field values for weight are always below the net tunnel ones, although for both sites and varieties this difference is not significant. There is a clear positive effect due to the use of net tunnels. Provided that net tunnel materials maintain the virus clean status, production of vines will depend on prevailing weather conditions and management. With good agronomic practices farmer multipliers should be able to produce clean planting materials using the net tunnels. Two rounds of harvesting and sample collection are remaining: October and December 2015.

Questions and answers

In your protocol, do you standardize the environment e.g. soil? And for how may years do you intend to carry out this sample?

The study is being done under farm management so no soil analysis was done. The only difference is that one is high, and the other is low virus pressure zone. If you do the same in Nigeria, it may be a good idea to do soil analysis from the beginning.

The same plants were planted and you harvested the vines. How do you know if it is natural degeneration because plants are getting older, or the quality degeneration is because of virus?

The materials are kept for all that period because we want to find out how long farmers can keep those materials under the net tunnels and rely on them. To know whether degeneration is because of viruses, there is virus testing using PCR at every harvest. The conclusion is that provided the materials will remain virus free, factors influencing the amount of material will depend on physiological age and agronomic practices. One of the questions we are asking is whether we should replant the material.

In terms of the cost-benefit analysis given that you get the materials from KEPHIS, is it possible to have a bigger net tunnel?

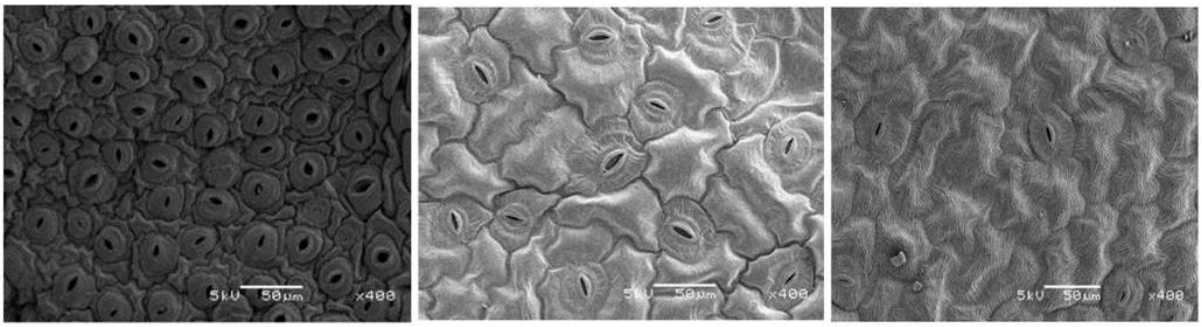
Establishment of a larger net tunnel depends on the need. The responses we got are that most are satisfied with the size.

5.5 Chitosan improved *in vitro* growth, leaf ultrastructure and acclimatization of micropropagated sweetpotato

H.C. Mihiretu, E. Du Toit, J.M. Steyn, and S.M. Laurie, Robbert

Chitosan is derived from Chitin (oligomer Chitosan is preferred). It is biocompatible, biodegradable, no acidic degradation and non-toxic. It is widely studied for different biochemical application including tissue engineering/ regeneration. Recently; agricultural use of chitosan is increasing.

5.5.1 Use of Chitosan in agriculture



Chitosan enhances crop productivity through its different bioactivity. It stimulates plant growth, improves seed germination and boosts disease resistance. It increases chlorophyll content and enlarges chloroplast size. Applied in the soil, it increases nitrogen fixing nodes of legumes and plant mineral uptake. Foliar application results in reduced leaf water stress and it protects the leaf against pathogen entry. It is used as coating in artificial seed production.

5.5.2 Use of Chitosan in plant tissue culture

Chitosan is used to increase shoot multiplication rate of different plants (chrysanthemum (14%); limonium (17.9%); strawberry (19.4%); grape vine, sweet basil and curcuma mangga).

Studies have also shown that it contributes to an improvement in photosynthesis activity, acts as an anti-oxidant, increases stress hormones such as abscisic acid and also results in an increase in scavenging reactive oxygen species.

5.5.3 Objectives of the study

Although chitosan has been used for improving micropropagation of many crops, no research has been conducted on sweetpotato so far. The use of chitosan to improve the rate of regeneration, *in vitro* growth and outside acclimatization of sweetpotato plantlets will reduce cost of tissue culture plantlets.

Therefore, the objective of the study is to explore the different bioactivity of *in vitro* applied chitosan on i*n vitro* growth performance, leaf ultrastructure, contamination rates and outside acclimatization of sweetpotato plant.

5.5.4 Methodology

Plant material: OFSP variety “Resisto” was used for this study. The standard explant preparation for sweetpotato was used.

Treatments and Media preparation: Common substrates (3% sucrose, 4.43 g of Murashige and Sckoog (MS) salt and 2% Gelrite (w/v)) were supplemented with different Chitosan concentration (Treatment 1:- 15 mg l^{-1}; Treatment 2:- 30 mg l^{-1}; Treatment 3:- 60 mg l^{-1}; Treatment 4:- 100 mg l^{-1} and Treatment 5:- 0 mg l^{-1} (control)).

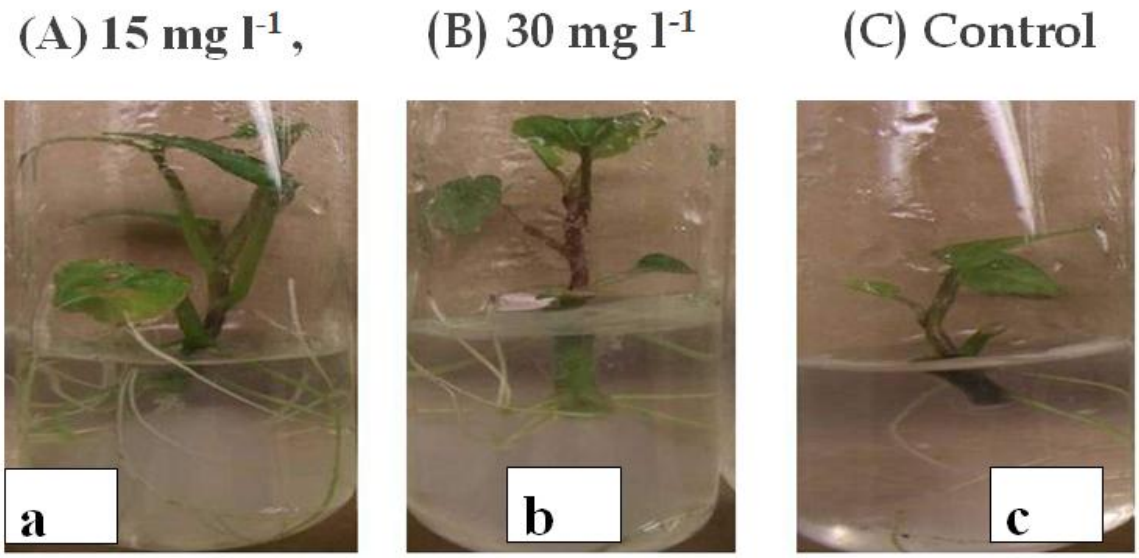
Leaf ultrastructure studies: Transmission Electron Microscopy (TEM) was used to study the internal structure of cuticle layer thickness, chloroplast (normality), chlorophyll density, and photosynthetic accumulation. Scanning Electron Microscopy (SEM) was used to study the surface of the leaf, stomata density, size, structure, stomata pore openings, and epidermis structure. Eight samples were collected from each of the five treatments, which were 30 days old *in vitro* and 20 days old acclimatized plantlets. The same procedure was followed for leaf segment fixation, post-fixation dehydration for TEM and SEM.

5.5.5 Results and discussions

Chitosan on root and shoot formation: Addition of 15 mg l-1 of chitosan significantly improved percentage of early root and shoot formation with significantly highest rooting and shooting success followed by the 30 mg l-1 treatment (*See Fig. 16*).

Effect on *in vitro*

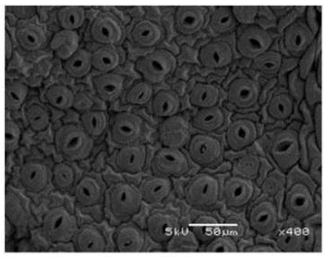
Fig. 16: Shoot and root differences of in vitro plantlets supplemented with different concentrations of chitosan



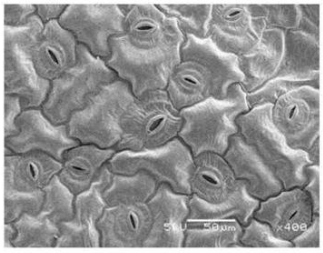
growth performance: 30 mg l^{-1} showed higher shoot growth, shoot and root weight, vine diameter, internode length and leaf number of sweet potato plantlets, measured 45 days after culturing.

Stomata density, size and shape: The 15 or 30 mg l^{-1} chitosan treatments had significantly the lowest upper leaf surface stomata density of 212 and 208 per mm^2 respectively (*see Fig. 17*).

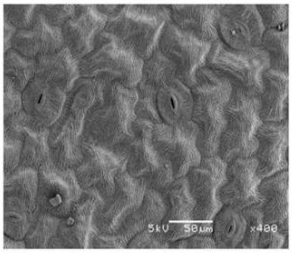
Fig. 17: Shoot and root differences of *in vitro* plantlets supplemented with different concentrations of chitosan



Control before transfer to the outside environment



15 mg/l before transfer to outside



After 45 days of acclimatization

5.5.6 Conclusion

Chitosan enhanced early morphogenesis (roots and shoot initiation) which led to the growth rate and biomass weight accumulation of plantlets.

Incorporation of chitosan in *in vitro* cultures improved greenhouse acclimatization of sweetpotato plantlets through rapid physiological and anatomical adjustment that lead to higher survival rate of plantlets

Generally supplementing 15 and 30 mg l^{-1} of chitosan in the growth media improved the quality and the rate of acclimatization of sweet potato plantlets. Therefore, it is recommended to supplement 15 to 30 mg l^{-1} of chitosan in the growth media for improved production of sweetpotato planting material through tissue culture techniques.

5.5.7 Questions and answers

How much does cheaper sand cost and how can I find it in SSA?

The cost is different from place to place. The study was done in South Africa and the sand is readily available there, but not in the rest of Africa.

6 SESSION FOUR: POST-HARVEST HANDLING AND UTILIZATION

6.1 Skit: harvesting and post-harvesting handling of sweetpotato in Kenya

Penina Muoki, Sarah Mayanja, Sindi Kirimi

Narrator: Fresh root market prefers roots that have been cleaned/ washed. Washing is often done in hurry while trucks are waiting to ship the roots to urban markets, often far away from the producing areas. Roots are washed by bouncing on the roots in a large container. Often this exercise leaves the roots with skin damage. Washed roots are briefly left to drain off excess water and then packed into bags. These bags may carry as much as 250kgs. Often, more than four men could be seen loading these sacks onto the trucks. Roots handled in this manner will last not more than four days. Clearly, this is very short time for processor's to be able to buy bulk quantities and thus reduce on unit transport cost. Kenya like any other African country is experiencing a robust urban growth, which calls for supply of cheap, high nutritious food such as OFSP. How then can farmers be incentivized to reduce harvesting and post-harvest losses? Furthermore, what are the critical points at which sweetpotato experiences damage? Does the Kenyan case resonate with handling procedures in other countries? I now invite you to watch a video taken from the field in Kenya and thereafter discuss these issues.	**Penina (washer)** changes into gumboots and a different Kitenge. She washes the roots in a big basin for a few minutes. **Kirimi/ worker** appears and starts packing the roots while Penina is still washing some more. There is a big sack that has already been filled with roots sitting beside the washing area. This bag is lifted to a truck.

6.2 Developing good post-harvest practice and storage facilities to facilitate the all-year round supply of OFSP

Andrew Marchant, Penina Muoki, Tanya Stathers, Ilaria Tedesco

Andrew Marchant spoke presentation about a study of the value chain and post-harvest operations to determine the economic constraints to effective All Year Round (AYR) supply, the post-harvest handling issues that affect storage, and to commence storage trials. He presented a review of the supply situation in Kenya, the benefits of storage, work undertaken on harvesting, post-harvest losses and current progress on storage.

6.2.1 Why is storage beneficial?

Storage helps to optimize yield / quality. It offers producers a system through which they can ensure continuity of supply. It is better to sell when prices are higher, therefore, storage can assist producers to get better prices. Rather than selling small quantities by the roadside, producers can aggregate and hire a truck to go and sell in markets where they are guaranteed better prices. Storage also allows harvesting to suit weather conditions; and to fit in with other planting regimes.

Sweetpotato roots are usually exposed to damage when harvesting, washing, packing, putting on roadside, putting on a truck, sending the crop to a trader, on to the wholesale market, and then on to the retail market. Some of the damage e.g. bruising cannot easily be seen. Damage levels are very high and they have a great impact on storage.

Fig. 18: Types of harvesting damage

Harvesting damage: 1. Cut; 2. Graze; 3. Amputation; 4. Bruising

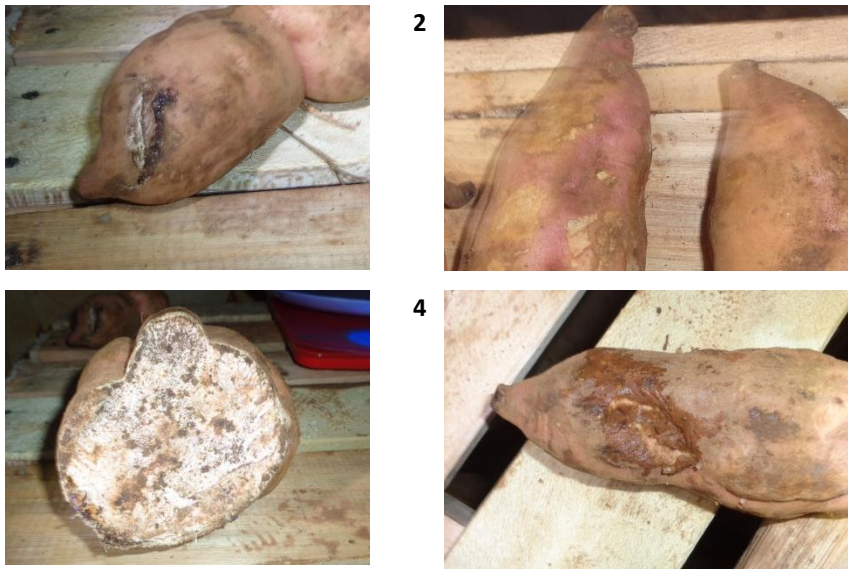
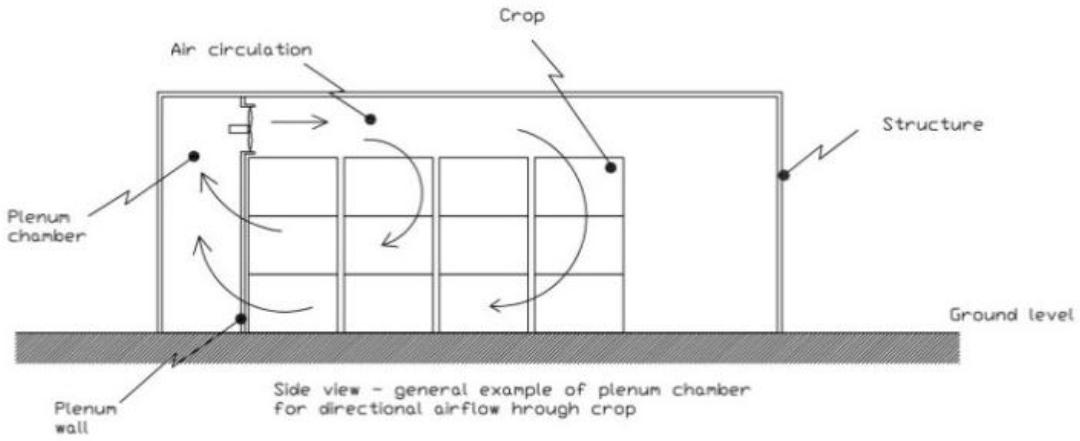


Fig. 19 shows the different containers in which sweetpotato are handled during transportation: In Kenya, there are 50 kg packs as well as the traditionally used larger ones that are joined together. Whereas plastic crates are much lighter than wood and are non-absorbent, they are also brittle and easily breakable. For the trials, wooden crates were used.

Fig. 19: Containers used to handle sweetpotato during transportation

Traditional double bag **Plastic crate** **Wooden box**

Curing, the process through which damaged roots are handled, has to be done, the question is only when and where it is done. When done pre-transport in the field, it is easy, low cost, and immediate; but the roots are exposed to insect damage. Furthermore, due to the uncontrolled environment, there is variability through the heap. Pre-transport stack and sheet curing is more controlled and consistent, but it has the disadvantage of potential double handling, just like in the field. Curing in the store provides a controlled situation with less handling.



6.2.2 Storage trials

Trials are taking place at various scales – domestic, small holder and small commercial. Small commercial is a successful model that provides opportunity to link with processors. One of the critical things about this model is that there is an element of sustainability, in terms of energy and management. Storage conditions were managed through air distribution - fan and plenum, timer; temperature-differential thermostat, over-ride thermostat, changeover switch, evaporative cooling, solar water heating and humidity - damp down for first day, then maintained at 90+% by closed system. Two varieties of 10 tons each were used in the trial. Logging of temperature, humidity, moisture loss and electricity use were done.

6.2.3 Results

Since there is no year-round supply of roots, storage is likely to be economically beneficial. The trials show that there is considerable damage and loss of roots during the post-harvest handling, which result in a lower shelf life. The damage is caused by breaking roots during harvest, bruising the surface during post-harvest operations and when over filling and stacking, lack of curing and aggressive washing. Storage is technically feasible and practically achievable. But the harvest techniques, post-harvest handling and curing are critical if storage is to be possible for 3-4 months. Storing fresh roots has minimal impact on beta-carotenoids.

6.3 The effect of different storage conditions, packaging and preservative treatment on the OFSP puree quality

Tawanda Muzhingi

Considerable experience has been gained in CIP on the manufacture and marketing of bakery products in which 20-45% of wheat flour has been replaced by OFSP puree. Experience across many SSA countries has shown that the use of OFSP flour as a substitute for wheat flour is not cost-effective; the use of OFSP in puree form is economically advantageous. Currently, processors store and utilize the roots for puree as needed, or prepare the puree and freeze it for future use. The major bottleneck to expanding use of puree compared to flour is the inconvenience of having to prepare and store the puree.

In the USA, Europe and China, high-end continuous flow microwave systems and aseptic packaging exist but are difficult to transfer to SSA. Research studies indicate that there is potential to store puree without refrigeration using sealed vacuum packaging and preservatives.

6.3.1 The case against OFSP flour

- Elaborate processing (washing, peeling, cutting, drying, chipping, milling and packing)
- Enhanced losses of pro-vitamin A carotenoids by exposure of cut OFSP to heat , oxygen and UV
- Poor conversion 5kg of OFSP roots =

  1 OFSP flour compared to 1.5kg OFSP roots = 1 kg OFSP puree

- Low wheat flour substitution in baking maximum 25% (OFSP flour) ≠ 60% (OFSP puree).

6.3.2 The Case against OFSP Puree

- The major bottleneck to expanding use of OFSP puree compared to flour is the inconvenience of having to prepare and store the puree.
- Research studies are needed to determine the storage life of this puree and in particular, the safety of the product as it ages.
- The use of vacuum packing and preservatives sealed puree provides processors with the chance to transport and store sacks of OFSP puree without cooling.

6.3.3 Research Design

- To determine the beta-carotene retention in OFSP puree over 6 months storage in vacuum plastic bags with and without preservatives.
- To determine the character and nature of microbial growth in OFSP puree over six months' storage in vacuum plastic bags with or without preservatives.
- To determine the varietal differences on the beta-carotene retention and microbial growth in OFSP puree over 6 months of storage in vacuum pack plastic bags with or with preservatives.

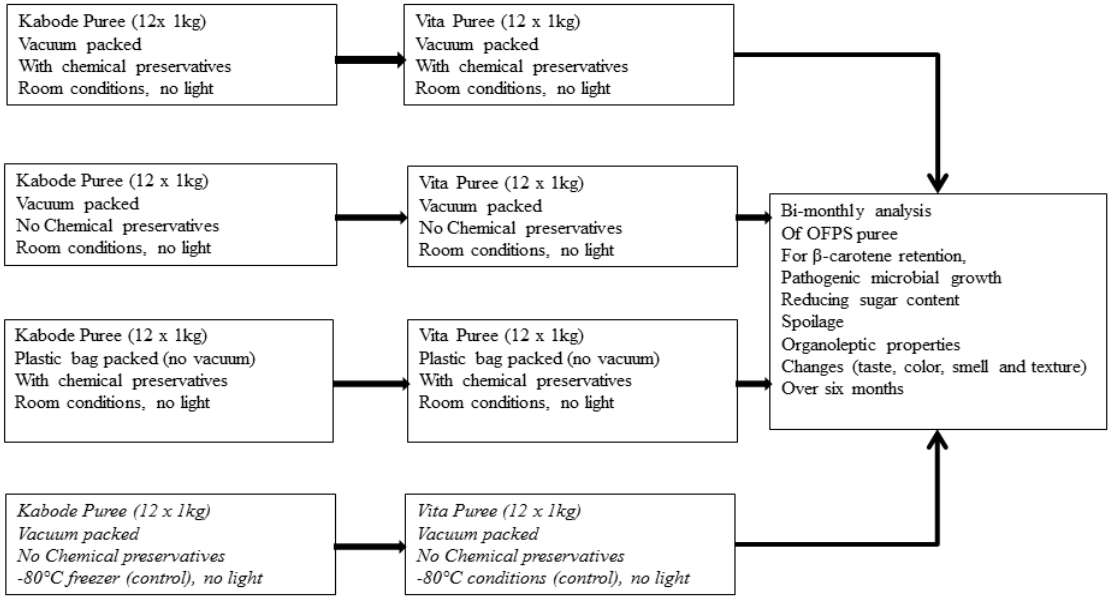
OFSP Storage Study: OFSP roots of Vita and Kabode variety were supplied by CIP SUSTAIN project in Kisumu, Kenya. All the OFSP puree processing, treatment and packaging was conducted at Euro-Ingredients Limited in Industrial Area, Nairobi, Kenya. Biochemical analysis was conducted at BecA and food microbiology analysis conducted by Kenya Bureau of Standards (KEBS).

Factors

- Packaging: Normal and vacuum packaging
- Preservatives: Chemical preservatives *potassium sorbate and sodium benzoate*: natural preservatives
- MaySa (*antifungal and antibacterial)*
- Genotype : Vita and Kabode
- Temperature: Room (Nairobi, Kenya) 15-25°C

Fig. 20: Process of root peeling, and cooking and puree processing and packaging

Fig. 21: Effect of storage conditions on OFSP puree shelf life



6.3.4 Preliminary findings

This is research in progress, waiting advanced statistical analysis to determine the differences in beta-carotene content by preservation treatment and packaging. There seems to be a varietal difference to the interaction of chemical preservatives and beta-carotene retention and packaging type. Vacuum packing is better than normal packing in TVC tests. At eight weeks storage puree beta-carotene (varieties Vita and Kabode) was still higher than 250 RAE/100g and in OFSP bread 125 RAE /100g.

There are some issues to consider:

- In baking applications we can dodge a food safety bullet (The kill step: baking at 200°C for at least 15 minutes will kill most of pathogens but unfortunately not spores and toxins).
- Good Agricultural Practices (farm to plate)
- Good Manufacturing Practices (HACCP and Food Safety Training)
- Cost effectiveness (packaging, preservative, transport and value addition)
- Nutritional and food safety analytical support is critical

6.4 Sweetpotato research at the Natural Resources Institute

Andrew Westby

Natural Resources Institute (NRI) has worked on sweetpotato for several decades. The focus is mainly on Africa, but work is undertaken elsewhere on all aspects of the value chain. NRI works in partnership with collaborating organizations and donors.

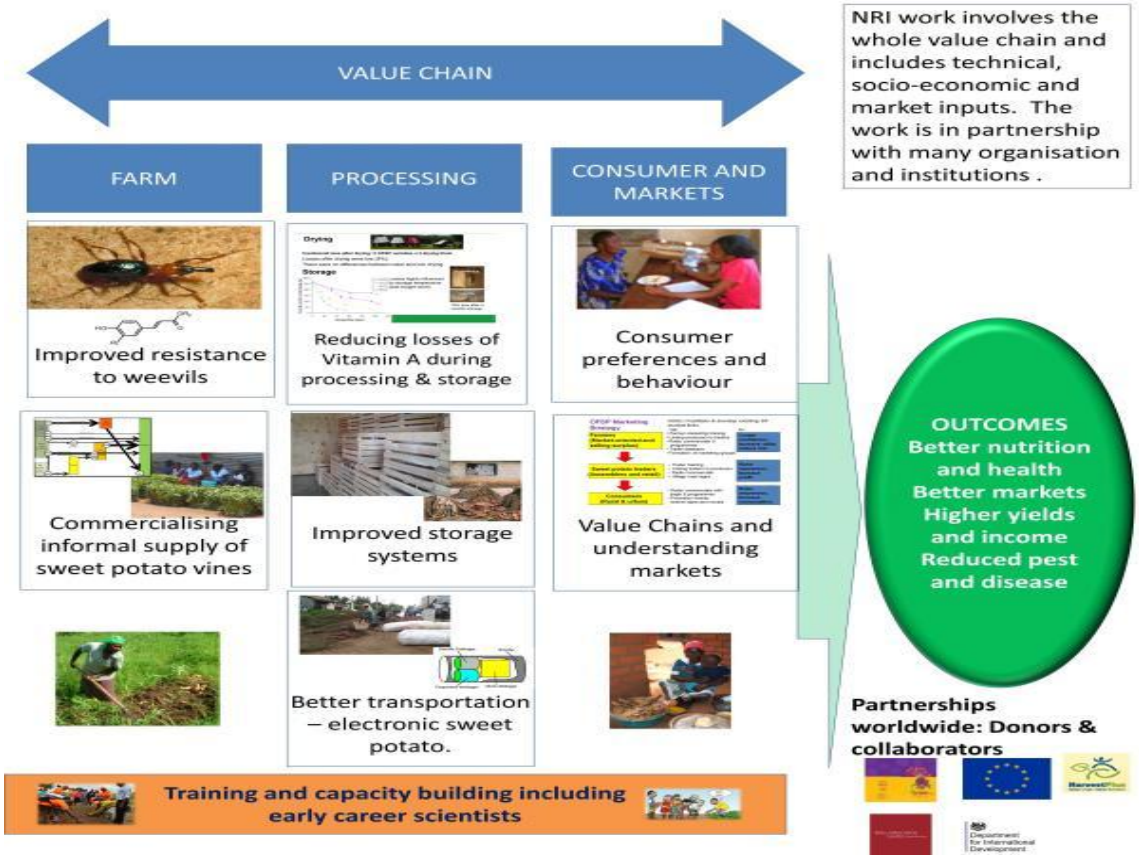
6.4.1 NRI Programme on Root and Tuber Crops in Development

The programme develops strategies which are economically beneficial, environmental, culturally and socially appropriate and gender sensitive. There are over 20 staff members with experience and expertise in root and tuber crops, value chain analysis, production, marketing, working with private enterprises, storage, processing, gender, socio-economics, consumer preferences and nutrition. The programme is funded by BMGF, Harvestplus, CGIAR and European Union (EU), Department for Environment, Food and Rural Affairs (DEFRA), Department for International Development (DFID) and others (*see Fig. 22*).

6.4.2 Electronic sweetpotato

The electronic sweetpotato, devised by Keith Tomlinson, is a device that resembles a sweetpotato and has a sensor that is supposed to look at where the damage occurs during marketing. It enables the tracking of consignments over long distances.

Fig. 22: NRI Programme on Root and Tuber Crops in Development



6.4.3 Varietal selection

New varieties of sweetpotato have been developed for higher yields, better disease resistance, better nutritional and health benefits, etc. Varieties were tested over a range of locations and over two seasons in Tanzania. Consumers reported wide variation in acceptance by variety, year and location. Models were developed to map acceptance by location and year. This is envisioned to be a useful tool for plant breeders.

Consumer acceptability of OFSP in Uganda/Tanzania/Mozambique: For most consumers, changes in appearance, taste and texture of sweetpotato was not a barrier to consumer acceptance – especially if it was a primary staple. However, 18% of consumers did not prefer orange to traditional varieties, so maybe there is need for alternative sources of vitamin A. Orange colour was found to be an advantage in promoting a bio-fortified crop because the trait becomes more visible. Acceptance differed between rural and urban locations. Rural consumers have higher acceptance for all type of sweetpotato (a staple), while urban consumers were more discriminating.

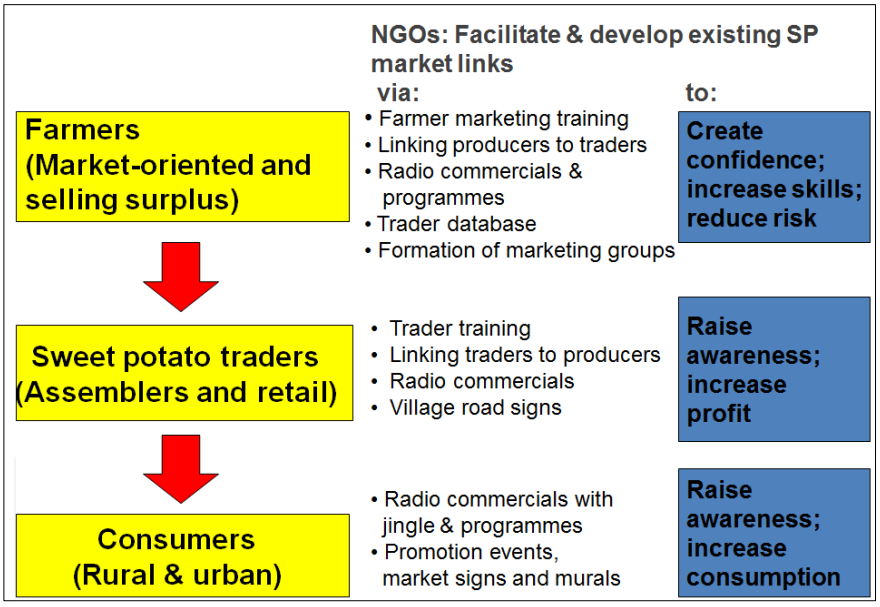
Consumer acceptability of OFSP in Uganda/Tanzania: Only for 23% of consumers tested accepted OFSP for its pro-vitamin A content, and they only consumed it weekly. Consumers were willing to pay more for OFSP if they received nutrition information, but the amount they would pay varied according to the way the experiment was conducted.

Impacts of processing and storage on pro-vitamin A retention: Losses after drying were low (9%). There were no differences between solar and sun dryers. Losses in storage of OFSP chips were highly influenced by storage temperature (and oxygen level). There was 75% loss after four months under ambient temperature of 23ºC. There is no simple technological solution for this, but the losses can be controlled by limiting the storage time e.g. to two months.

6.4.4 Experiences of OFSP Marketing in Mozambique and Uganda

Fig. 23 below shows the OFSP marketing strategy that was implemented.

Fig. 23: OFSP Marketing Strategy



The following lessons emerged:

- Where marketing linkages were made, traders trained and product promotion undertaken, it was possible to create market for OFSP.
- The main reason for planting OFSP was household consumption, but it was important to have a market to sell the surplus.
- Traders are vital in seeking out trading opportunities and they were willing to embrace OFSP if given information about it.
- A high percentage of farmers expressed the intention to increase OFSP production to take advantage of market opportunities.
- More than 85% of consumers in both countries reported that they would purchase OFSP in future.
- Marketing of OFSP is not uniform because there are different levels of market access.
- It is an advantage to have market led rather than production led marketing.

6.4.5 Commercializing clean sweetpotato seed production in areas with a long dry season

This work is being led by Richard Gibson. Due to long dry season, it is difficult to keep planting material. In Uganda and Tanzania, this project is done with vine suppliers to better link to research and improve their business processes. The project is funded by BMGF.

The project has had successes with promoting improved white and orange-fleshed varieties, use of fertilizer and compost, use of planting on the flat both for increased vine production and improved irrigation, record keeping and business planning and exploring new markets and new ways of marketing. The effect of different rates of NPK fertilizer on the production of vines and profitability.

6.4.6 Role of mobile phones in vine selling

A vine multiplier with a mobile phone

This project is investigating and promoting the role of mobile phones in vine selling. The benefit to multipliers is being able to contact their customers. The benefit to town sellers is being able to order new supplies of vines when they want them and also to be contacted by their customers. Transporters are phoned when transport is needed and they can all use mobile money.

The multipliers are starting to have mobile phones; and town sellers have a mobile phone number on their banner for customers to call for orders.

6.4.7 Resistance to sweetpotato weevil

This work is done by NRI, (Phil Stevenson), National Crops Resources Research Institute of Uganda (NaCRRI) (Gorrettie Ssemakula/Benard Yada/Milton Otema Anyanga), CIP (Robert Mwanga) and North Carolina State University (Craig Yencho). Farmers report New Kawogo to be resistant. Laboratory experiments support field data. The following has been undertaken:

- Bioassay to evaluate the effect on oviposition and feeding of *Cylas* spp. by hexadecylcaffeic and coumaric acid on root surface.
- Feeding and oviposition of *C. puncticollis* on Naspot (susceptible) periderms treated with hexadecylcaffeic acid (0.5mg/cm^2)
- Mapping New Kawogo and Beuaregard (NKB) is ongoing. NKB-Weevil resistance population, 287 progeny (NaCRRI, Uganda) is set to be screened for chemical differences corresponding to quantitative trait loci (QTLs) (*see Table 11*). Trait loci for weevil resistance will be used as a breeding tool to produce resistant varieties with other good agronomic and food quality trait.

Table 11 Ongoing research - mapping New Kawogo x Beuaregard (NKB)

Trait	New Kawogo	Beauregard
Dry matter (%)	30-34	18-20
Flesh colour	White	Orange
SPVD resistance	Resistant	Susceptible
Weevil resistance	Resistant	Susceptible

6.4.8 Conclusions for NRI work

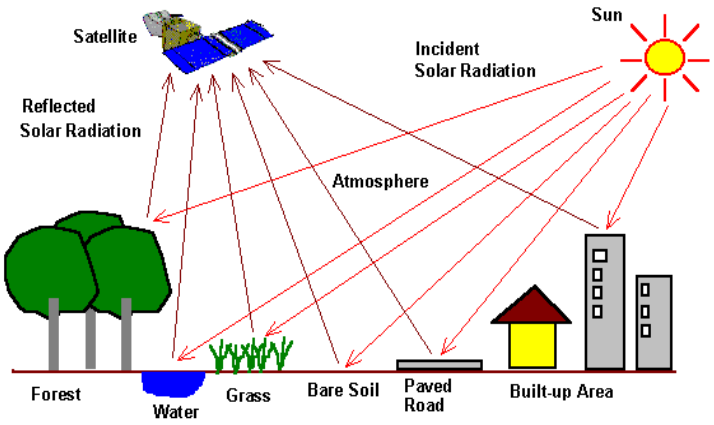
The work implemented by NRI requires a diverse range of skills and expertise. Collaboration with partners is vital for NRI work along the value chain, covering pests, markets, preferences, transport, storage, varietal selection and others.

7 SESSION FIVE: DELIVERING OFSP AND GOOD NUTRITION AND REMOTE SENSING TO CAPTURE AREA UNDER PRODUCTION

7.1 UAV-based remote sensing as a monitoring tool for smallholder farming

Elijah Cheruiyot

The potential of satellite remote sensing in gathering crop statistics data has been demonstrated, but associated costs are also prohibitively high and the data quality is often negatively affected by clouds. The objective of this project is to use Unmanned Aerial Vehicle (UAV)-based remote sensing technologies to provide a cost effective means of gathering, processing and interpreting adequately accurate and timely crop statistics data at a large scale with minimal effect of clouds.

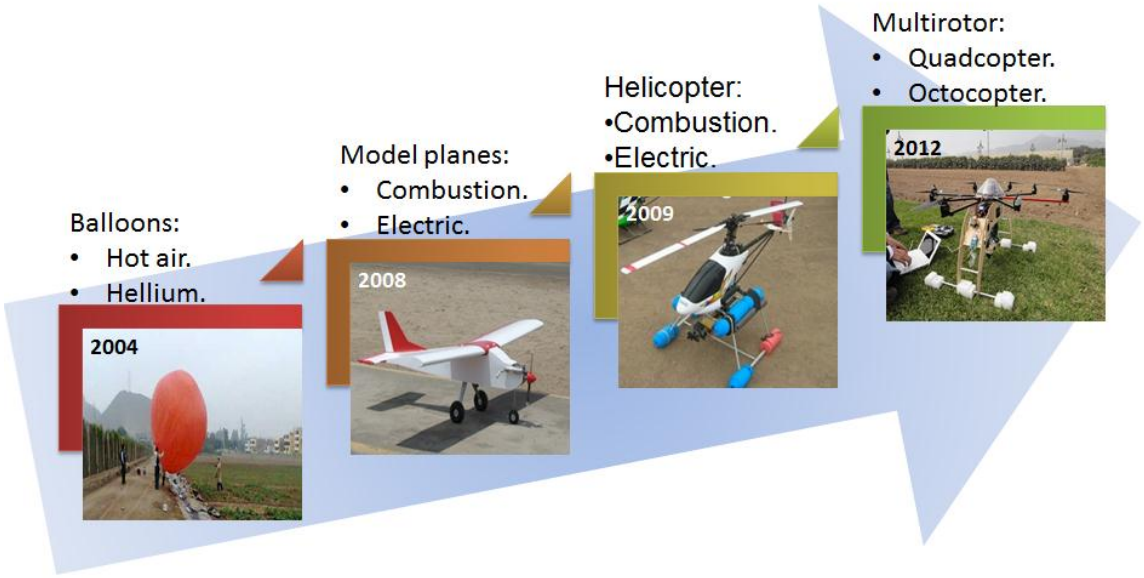


Credit: Centre for Remote Imaging, Sensing and Processing (CRISP)

UAV – Agricultural Remote Sensing Platforms (ARSP) are used for various applications, such as characterization of crops (detection of infection and water deficiency); crop discrimination; and soil characterization, and it helps to determine specific actions, e.g. the type of fertilizer to use. All these applications depend on the type of sensor that is attached to the drone.

UAVs fly very low, and below the clouds, so the user is likely to get better and higher quality data than if satellite systems are used. At CIP, the use of ARSP was started in 2004, using a hot air and helium balloon. In 2008, work to test the use of model combustion and electric planes was started, but these need a runway. Electric and combustion helicopters tested in 2009 transmitted additional data on to recordings which then distorted the findings. This, therefore, led to a transition to multirotor quadcopter and octocopter *(See Fig. 24).*

Fig. 24: The history of ARSP at CIP



7.1.1 Agricultural Remote Sensing Information System

The aim of the Agricultural Remote Sensing Information System (ARSIS) "proof of concept" project is to:

- Develop and validate a low-cost UAV-based remote sensing tool for crop area determination (ARSIS) using sweetpotato as a pilot crop.
- Develop an out scaling plan that describes a path forward for the validated UAV-ARSIS, as a logical next step of the "Proof of Concept" project.

During a stakeholders meeting, the following issues arose: costs, accessibility, and user-friendliness; involving local institutions at different stages; stepwise progression from simple to complex tools; complementarity with satellite imageries; mapping multiple crops; usability for yield assessment and feasibility of discriminating varieties.

7.1.2 Achievements

A low-cost UAV platform has been assembled in collaboration with ICRAF and University of Nairobi and fitted with a locally assembled multispectral acquisition system. To reduce on camera cost while improving image, a normalized difference vegetation index (NDVI) sensor with a CIP built camera is being used. A field mission was conducted in Mwanza with support of CIP partners in Tanzania.

Two data processing programmes have been developed at CIP, namely ISAM_CIP for image stitching and Spectra-CIP for collection of spectral measurements with spectroradiometer, while design of improved sensors for various agronomic applications is on-going.

A CoP was established comprising core developers, application scientists, end users and enablers and an online platform (UAV4Ag) was established.

Processing multispectral imageries to achieve crop discrimination requires special equipment and skills, but texture-based classification produces almost equally good results with images taken using regular cameras.

7.1.3 Way Forward

Fusion of fine resolution UAV data with lower resolution satellite data has the potential of increasing availability of data, but work is ongoing. The method is yet to be tested with crop distribution.

The next major step is up-scaling of the crop statistics data collection to larger areas by fusing UAV-based data with satellite data. Data acquisition field missions are planned for Uganda and Kenya. A second stakeholder workshop will be held in March 2016 to share progress and discuss regulatory frameworks in the region. The CoP will be expanded within the region, e.g. into Rwanda.

7.1.4 Questions and answers

Is there any preliminary cost-benefit analysis related to the remote sensing?

There is no published document clearly stating the cost-benefit analysis but there is clear evidence from the work done so far that this technology is cheaper than accessing satellite data. The issue is how to make the drone system itself cheaper, and that is why the project is focusing on developing low-cost software and hardware.

Is it possible to discriminate between crops?

If we have specialized sensors like multi-spectral cameras, one can discriminate between crops. This is more expensive, but the project is working on ways to cut costs by using the same sensors to achieve crop discrimination.

What is the purpose for the remote sensing? Is it for crop management or crop distribution on a very small area?

In East Africa, we are aiming at crop discrimination and analysis, trying to get crop statistics to aid in government policy making, but there are various applications for crop management. The whole point of this approach is specifically focused on ground-truthing by combining high resolution drone data from small areas with satellite data of large areas like the district level. Therefore, it is a combined process that aims to show that it is possible to get discriminated crop data at district level.

7.2 Maternal nutrition outcomes in an integrated agriculture, health and nutrition program in western Kenya

Frederick Grant

The BMGF supported Mama SASHA project was a 5 year integrated effort that sought to answer the question "can linking vitamin A rich sweet potato to existing health services improve maternal and child nutrition? The action research project was implemented in eight health facilities which were purposively drawn from the larger pool of health facilities in Busia and Bungoma counties and randomly allocated to either control or facility. Control facilities received the standard health systems strengthening components provided by the International NGO PATH through its United States Agency for International Development (USAID) financed APHIA-+ program.

Mama SASHA had multiple components to connect pregnant women from communities to nearby Antenatal Clinics (ANC), nutrition and health education and OFSP extension (Figure 25). Briefly, Community Health Workers (CHWs) working in communities raised awareness of the importance of ANC. When women came to ANC they received vouchers for 200 free orange sweet potato vines (100 of the variety Kabode; 100 of the variety Vita). At the clinic they also received enhanced nutrition counselling. When they returned to the communities mothers redeemed their vouchers from nearby vine multiplier farmer plots supported by the project. They also joined project-supported pregnant mother clubs in their villages. These clubs met monthly and reinforced messages on health and nutrition and preparing nutritious foods. Mothers received support by agriculture extension agents for growing OFSP. They were entitled to pick vouchers at four separate time points – once a trimester or three times during pregnancy and once in the first 6 weeks postpartum at a postnatal care visit.

Fig. 25: Mama SASHA Project: testing linking OFSP to health services for pregnant women for increased impact on nutrition in Western Kenya

7.2.1 Evaluation Strategy

The evaluation strategy comprised the following components:

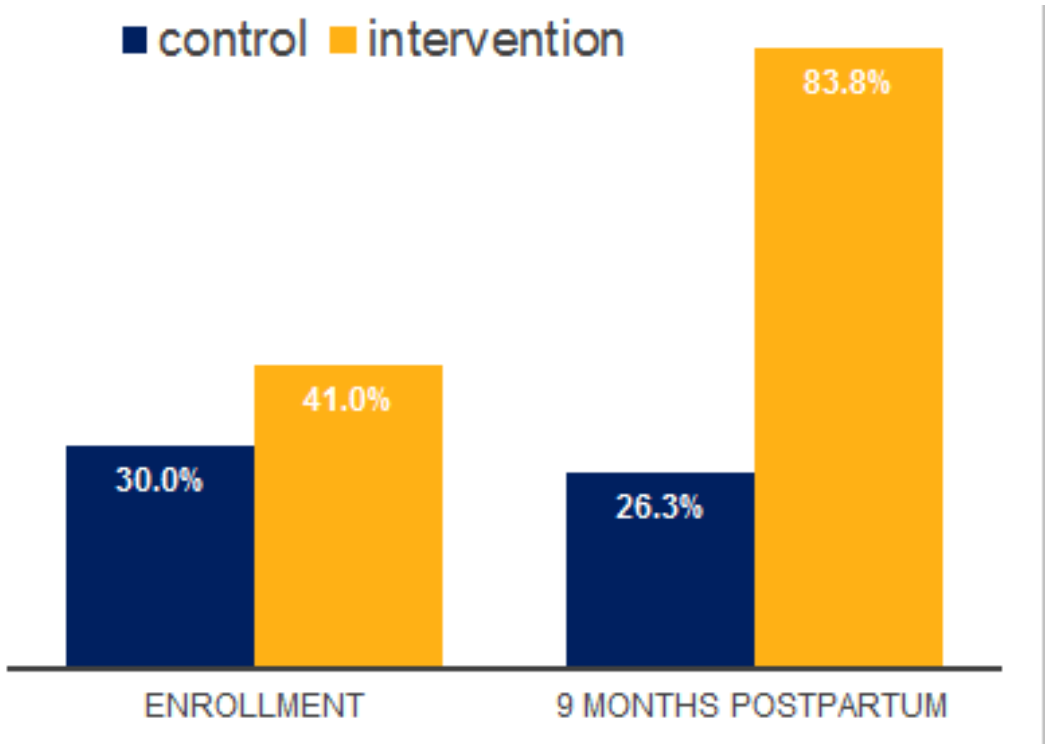
1. A cluster randomized at facility level: Four intervention and four control facilities across Bungoma and Busia counties
2. Cross-sectional baseline and endline surveys (n>2000 / round): The objective was to assess population level impact on child nutrition. Two-stage cluster randomized surveys were carried out in catchment areas of intervention and control facilities between March and May 2011; and between March and May 2014.
3. Detailed costing data for cost-effectiveness analysis
4. Nested Cohort Study (COVA): This study assessed individual level impacts on maternal and child nutrition. It comprised a longitudinal study of 505 women enrolled in pregnancy and followed to 9 months postpartum, from November 2012 until July 2014.

Fig. 26: Schedule of data collection for the nested cohort study (COVA)

Data Type	Enrollment (10-24 wk)	Late third trimester	4m post-partum	9m post-partum
Socio-demographics				
Program uptake				
Food security; dietary diversity; OFSP consumption				
Knowledge of VA / nutrition; OFSP				
Morbidity, health care utilization				
Anthropometry	Mothers	Mothers	Mothers&Infants	Mothers&Infants
Breastmilk retinol and carotenoids			Mothers	Mothers
Micronutrient status: RBP, ferritin, TfR, CRP and AGP	Mothers	Mothers	Infants	Mothers&Infants
Anemia	Mothers	mothers	Mothers	Mothers&Infants
Multi-pass 24 hour recalls (subsample, Table 3)				Mothers&Infants

7.2.2 COVA Findings

Fig. 27: Sweetpotato production in the previous year



The findings presented focus on maternal nutrition from the COVA study. Sweetpotato and OFSP production: There was increased production of sweetpotato and OFSP. At enrolment (n=505), 29 intervention and 4 control women reported OFSP production in past year. At 9 months postpartum (n=384), 70% of intervention women produced OFSP compared to <5% of controls and 92.7% of intervention women received

vouchers for OFSP vines. 13 women did not redeem any vouchers due to season, distance to the DVM or not being able to obtain permission to plant.

Maternal Nutrition and Health Knowledge: Based on indicators as summative indices and an examination of changes in knowledge from enrolment to 9 months postpartum, one observes an overall improvement in the knowledge of ANC, vitamin A and Infant and Young Child Feeding (IYCF) among intervention mothers; similarly intervention mothers showed greater improvements in indices of vitamin A and IYCF knowledge.

Maternal Diets: There was greater consumption of OFSP – when asked if they had consumed OFSP in the last 7 days, a significant number of women were found to have increased consumption, and especially as they were in the project for a longer time.

Diet Diversity: There was no observed improvement in dietary diversity among the cohort of 505 women, but there was an increase in vitamin A intake. There was a significant difference in vitamin A intake between the intervention and control sites. There was not much difference in retinol.

There was limited impact on maternal nutritional status in terms of MUAC. In the beginning the pregnant women at the intervention site had better MUAC but as time went on, they started to diminish and the levels came to almost the same level as those at the control sites came to almost the same level. There was only a small improvement in haemoglobin, but it is likely that it would have been better with time.

7.2.3 Conclusions

A nutrition and health linkages program that promoted OFSP and provided enhanced nutrition education was associated with greater OFSP production, greater improvements in vitamin A knowledge among mothers, greater vitamin A intakes among women and borderline improvements in maternal vitamin A status and anaemia in pregnancy. Some ongoing and planned activities are:

- Analysis of data from broader evaluation strategy to identify impacts on child nutritional status
- Quantify breast milk retinol and beta-carotene and identify pathways from maternal intakes to infant status
- Apply structural equation modelling to quantify pathways of effect
- Finalize cost-effectiveness analyses

7.2.4 Questions and answers

How did you ensure sustainability of Mama Sasha?

The pregnant mothers clubs have been taken over by the health services; for agronomic- we trained farmers and they formed cooperatives. We provided each farmer with 2 net tunnels with material from KEPHIS, they are now able to produce and sell the materials. They are doing root and vine production. We linked them to NGOs that are always looking for vines for their own beneficiaries e.g. One Acre Fund. The findings have informed other projects too.

7.3 Orange sweetpotato feeding the future

Abaijuka. I, S. Magezi, J. Muduwa. Laila. K, Ball. A. Bho.M & Z. Manfred

The goal of HarvestPlus is to reduce micronutrient malnutrition and improve dietary intakes of vitamin A and iron for 286,000 households in 25 districts in Uganda by 2015. The purpose is to increase production and consumption of OFSP and high iron beans in the area of influence. This is done through delivery of vines and training services through direct and indirect channels.

7.3.1 Objectives of the HarvestPlus Uganda M&E system

A data quality assurance policy and plan, and staff and partner capacity is essential for good data quality. A well designed M&E system is crucial for decision making and fundraising. HarvestPlus Uganda has a challenge to harmonize the M&E systems of the three main partners: USAID, HarvestPlus Global and Feed the Future.

HarvestPlus Uganda has further developed its M&E system by defining its objectives and scope. The main objective is to generate high quality M&E data for decision making. The specific objectives are:

- Setting M&E standards that conform to global M&E best practice
- Timely recording, processing and sharing M&E data
- Generate accurate data for organizational learning and accountability

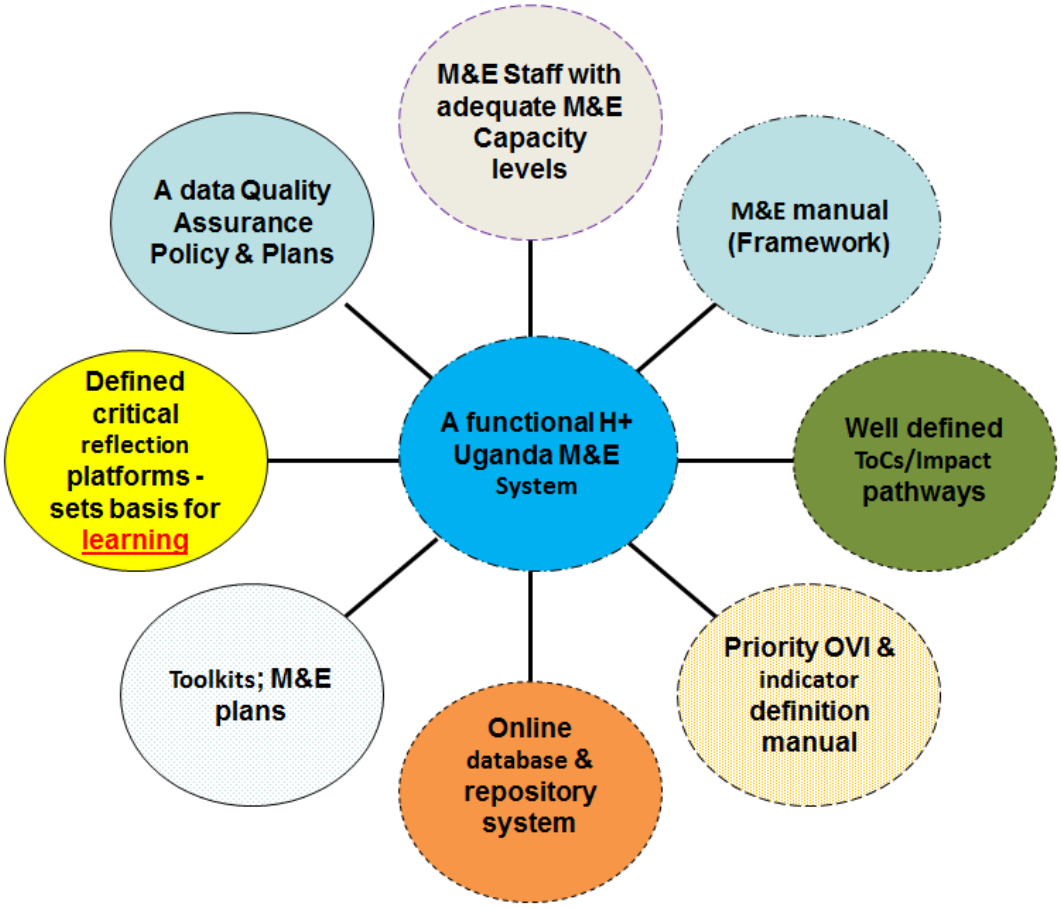
The system is used to track 4 process, 8 outputs, 12 outcomes and 3 impact level indicators.

7.3.2 Core components of the M&E process

Multipliers' data are collected from multipliers and captured by NGOs. These data reveal how many farm households are reached with vines. These are called indirect households.

The data then goes to the extension worker who is in charge of the sub-county, after which it goes to the NGO level. At every stage, there is data checking and validation. This is then sent to the HarvestPlus M&E officer for checking, forwarded to the country manager, who approves it for sharing with HarvestPlus global. At this level, it is disseminated to all stakeholders.

Fig. 28 The 8 pillars of the HarvestPlus M&E system



7.3.3 Ensuring high quality data

High data quality is ensured by keeping reference to priority indicator list and reference manual, customising generic data collection tools, sharing tools with partners and training utilisation, developing country level data quality assessment plans and periodic data quality assessments at country program and partner level.

HarvestPlus Uganda uses data collection tools like distribution forms, training attendance sheets and training reports, review tools for farmers growing OFSP, tools for children under five, tools for tracking OFSP vines disseminated by non-partner NGOS and private sector, and tools for estimating OFSP vines with multipliers.

HarvestPlus Uganda's M&E system generates raw data in the form of hard copy forms from partners, a country specific database, a household workflow database and data files from surveys. These data are incorporated into annual reports to USAID, annual and quarterly reports for HarvestPlus, survey reports, mid-term evaluation and success/impact stories.

7.3.4 Utilization of M&E outputs for HarvestPlus Uganda

The main uses of the data generated are planning and decision making, research, learning, fundraising and advocacy at public policy levels.

7.3.5 Constraints of M&E activities

First, local partners have limited capacity for data capture, processing and management. Secondly, budget cuts usually affect the extent to which M&E activities can be implemented. Thirdly, at HarvestPlus global level, the M&E system incorporates six crops from 10 countries and the tools for different indicators, as well as the databases and implementation approaches from all these crops and countries must be harmonized. Lastly the main partners, Feed the future, USAID and HarvestPlus global have different M&E systems which must be harmonized.

To address these constraints, HarvestPlus Uganda plans to strengthen data collection capacity at partner level, finalize the new expanded database and training staff in its use, fundraise for M&E or lobby at HarvestPlus level for more, intensify data quality checks and develop formal reports that enable easy follow up to ensure improvement and focus on pilot cost indicators to enable management to compute the cost of producing a unit of planting material, delivering a unit of planting material and reaching a household with planting material.

7.4 Orange-fleshed sweetpotato in the school feeding program of Osun State, Nigeria: conception, inception and inclusion

Olapeju Phorbee

Sweetpotato for Health and Wealth in Nigeria and Jumpstarting OFSP in West Africa for diversified markets are two projects that focus on development of the value chain for health and wealth of the rural households in Nigeria, working in Osun and Kwara states. The activities related to value chain development in these states include:

- Establishment and empowerment of vines multipliers
- Dissemination of vines to farmers and households for root production
- Identification and training of processors on OFSP-based food development
- Sensitization, public awareness and Advocacy to policy makers and investors on OFSP
- Demand creation for OFSP roots at both formal and informal sectors

Demand creation for OFSP has been created through OFSP product processing, enrichment of some indigenous foods with OFSP for household consumption and commercialization and development of novel commercial OFSP products. Out of search for OFSP demand at the formal sector, inclusion in the school feeding menu was conceived.

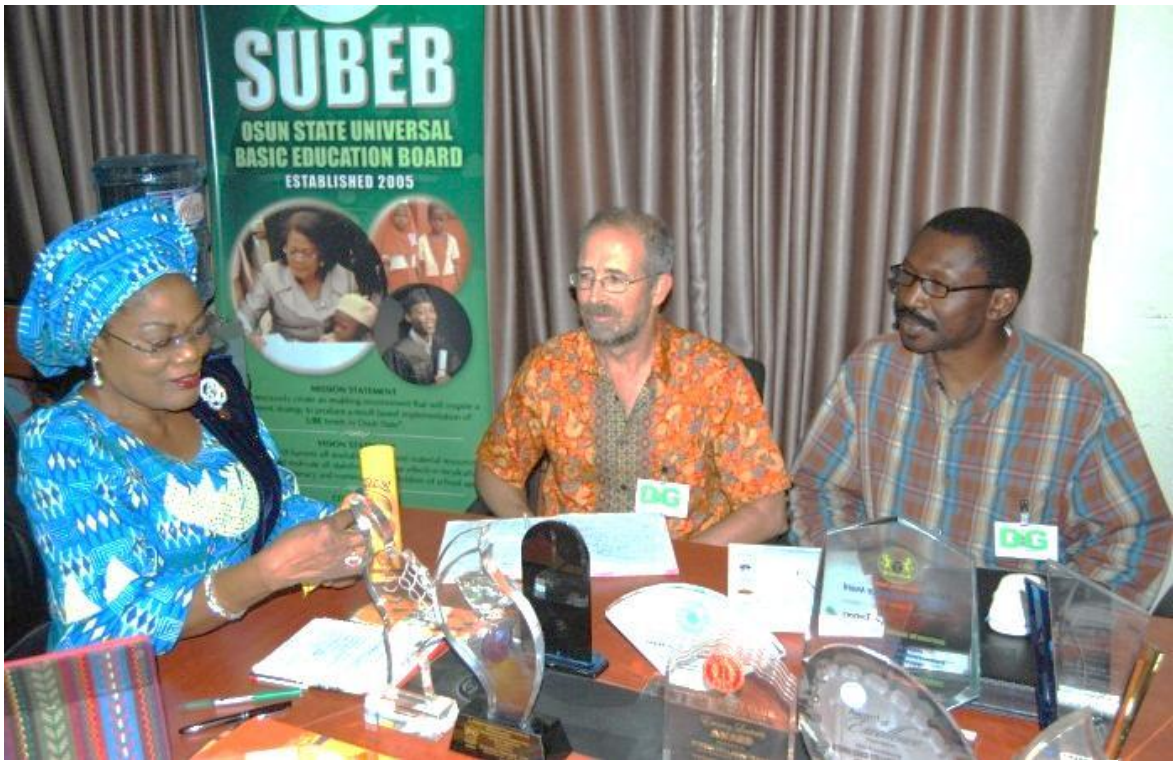
7.4.1 About the School Feeding Program in Osun State

Osun state has the most successful school feeding program where the government feeds about 250,000 elementary 1-IV pupils on daily basis with varieties of balanced meals. This so far, has improved school enrolment as well as cognitive development of the pupil beneficiaries in the state.

Varieties of home-grown meals are served thus improving farmers' productivity, creating jobs for the women who are the school cooks. The program employed about 3,000 women to cook and serve the students, thus improving livelihoods of the women and youths in the state.

Inception: The approach used here was the formal introduction of OFSP to the government of Osun State for inclusion in the school feeding menu.

Advocacy: Visits to all identified stakeholders including policy makers in the state were made. A special visit was made by CIP staff to the Deputy Governor of the state who doubles up as the Honourable Commissioner for Education. The purpose of the advocacy visit was to share the inherent nutritional and economic benefits of the crop especially when included in the school feeding menu; the reduced incidence of vitamin A deficiency problem, which is long standing in Nigeria; income generation for youths and women especially the school cooks and small scale processors; the potential for households to access the vitamin A rich crop through the pupils and improve household food and nutrition security.



High-level advocacy meeting between project staff and the Deputy Governor of Osun State Nigeria

Sensitization: State-wide sensitization of stakeholders was organized in six representative schools in the six zones of the state. All relevant stakeholders - head and health teachers, Parent-Teachers Associations, school cooks, farmers and O-MEALS team - were sensitized on the importance, agronomical, nutritional and economic benefits of OFSP. Myths around sweetpotato were dispelled.

Cooking demonstration and consumer acceptability assessment of OFSP pottage: Also at the sensitization, the proposed OFSP meal; pottage was cooked by the caterers and assessed for consumer acceptability of some sensory attributes. Altogether, 466 people participated in the assessment. More than 90% of the participants in all the 6 locations accepted the pottage for taste, colour, flavour, texture and overall acceptability. All of them were affirmative in the support for inclusion in the Osun school feeding menu.

Inclusion: Feedback from the sensitization on the OFSP pottage acceptance was taken back to the Deputy Governor who finally gave her approval for inclusion in the school menu. Because of the limited number of roots from farmers in this pilot phase, the actual feeding of the pupils with OFSP pottage started only in eight schools comprising 4,160 pupils consuming about 1.2 tons on weekly basis. The pilot schools were purposively selected considering proximity to OFSP farmers, ability to study the flow of the process and possibilities of scaling-up.

Other complimentary activities with the pilot: Base and end-line surveys were carried out in some of the pilot and few control schools on acceptance of the meal. Knowledge of teachers on OFSP and other related issues

for impact assessment, appropriate strategies for scaling up and certainty of sustainability were also assessed. Monitoring of the pilot was ensured on weekly basis throughout the phase.

7.4.2 Base and endline survey results

Baseline

The survey used structured questionnaire comprising socio-demographic information, knowledge of food and their nutrient composition, sources of information on sweetpotato, etc.

In total, 60 teachers (5% male, 95% female), including 20 from non-pilot schools, were surveyed. Among the teachers, 63% reported farming outside their teaching profession and 30% farm sweetpotato while 49% know OFSP and 62% of this group know through friends and seminars that OFSP is a good source of vitamin A.

Endline

After a term of feeding OFSP pottage in the eight pilot schools, the same questionnaires were administered to the same number of respondents in the same schools. The findings here were very similar to those of the baseline but on awareness of OFSP, 88% were affirmative, unlike the baseline which was 49%. The increased awareness was obviously as a result of the OFSP inclusion in the school feeding menu coupled with the media awareness. Also, the same reasons were attributed to the increase in the knowledge of OFSP as a good source of vitamin A, which was found to increase from 62% at the baseline to 89% at the endline.

> *If we eat this product, our body will be healthy, our mind will be healthy, and we will be healthy to study better* - pupil beneficiary

Monitoring of the Pilot

Every week, a monitoring team visited at least two schools to monitor the pilot and assess acceptability of the menu. At the visits, the team interviewed the teachers, pupils, caterers, headmasters, and health teachers. The questions asked focused on their assessment of the product, the problems encountered or observed; the opinions for improvement; and any response (positive or negative) from the parents. The questions directed to pupils were: 'did you eat OFSP last week? Why/not? What did your teachers/parents tell you about OFSP?'

There was initial disagreement between farmers and cooks on logistics of root procurement especially costs of roots and transportation. This was resolved amicably between both parties.

Farmers and cooks' had limited skills in calculating quantities of available OFSP roots and quantity required to serve a particular population of pupils respectively. This posed a challenge as it created gap between planning and implementation.

DVMs and farmers had low capacity to meet the demand of roots for the school feeding. The OFSP inclusion was approved during dry season when roots were generally scarce and was coupled with the farmers' doubt that the inclusion was going to be approved. This resulted in root shortage during the pilot, thus necessitating sourcing roots outside the state of Osun.

Problem of quality control was also experienced initially because different cooks across the zones were exploring different recipes. This was resolved by harmonizing recipe and O-MEALS team working closely with the cooks and monitoring on weekly basis to ensure uniformity of meals.

There was initial rejection of the OFSP pottage in few schools due to low awareness of the new meal. This was resolved by increasing public awareness of the crop and the program, exploring media sensitization across the state.

7.4.3 Way forward

- Establishment of more commercial OFSP farmers to serve the program
- Scaling up to more schools by the next academic session
- Results, findings and experiences of the pilot were documented for possible adoption in other states of Nigeria.

7.4.4 Questions and answers

How are you linking farmers to the school feeding program?

We have records from the OFSP farmers. When this was approved there was a meeting with them. The 8 schools were selected also based on proximity to OFSP farmers. The schools and farmers brainstormed about how to get the OFSP to delivery points and then from there to the vendors. Sometimes in the beginning, the project had to intervene to address some bottlenecks. Findings show that it is now going to have to be scaled up to commercial farmers in the next phase. Contract farming will be entered into with these farmers, whose list is currently being compiled. This is the only way the demand for OFSP in the schools will be met.

Did the design of the project include schools producing roots for themselves?

The students are advocates for OFSP. The project is also mandated to disseminate OFSP vines to households, so this is ongoing. In schools, some have established OFSP, but this is a different arrangement by the government, and the garden cannot supply all the OFSP demand for the school feeding program.

Will the school feeding program be implemented in other states?

With the success seen in Osun state, it may be possible now to scale up to other states. Kano state is already working on this, although it is not a state targeted under the Sweetpotato for Health and Wealth project. Some are already calling on the project to work with them, based on the information they have seen during project presentations at exhibitions and so on.

7.5 Community of practice panel discussion

Facilitator: Margaret McEwan

Within the SPHI, there are 4 communities of practice on (i) breeding and genomics; (ii) seed systems and crop management; (iii) monitoring, learning and evaluation; and (iv) marketing, processing and utilization. Almost all participants of the SPHI 2015 are members of one or more CoPs.

The SPHI is a very widespread community with broad interests, the CoPs were created as groups of people with who share a common concern, a set of problems and interest in a topic who come together to fulfil their individual and group goals. They share best practices and generate new knowledge to advance their domain or professional practice. They interact online, face-to-face, through task groups etc. The CoPs have been in existence for different periods of time, and therefore a difference in the depth of experience. The leaders of the communities of practice were introduced as follows:

- Robert Mwanga, Craig Yencho (breeding and genomics)
- Julius Okello, Justus Lotade (monitoring, learning and evaluation)
- Francis Amagloh, Madjaliwa Mzamwita (marketing, processing and utilization)
- Jean Ndirigwe, Jude Njoku (seed systems and crop management)

Christine Bukania has a role of nurturing the communities of practice and looking at them from a knowledge management and learning perspective.

The discussion had two rounds of questions and distributions from the leaders of the CoPs, based on contributions from their members. This was followed by plenary contributions from participants, and a knowledge management perspective. Finally a wrap-up was done, in which the leaders stated what they would take back to their CoPs.

Round 1:

- What are the technical highlights of meetings and online discussions that you would like to share from your CoP to other CoPs for them to take note of or take action on?
- How have your discussions translated into doing something differently or starting a new research activity or changing an intervention?

SpeedBreeders (Robert): The breeders were among the first to come up as a community, not initially as a CoP, but eventually, that is where it evolved to. Annual breeders meetings bring breeders together; the meeting has grown over the past 5 years from 25 to 45 participants). The breeders share progress reports, which help the different programs to learn from one another and to challenge one another – either as individuals or as regions (East, Central, West and South Africa). They try to put into practice the lessons they have learnt at these meetings. When we started off, each of the programs was conducting the trials their own way. After discussions, we got some ideas to use the same program. Now, 14 countries are using CloneSelector to conduct trials using similar protocols. This is being developed jointly with the support of CIP Lima and statisticians. The breeders also share advanced equipment at the support platforms in Ghana, Uganda and Mozambique, e.g. near infrared spectrometers (NIRS) and freeze driers for assessing quality traits and PCRs for virus detection which help national programs in the region and graduate students to get training, external examiners and to help them to pass quickly through their university.

MLE (Julius): This is the youngest CoP but we have had interesting interactions. I would like to highlight three technical things that have come out of this. Through the online discussions, we asked whether we should pay farmers for information that we get from them when doing studies. The general consensus was that we need to be careful not to create professional respondents, which is the risk run when payment is done. We do have to recognize, however, the varied contexts that we work in. The second debate was on how we

define beneficiaries especially the indirect. As a CoP, we felt that we need to define indirect beneficiaries as those where implementing organizations/institutions and partners have some contact and influence. Related directly to that was how to measure indirect beneficiaries. We are still discussing this, but our options are through surveys, tracking and network analysis. We have not been able to come up with researchable issues yet because we are still a young CoP.

MPU (Francis): We have about five highlights from our discussions. We are the link between agriculture and nutrition and so we are very important. The first thing we talked about is how we can improve the fresh roots market. Promoting the use of OFSP in product development is one of the ways we feel should improve nutrition. We would like to document and understand the distribution of revenue across the value chain, and that is something that we would do with the MLE CoP. There should be a strong linkage with the CoPs, e.g. with the breeders, so that when they come up with a new variety, the MPU CoP can advise on the attributes of the root such as the shape that is appropriate for the market. With the Seed Systems and Crop Management, we would like to establish the right harvesting times to have high quality roots. We also came up with marketable products that would add value for OFSP, e.g. bread, doughnuts, juice and crisps in that order. Some products such as spread from OFSP would target the high-end market. Each and every member should communicate the health benefits of OFSP.

Seed Systems and Crop Management (Jude): The SSCM has been around for one year and has around 90 members on a Google group. We have discussed around seven topics which have raised some researchable topics. The first topic I'd like to highlight is how farmers can package and transport vines. Some people talked of removing leaves before transportation, and how to prevent vine degeneration. This has led to some research especially in Nigeria, where we are carrying out an experiment on the effect of stripping on establishment and yield. Other topics were how to community approaches to healthy seed systems, how to get healthy planting material and sustain them, and how to manage net tunnels. We looked at virus resistance, which led to work on seed replenishment in farmers' fields. This is interesting for breeders i.e. should they breed for resistance or tolerance or varieties that recover from infection.

Round 2

- As a virtual community, it is sometimes difficult to communicate and get a sense of community. What are some of the learning processes within your CoP that you think others should try and how do you see your CoP evolving in the future?

SpeedBreeders (Craig): I don't think all CoPs are the same. The breeding one is not a dynamic online CoP, they meet annually, but I know who I need to reach out to. The breeding CoP cannot make progress without knowing the developments in others. It takes a lot of time to participate in all, and one does not have to actively participate in each, but it adds value to read and understand what is going on in other CoPs. The genomics for sweetpotato (GT4SP) project is a direct outcome of the breeding CoP. CoPs facilitate harmonization of the tools, and this has been quite successful among breeders. We need better tools. I see a need to push boundaries further, but I also need the need to translate this to new products. We cannot be everything and do everything; the CoPs will facilitate the discussion on how to translate new technology to the field level.

MLE (Justus): People share knowledge and promote learning among CoP members. We share articles related to the areas of discussion to enhance our understanding, e.g. the articles on how OFSP reduces diarrhoea and social impact measurement. As we are the youngest CoP, during our earlier discussions, we opened to additional people and we also suggested that we should register with other online groups.

MPU (Madjaliwa): Communication is important and we created a Google group through which we share information. I would like to urge the SPHI organizing committee to ensure that people are interconnected through Google groups. Secondly, different CoPs need to understand the challenges, needs and expectations

of other CoPs and it would be important to have representatives from different CoPs in our annual meeting. We need to write proposals to attract funding to carry out research on various activities such as marketing, processing and utilization.

Seed Systems and Crop Management (Jean): Our CoP is young, but we have learnt and shared a lot. When I look at the members, we would like to make the CoP an innovation platform that can also bring on board the private sector. We raised some research topics during our annual meeting, and most of the members are regional. If we also globalize the CoP, it will expand the range of experiences. We should make it more dynamic e.g. by raising funds by interacting more, developing proposals. We discussed a lot on our topics, and the question now is how we can put mechanisms in place to share findings from these discussions with others.

Contributions and questions from plenary

It is one thing to develop tools, but what is our commitment to actually use them?

- The MLE has strongly advocated for harmonization of M&E tools. Often, we are looking at the same set of indicators, measuring the same beneficiaries and we would like to cascade indicators upwards from projects to programs. It is very difficult to do this. When we are measuring, we should develop tools that enable us to combine and compare. We are advocating for the use of tools that had been developed by SASHA over time to other projects.
- The experience with CloneSelector is that a new tool should have advantages and be easier to use. However, there has to be training and follow up to get it adopted.
- The breeders established a common dictionary of terms of scoring methodology to evaluate materials, with a set of descriptors which enabled condensing of a very complex set of data into a specific set of descriptors.

Can our conclusions and recommendations from the CoPs be linked to end users to design programs and improve implementation?

For the MPU we always invite stakeholders and students to the meetings. What we want to do more is for example, with the bread in Kenya, how do we get funds to replicate it in other countries? Most of the programs and projects we run in-country have strong market links.

What strategies can we use to get younger scientists more involved in the CoPs?

- We tend to invite people who are working in the processing sector and so on, who are well established and most often they are not young.
- We all age ourselves. We are conducting CoPs using email, and that for young people is already too old, and Facebook might also be too old for them as well.

It would be good to have something like an e-newsletter to have key highlights from the different discussions to share with other CoPs.

- It is necessary to summarize what comes from the discussions and share it across CoPs. This would have to be documented in a structured way and disseminated to the other CoPs.
- The Portal will collate all kinds of documents, online discussions and one can see and join these discussions so long as you are a registered member.
- The e-newsletters in a very summarized way, offers another opportunity for members to find out highlights of the events and discussions of the other CoPs

8 SESSION SIX: COMMERCIAL SWEETPOTATO PRODUCTION AND MARKETS DRIVING SWEETPOTATO UPTAKE

8.1 Commercial sweetpotato production methods in South Africa

Jacobus Risseeuw

The presenter who runs a commercial sweetpotato production business called Risseeuw Boerdery in Limpopo South Africa with other family members, shared his experiences and factors that influence successful commercial sweetpotato production.

A commercial farmer becomes successful based on the way he/she thinks, his/her actions and how seriously he/she takes his goals. The commercially oriented farmer must clearly define a vision for the future and set up a five-year plan to achieve that goal. This could include changing the way the farmer does things, if that is what is required to attain a different outcome.

Components of a business plan

There are six Ms that should be considered when making a business plan, and these occur in a specific order:

Management: this involves making a strategy (business plan, goals and action plan). It requires an evaluation of one's position, capabilities and resources. A SWOT analysis is undertaken. For example, the strengths could include being hardworking, trained staff members who share one's goals, financial and technical support. Weak points could include lack of marketing skills, downtime of tractors, high maintenance costs, lack of high tech equipment and low production. Opportunities include windows identified in the market during times of low supply and high demand and government grants for new developments. Threats could be technical problems, e.g. with the Maputo harbour in terms of logistics, strikes in the harbour and the nature of labour legislation which affect the transportation of sweetpotato, and increases cost when the Cape Town route is used. Other problems include, labour legislation, high labour costs (35% of total costs), high crime, corruption and weak infrastructure, roads and railway.

Marketing: The customer is always right and as a business, this must always be the number one focus. Also, as a commercial producer, it is important to always look at the market that pays well. The factors that influence this include: Packaging, sizing, colour, varieties, yields, and nutritional value. GLOBALGAP Accreditation improves the export rating.

Money: Cash flow (enough cash), financial records of previous crops, financial discipline and ensuring that in case of shortages, there are possibilities to get financial support.

The other three Ms i.e. manpower, materials and machinery, come in to play when coordinating action to achieve the business goals.

8.1.1 Soil preparation

In the field, after ploughing compost is spread out into the soil and since the rainfall is very low, just around 450 mm, the company is under an irrigation scheme. After spreading the compost, it is tilled into the soil. Since for sweetpotato there are few insecticides that are registered. These are usually sprayed into the soil to control insects before planting.

Row ridges with fertilizer hoppers are used to make double ridges. The soil is irrigated to make it moist. Two furrows are made on one ridge.

Virus free material comes from the Agricultural Research Council. These vines are planted carefully to avoid planting them upside down, in which case they would grow but would not give a yield. The sweetpotatoes should have the right size, be high yielding, have a good quality and good shelf life, and look nice; the house wife must have a desire to buy it when she sees it. This is important if sales are to be made.

Picking up and handling sweetpotato

The enterprise recently acquired a one tine ripper, which extracts the roots. However, many are left below the surface. The roots are picked up and handled carefully as they are packed into the crates. About 1,850 crates are packed per day by 42 people.

As a company that focuses on the export market, handling is critical to ensure that the condition of the roots is of exceptionally good quality. The market currently fetches 800,000 rand. Furthermore, the crates themselves break easily and must be handled with care.

In the second pick up, the potato harvester is used. The two processes are done to prevent sweetpotatoes falling on to each other and getting skin damage. The crates are then loaded and taken to the pack house.

8.1.2 Pack house and marketing

Sweetpotatoes packed and ready for the market

When they get to the pack house, the sweetpotatoes are placed on to palettes. They are soaked to remove all the dirt and then into high volume spray. After that, they are put on the conveyor and carefully handled as they go into the second wash. The tips are cut off because if this tip is too big, they cannot be exported. The roots are put into chlorine oil and then taken through a dryer, after which they are sorted to remove the extra-large, small and damaged roots. They are then sized and taken into the curing room (28 degrees centigrade) for not more than 48 hours. Beyond this, there is a risk of sprouting. The roots are then taken to the cold room and packed - sweetpotato sizes are 3kg and 1kg packages, and there are those that go into the local market. For the export market, 20 palettes are packed per container. They can take up to four weeks to reach the European market, a problem for which the company has yet to find a solution.

As part of management, an analysis is done after the crop, in which the yield, costs and profit are calculated. The cost of production is around 100,000 Rand, and the sales are around 150,000 Rand, making a profit of 50,000 per hectare. This information helps to improve production practices, cut costs and labour and improve maintenance

8.1.3 Questions and answers

Please tell us more about the profitability of the value chain as defined by yield per hectare, the financial loss due to the yield gap under current farming practices and the percentage of production that is sold?

Yields vary between 40 and 70 tonnes per hectare. The revenue is from 20 hectares with ZAR 100,000 per hectare ($6,650 USD).

Is it possible to establish large farms through land swaps or consolidation of land with subsistence farmers?

Transformation of small holders into commercial farmers is possible but it depends on the government policies. In South Africa, after World War II, the government gave land to returning soldiers. These new farmers were registered in cooperatives that supported the supply of inputs and marketing. They also had

access to loans at low interest rates. This policy helped to establish many new farmers who could successfully produce for the market.

What products do you use for soil sterilizer, what are the costs and impact on profitability?

Disease control is through two registered chemicals – an herbicide and a pesticide. The soil is sterilized prior to planting with an unregistered product, but as the crop is not on the field yet, this seems not to clash with official standards. Vines are from a farm 250 km from the north. This farm is isolated so the risk of contamination is minimal. The farm receives basic material from the Agricultural Research Council.

8.2 Seed Farmer Market Consumer, SeFaMaCo

Antony Masinde

SeFaMaCo is a model that is meant to connect the players from the seed level to the farmer, market and consumer level. The goal of the project, which is entitled 'Integrated value chain development and smallholder farmer (SHF) commercialization of banana and sweetpotato for Tanzania, Uganda & Ethiopia based on a Seed-Farmer-Market-Consumer Model', is to optimize profitability and productivity by catalysing market oriented value chain-wide competitiveness and investments in banana and sweetpotato for increased household incomes.

This is in the realization that for any entity to be considered commercial, it must be based on the pursuit of profit function. The stakeholders must maximize their revenue against their costs. This requires an analysis of the productivity and how this can be optimized to influence profitability of small holder farmers.

8.2.1 Landscape Study

To evaluate whether the model is injecting efficiency in the value chain processes, studies are undertaken. The landscape study revealed very interesting findings.

In Uganda, the dormant productive capacity is 83% of what they are producing now. This represents what they need to achieve in order to reach optimum productivity. In Tanzania, the dormant capacity is 88% and in Ethiopia, it is 81%. This means that farmers in these three countries are producing below capacity. This is very expensive. The combined annual farm gate value is USD 371 million (Tanzania, Ethiopia and Uganda), against a potential of USD 2.03 billion; and the commercial loss or opportunity cost of low productivity is USD 1.74 billion annually.

8.2.2 SeFaMaCo Outcomes (Figure 29)

1. Enhanced strategic investments in commercial seed enterprises responsive to market driven clean and quality Sweetpotatoes purchased by SHF – Seed Marketing Enterprise Development (SEMaD) Approach.

2. Commercialized SHF through increased productivity and yields of market preferred varieties of sweetpotato strengthened Farmer Organizations for collective marketing and inclusion of youth and women as value producers.

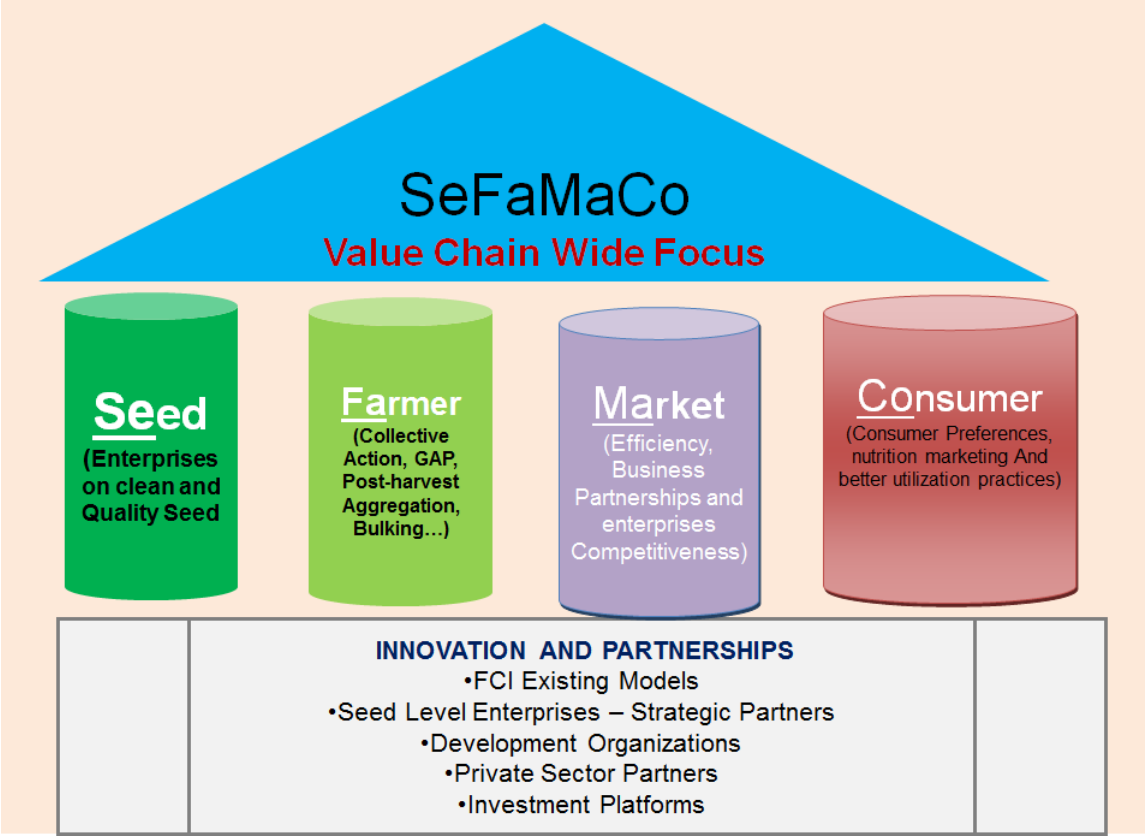
3. Increased market share of sweetpotato through enhanced value chain efficiency, market partnerships and competitiveness in informal traditional markets and schools as demand catalysts for other distribution channels.

4. Increased utilization of sweetpotato through positive image building, product diversification, nutrition education and enhanced consumer preference in rural and urban areas

5. Enhanced learning networks strengthened through strategic alliances and partnerships based on an upgraded SeFaMaCo model.

As a business model, SeFaMaCo focuses on value chain, innovations and partnerships (*see Fig. 29).*

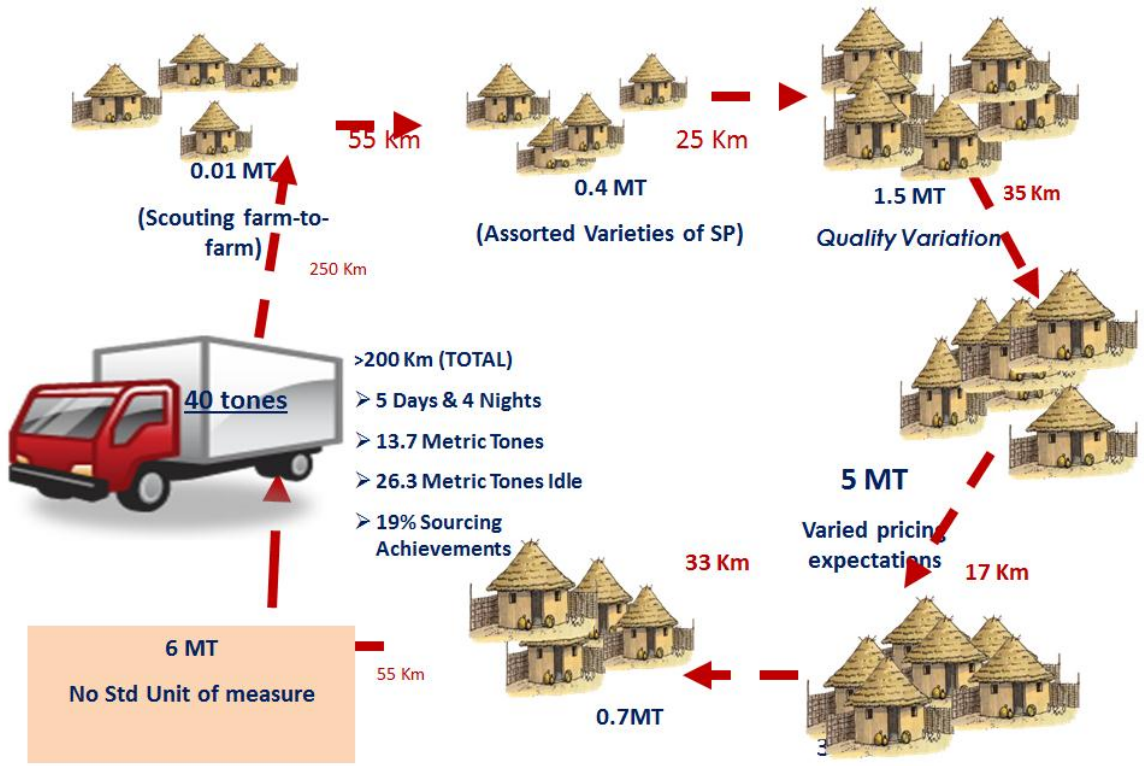
Fig. 29 The SeFaMaCo model



SeFaMaCo targets 541,588 sweetpotato clients, 102,920 farming households (40% women & 30% youth, 844 commercial villages, 303 wholesale buyers and 279 seed enterprises.

The figure below (Figure 30) is an illustration of inefficiencies encountered in the supply chain. The capacity of the truck is 40 tonnes, but at the end of it, after moving over 200 km and spending five days and nights on the road, the truck has been able to collect only 13.7 metric tonnes. This means that the idle capacity is 26.3 metric tonnes.

Fig. 30: Inefficiencies encountered in supply chain facilitation.



Farm Concern International (FCI) is working with partners to respond to some of these questions asked globally:

- Why are smallholders still not attractive to the private sector?
- Why is the private sector not considering smallholders as part of the supply chain systems?

Often, the system itself tries to compensate. In this example, the various options are:

- Trader to absorb cost and compromise profits
- Sweetpotatoes consumer prices increased to cater for the high sourcing cost
- Transaction costs transferred to producers through lower prices for their produce
- Evenly distribute business cost to all levels

The default solution by buyers is to transfer transaction cost to producers resulting to low and unpredictable commodity prices.

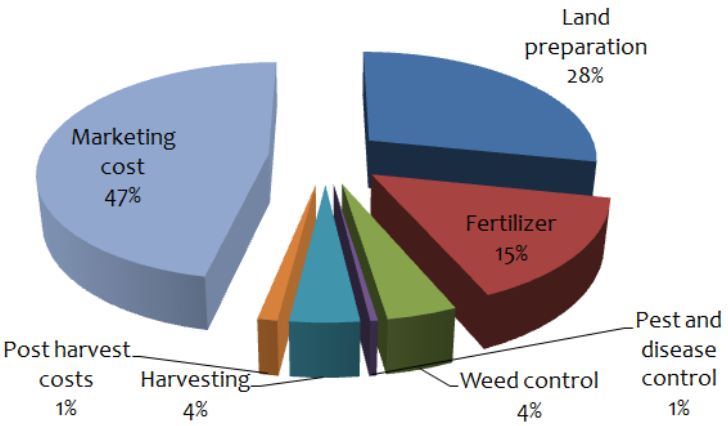
Under the SeFaMaCo model, efforts are being made to build partnerships with the informal market, e.g. standardize the packaging. All the business principles that apply at the business level should apply at the SHF level, so that there is no 'sympathetic' buying. Rather, they should demonstrate value that the private sector is willing to pay for. However, because pure business principles would be too harsh for SHF, there is need for Value Chain Development facilitators.

8.2.3 Progress

The project is working on breeding to develop improved varieties and access to clean planting material. For example, preliminary analysis shows that Uganda has made tremendous progress in this regard, but marketing costs account for 47% of all costs of sweetpotato farmers. SeFaMaCo has initiated development of 173 CVs across the three countries, created linkages to seeds suppliers, structured governance in various-levels, built partnerships with Business Development Service providers and is in the process of developing an information exchange platform.

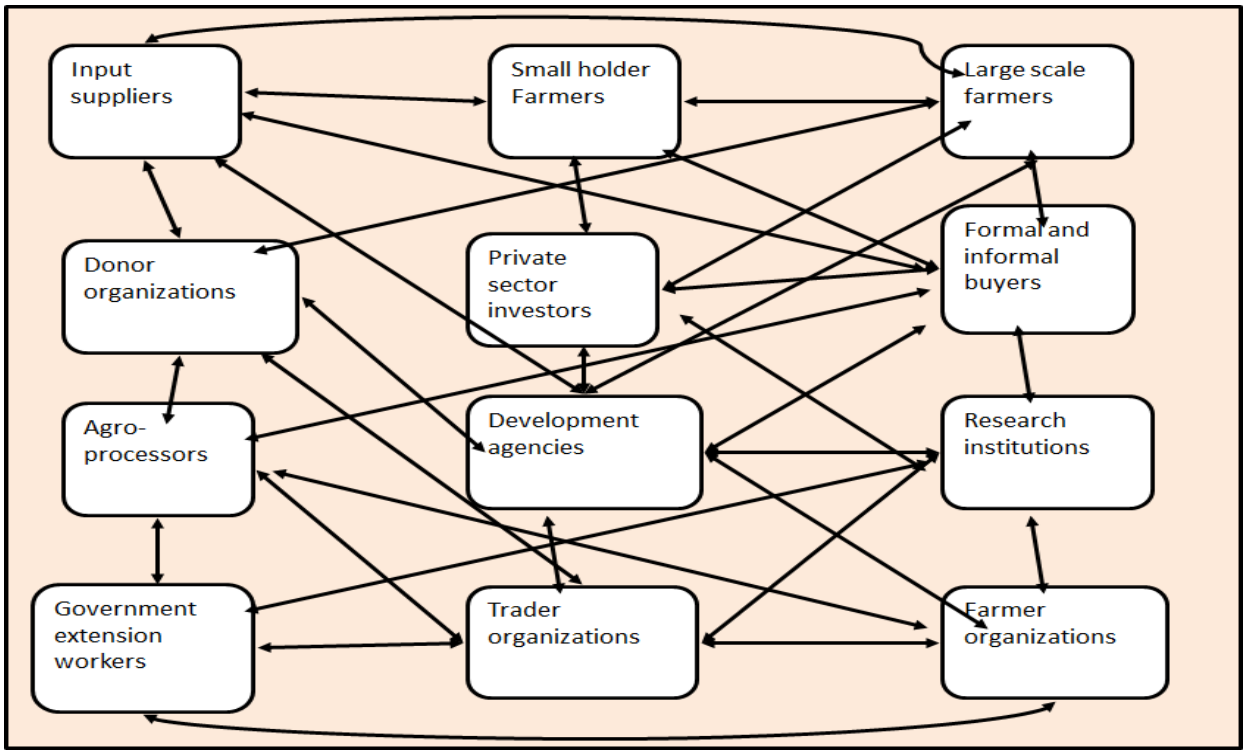
Through commercialization campaigns, farmers are supported to move from subsistence to commercial production by undergoing a lifestyle change.

SeFaMaCo is creating efficiency in informal markets and other markets. 84 wholesale buyers, 20 Traditional Informal markets, 15 Small and Medium Enterprises (SME) have been mobilized and so far in the three countries, USD 21 million has been mobilized.



There is also need to get improved varieties as a pool, and to promote an agri-investment network (Figure 32) through which there is investment at different levels.

Fig. 32: Agri-investment Network



8.2.4 Questions and answers

What is the strategy for improving productivity?

One of the problems that face sweetpotato investment in SSA is low productivity. We are having a challenge with access to inputs and quality planting material. The low productivity of sweetpotato can be raised by building partnerships among producers so that such bottlenecks are addressed.

What were the farm gate sales?

These are farm gate sales, with linkages between informal markets and other formal markets.

Can small holders be transformed into commercial sweetpotato production?

SeFaMaCo is based on lessons from the commercial model villages implemented in different countries, which aim at aggregating enough stock to attract buyers to the village. The model attracts buyers to the village rather than to individual producers.

What strategy are you using to attract different players on board?

We have learning (agri-investment) platforms with players from seed production, trade and so on so that we can bring key stakeholders together.

8.3 Integrating orange in Zambia: Farmer-to-farmer linkages to sustain access to a vitamin A rich food that earns income

Felistus Chipungu

Integrating orange in Zambia: combating vitamin A deficiency and food insecurity through the effective use of orange-fleshed sweetpotato in eastern and central provinces is a project, implemented by CIP in Zambia from 2011-2015 and funded by USAID- Feed The Future initiative.

Vitamin A deficiency is prevalent in Zambia, which is at 54% in children under five. Sweetpotato varieties traditionally grown and consumed in Zambia are white fleshed and lack beta-carotene. The general purpose of the project therefore was to (a) contribute to increased frequency of intake of vitamin A rich foods, especially of women and children under five years of age; (b) improve overall household food security and diet diversification through dissemination of OFSP.

In Zambia, the staple food is maize, just like in Malawi. Sweetpotato is important to complement the maize. The project had the following outcomes:

- 15,000 households growing and consuming OFSP (75% of them with women and children)
- Improved foundation "seed" management through vine conservation and DVMs
- Empowerment of women in rural households
- Establishment of active, knowledgeable sweetpotato community

In the implementation process, there was a process of identifying recent technologies and the existing gaps. The important one was varieties: there was only one OFSP variety. Others were agronomic practices to increase yield, seed systems- access to quality vines timely, post-harvest handling and marketing, packaging of selling vines, processing and utilization .

A process of identifying key partners was undertaken. The main one was Ministry of Agriculture, Zambia Agricultural Research Institute (ZARI) as well as those that are working in food security and agriculture related activities. The project worked in eastern and central provinces.

8.3.1 Activities

Variety development and release was done in collaboration with ZARI. Variety evaluation trials and preference tastes resulted in the release of four varieties whose yield ranged from 19 to 25 tons per hectare. The ones most preferred by farmers were Chunfwa and Olympia.

Vine dissemination was geared towards increasing access to the improved OFSP varieties by farmers and ensuring timely access to high quality seed. As evaluation of the varieties was taking place, they were sent for cleaning in Nairobi and Maputo and cleaned vines were grown in a screen house at ZARI-Msekera. This work concentrated on the two OFSP varieties Chunfwa and Olympia.

Vine multipliers were identified in villages and agricultural camps in partnership with MAL in each district. They were to multiply vines during the dry season under irrigation.

Specific activities included: training of multipliers and partners on rapid multiplication, agronomic practices and disease management; vine distribution from ZARI screen house to farmers and partners for nursery establishment; facilitating some multipliers with treadle pumps, bicycles, net tunnels, and sign posts; and facilitation of vine dissemination to beneficiaries. Signposts were put up to help people source the vines.

These farmers were also empowered to source vines intended for multiplication from ZARI; rapidly multiply vines for timeliness and quantity under irrigation during the dry season, and commercialize vine production and circulation through promotions to create demand for vines and root.

Market promotion of vines was done during market days in the various districts. The farmers were trained on how to handle and package vines - 100 pieces of 30 cm sold at 5 Kwacha each.

8.3.2 Achievements

Generally, technical information has been delivered to multipliers - gardens had trenches and fences around to deter animals, mulching nursery beds in the hot months of October and November, and effectively using net tunnels i.e. cutting vines from the net tunnels and multiplying in open fields.

In 2015, the project developed a report of progress with regard to vine dissemination and other activities such as variety production, packaging and distribution points where CIP facilitated dissemination of vines. According to the data, the number of DVMs has increased. CIP facilitated dissemination for CIP vine multipliers (*See Table 12).*

Table 12: Vine dissemination and sales

	2012/13	2013/14	2014/15	Total
No. of new multipliers established	280	160	358	**798**
No. of continuing multipliers		160	78	**238**
No. of direct beneficiaries	1895	5,296	10,608	**17,802**
% of beneficiaries who paid for planting materials	100	100	30	

436 (97 women, 328 men) multipliers in 73 Agricultural Camps across six implementing districts of Eastern and Central Provinces benefitted from vine dissemination. The project surpassed its goals, directly reaching 17,802 households with improved OFSP planting vines through CIP, partners and vine multipliers.

In the first years, farmers were encouraged to sell their vines to create an incentive. Most were for sale during market promotion, but some were distributed through vouchers for targeted households. In 2014, to increase the production of vines, some vine multipliers received peddle pumps. As a part of loan repayment, they had to produce 400 bundles to be distributed to target households. These figures are not reflected in the table above.

In one district in the region, the project tried to see if farmers could get their own materials to the market. The project only facilitated advertisement of the market day and organized the market, and the farmers brought the bundles for sale. Therefore, it is clear that if well facilitated, farmers can produce and sell their planting material.

8.3.3 Challenges

In the 2014-2015 seasons, the water sources for the multiplication dried out completely due to the delayed onset of rainy season. Some of the vines also dried out before planting and some fields were swamped with weeds.

Some farmers' innovations did not work well. For example, they were given net tunnels, but some also decided to make additional ones using sleeping nets, which unfortunately had holes in them and were not protective enough (see photo on the right).

Local laws are not effective in some areas with regard to controlling grazing animals from invading farmers' fields.

8.3.4 Way forward

Farmers do make money from vines when empowered and this should be encouraged for sustainability. Vine multipliers should be linked to agro dealers.

8.3.5 Questions and answers

When the vines were sold directly, what percentage of what was produced was actually sold?

Individual producers have different capacities. DVMs meeting certain institutional standards have been equipped with treadle pumps. These pumps have pushed vine production up.

How did you ensure the quality of the planting materials?

Quality assurance is through the screen houses. That is the starting point. There is no seed system comparable to pollinated crops and there is no inspection by the government.

8.4 Participatory radio: specific style of radio that goes over a 4 month period

Karen Hampson

Radio, when done well, can impact millions with actionable and relevant information on innovations that have been proven to work for farmers.

Farm Radio International (FRI) uses participatory radio campaign methodology, which is a specific format that runs over a period of four months. It starts with introduction, then discussion and analysis and interaction with the farmers, and then they are asked to vote on specific issues. FRI has tested its participatory radio campaign methodology over 100 times across eight countries; therefore it is a well tried concept which has proven that when used, people in listening communities are five times more likely to take up a practice featured in the campaign.

FRI works directly with topic specialists to develop radio programs. The organization supports existing broadcasters to produce targeted radio programs that focus specifically on specific measurable objectives. The approach includes face-to-face activities to broaden understanding of nutritious crops, and how to prepare and serve them to their families. Both men and women are targeted in the programs that help to inform decisions on what to grow, eat and consume for the household.

8.4.1 Project examples

FRI has had the following two recent projects

- Using radio mini-drama to contribute to increasing knowledge and consumption of OFSP in Uganda
- Promoting the production and consumption of sweetpotato in Ghana, Uganda, Tanzania, and Burkina Faso through participatory radio campaigns.

8.4.2 Key Steps

The steps used for the production are as follows:

Audience research – conception before the radio program goes on air takes about 4 months. During this time, research is done to find out what people listen to, and at what time, the knowledge gaps, planning broadcast times, selecting partner radio stations, baseline/endline.

ICTs for immediate audience feedback and increased interaction (SMS, voice, beep-to-vote etc.)

Close partnerships with CIP, HarvestPlus and other country-level OFSP partners to ensure messaging is consistent, accurate, and locally relevant - (e.g. Advisory groups, comments on scripts and technical questions, input at Program Design Events, feedback on programs, sharing technical resources)

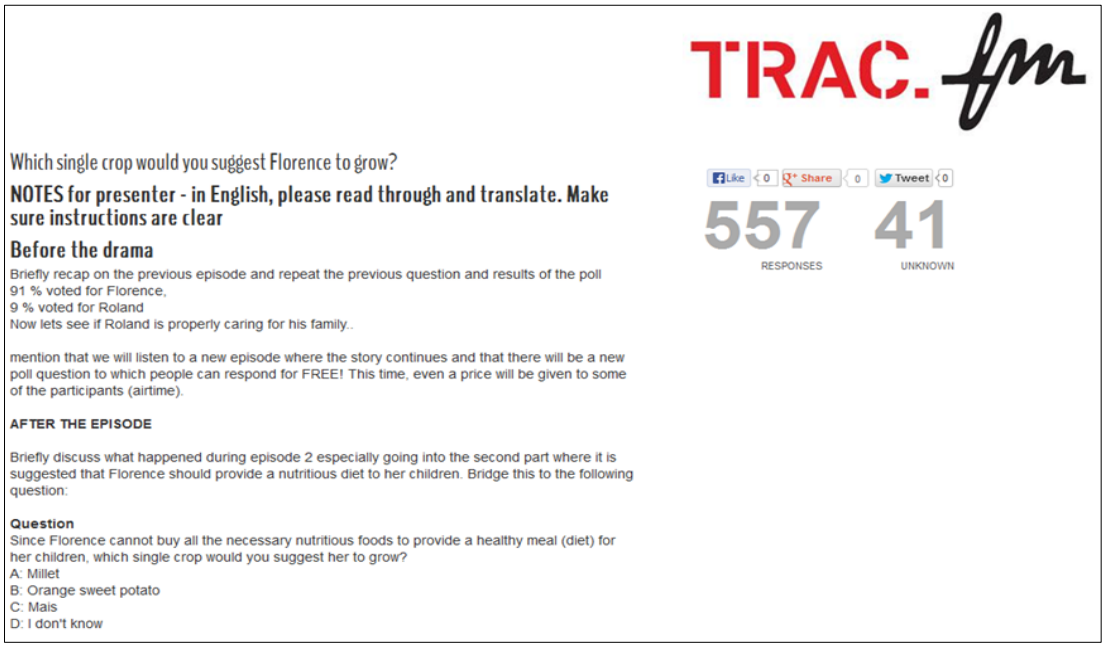
Broadcaster training in interactive radio and OSP

8.4.3 My Children – radio drama

HarvestPlus wanted to reach 350,000 households in Uganda. *My children* was prepared is a drama made up of 30 episodes, each 2-4 minutes long which are repeated. Each episode focuses on one key message or piece of information regarding production and nutritional aspects of OFSP. Listeners participated through free SMS polls and quizzes at the end of each episode. In partnership with an organization called Trax FM, listeners could call and listen to previous episodes for 55 UGX/minute. Although the aim was to reach 350,000 households, there was potential to reach an audience of millions.

Participatory radio approach was implemented in four countries. 42 radio campaigns were broadcast via 15 radio stations between 2012 and 2015. Topics included: nutritional knowledge regarding young children and mothers, production, consumption and sales.

Fig. 33: Screenshot of SMS poll in Uganda



A household survey, baseline and endline were conducted. A combination of participatory radio campaigns and mini dramas were used in selected stations in Tanzania, Ghana, Uganda, as well as on air cooking shows.

8.4.4 Outcomes – drama

Some of the outcomes of the drama are as follows:

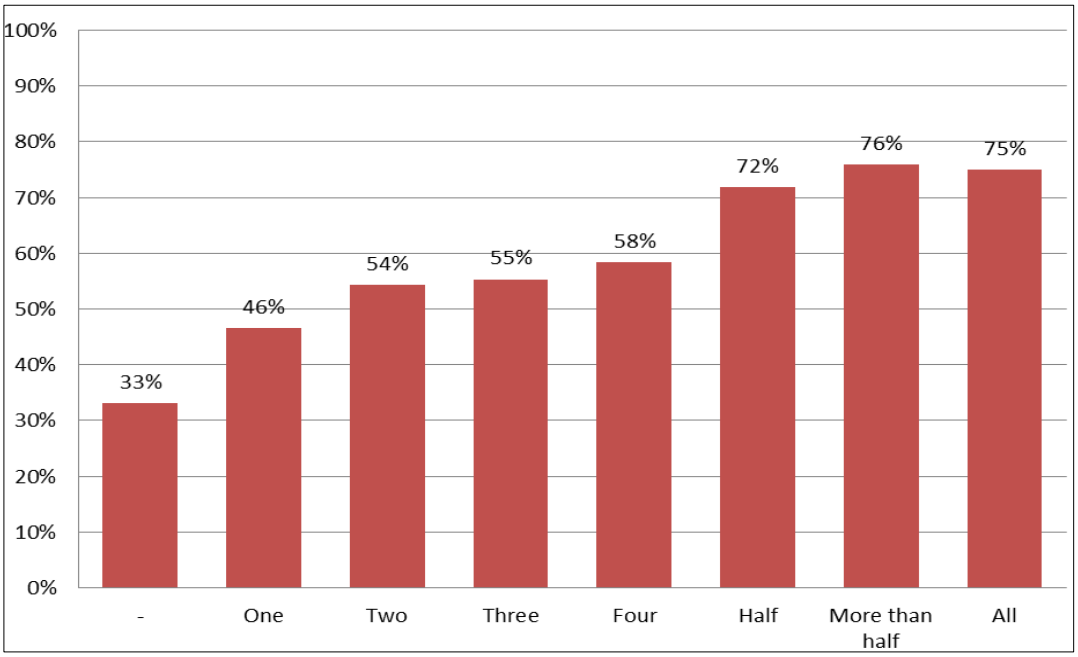
- Farmers have gained knowledge on the nutrition content of OFSP and its use, Vitamin A and effects of Vitamin A deficiency
- Positive change in attitude to OFSP, leading to demand for vines outstripping supply.
- Vines are now moving around Uganda and being shared by farmers.
- Women want to join groups so as to obtain OFSP vines.
- Children ask for OFSP, attracted to its colour and taste.
- Those who have vines say they have started to change their lives; others are still accessing vines and plan to grow.

> *"The radio is where we are not. It eases our work. The drama answers some of the questions that the farmers ask us. It also helps to introduce us to new villages."* Tadeo Khamala, field extension worker, HOCADEO.

The emerging outcomes of the OFSP project are:

- There is increase in demand for planting material.
- Diversification of preparation methods for household consumption (yogurt, chapatis, bread, etc.).
- Higher prices for sales in OFSP than other varieties (Ghana).
- Demand for vines and products (roots, flours, processed foods in non-traditional growing areas and urban centres) as evidenced through beep-to-vine study Tanzania.

Fig. 34: Percentage of respondents that grow OFSP by listening behaviour



Knowledge increase – 30%: In Tanzania, 31% of men and 34% of women scored 50% or above in knowledge quiz at baseline. In the endline/outcome survey, these numbers were 61% of men and 59% of women scoring over half in the knowledge quiz.

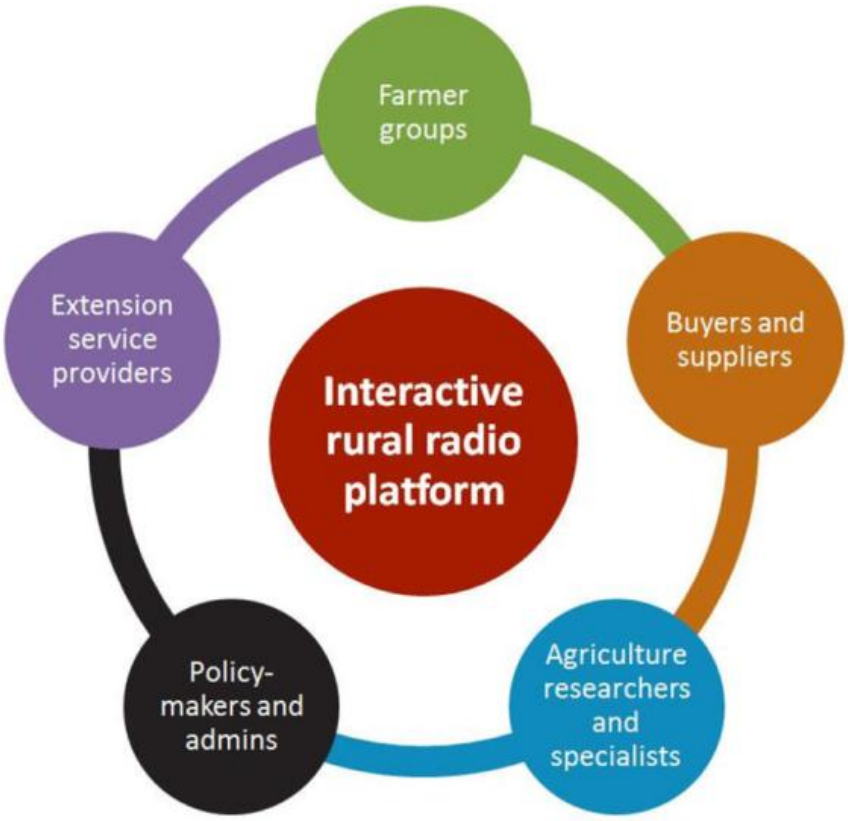
Beep2Vine – linking farmers to planting material: The list of vine suppliers was developed from NGOs, regional research centres, etc. FRI created a 'Beep2Vine' system where listeners place a missed call (beep) if they are looking for vines. Callers received SMS with mobile number of a supplier in their region. Three regions were involved in study (Pwani, Mwanza and Northern). There were 689 registered listeners. 80% of B2V users received vines, 92% continue to use them a year later. In Hai/Kili, there was only one seller Rashidi, who made 1,585,000 TSH. In Pwani, six sellers were listed and 330,000TSH worth of vines was sold. In Mwanza, three sellers made a total of 360,000 TSH. So, on average, the sellers made 758,333 TSH from the system (USD 360) and a total of 455 bundles of vines were sold. FRI's projects can reach a farmer with vital extension information for pennies per listener. Participatory radio campaigns have reached "new practices" for less than 1USD per farmer (Irish Aid 2014).

8.4.5 Next steps

The following are the planned next steps:

a) Second mini-drama series in Uganda in production
b) Target urban centres to increase the demand for roots and processed products.
c) Expand beep-to-vine service; include training for sellers, and users of system.
d) Expand country reach (Nigeria, Mozambique?)

Fig. 35: Interactive rural radio platforms



FRI's future vision is to move from one-off projects to interactive radio platforms that become an integral and transformative component of public extension systems at various levels as well as a trusted and dependable mobilizer of, and advocate for, small-scale producers as illustrated by *Figure 35.*

8.4.6 Questions and answers

How do you deal with literacy levels for farmers who cannot read text messages?

Beeping does not cost anything and is something that requires the least level of skill. In response to the beep, the beeper receives details of vine multipliers closest to him/her. It may be possible that the beeper cannot read, but it is often the case that another member of the household or a neighbour can assist.

Is there a way you can estimate the number of people listening to a specific radio program?

Audiences are estimated indirectly. One way is using GIS data by using coverage maps which are overlaid over maps with demographic data. The coverage maps also tell us the area that the signal reaches, while the demographic maps tell us how many people live within the covered area. Thus we have a rough estimate of the number of people we may reach. The other way is doing surveys in which the population is questioned to establish the percentage of the sample who listened in.

8.5 Jumpstarting orange-fleshed sweetpotato in West Africa through diversified markets

Erna Abidin, Kwabena Asare, Eric Dery, Justus Lotade, Koussao Some, Ibrahim Koara, Brian Kiger, Joseph Nchor, Issah Abukari, Kwabena Acheremu, Jude Njoku, Ted Carey

Jumpstarting orange-fleshed sweetpotato in West Africa through diversified markets is a three-year pilot project for West Africa and funded by the BMGF. The vision of the project is sustainable and inclusive market-driven approaches for OFSP to increase incomes, and improve health through consumption of vitamin A rich OFSP, especially in women and children in Ghana, Nigeria and Burkina Faso.

The project outcomes are:

1. Formal and informal diversified OFSP market opportunities developed in pilot areas in Ghana, Nigeria, and Burkina Faso.
2. Viable Quality Declared Planting Material (QDPM) seed system in target areas capable of expansion in response to increased demand.
3. Households, including women and children, in target areas have increased vitamin A consumption from OFSP.
4. Commercial sweetpotato planting material and OFSP producers, including women, increase income through participation in OFSP value chains.

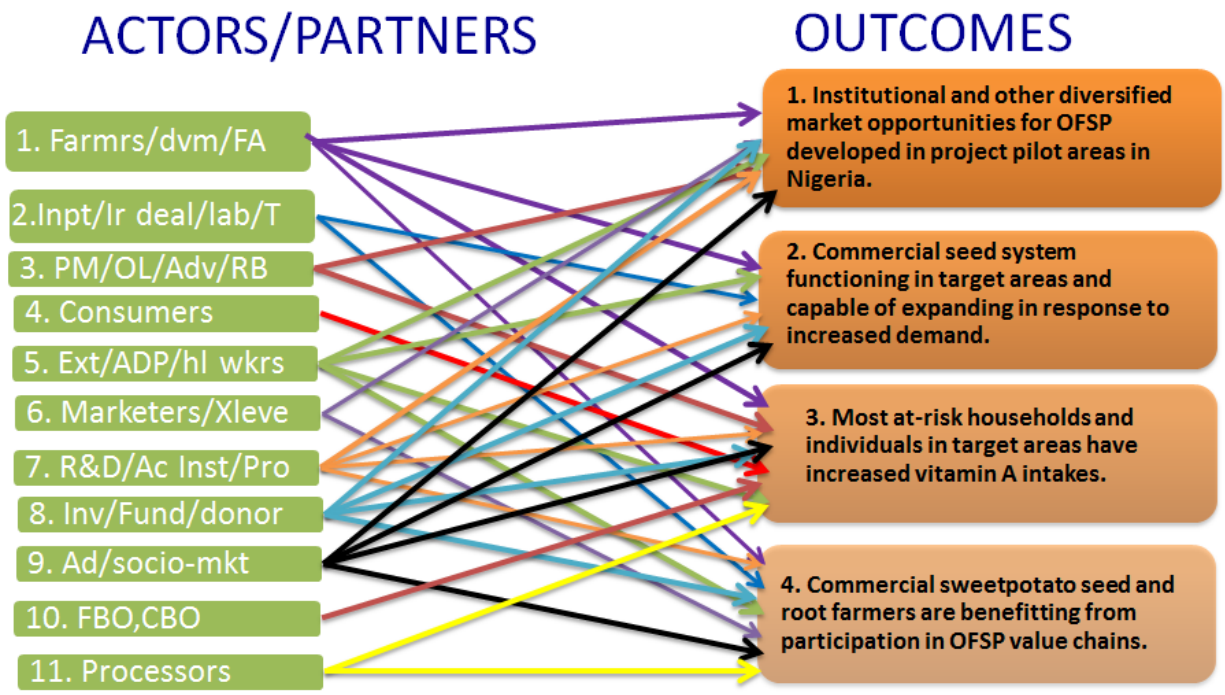
There are a number of projects in West Africa: The Jumpstarting project is implemented in two areas in Ghana and Burkina Faso, and in two areas in Nigeria.

CIP works in partnership with various NGO partners, such as ACDEP, iDE Ghana and Burkina Faso, ESOKO Ghana and Burkina Faso. In Ghana, CIP works with the following government agencies Council for Scientific and Industrial Research-Savanna Agricultural Research Institute (CSIR-SARI), Crops Research Institute (CRI), MOFA, MOFA-WIAD, Ghana Health Service, and University for Development Studies; In Burkina Faso, INERA and Ministry of Agriculture and in Nigeria, National Root Crop Research Institute (NRCRI). The O-MEALS school feeding program has already been initiated in partnership with the State Agricultural Extension (ADP). A school feeding program is also being planned in Ghana. Other program partners include MEDA, TRAX-Ghana, SNV, World Vision International, Partnership for Child Development (PCD), FRI, Helen Keller International (HKI),

and Catholic Relief Services (CRS). These actors (Fig. 36) were selected based on the outcomes of the project and are classified as follows:

1. Farmers, decentralized vine multipliers, farm associations
2. Transporters, input dealers/irrigation equipment dealers/labour
3. Policy makers, opinion leaders, advocacy, regulatory bodies, relevant ministries
4. Consumers, school community
5. Extension/agricultural development program/health workers
6. Marketers/multilevel
7. Researchers, academic institutions, professionals
8. Investors/fund providers/international donors, organized private sector
9. Advertisement/media/social marketers
10. Faith Based Organizations (FBO), Community-Based Organizations (CBO), NGOs
11. Processors

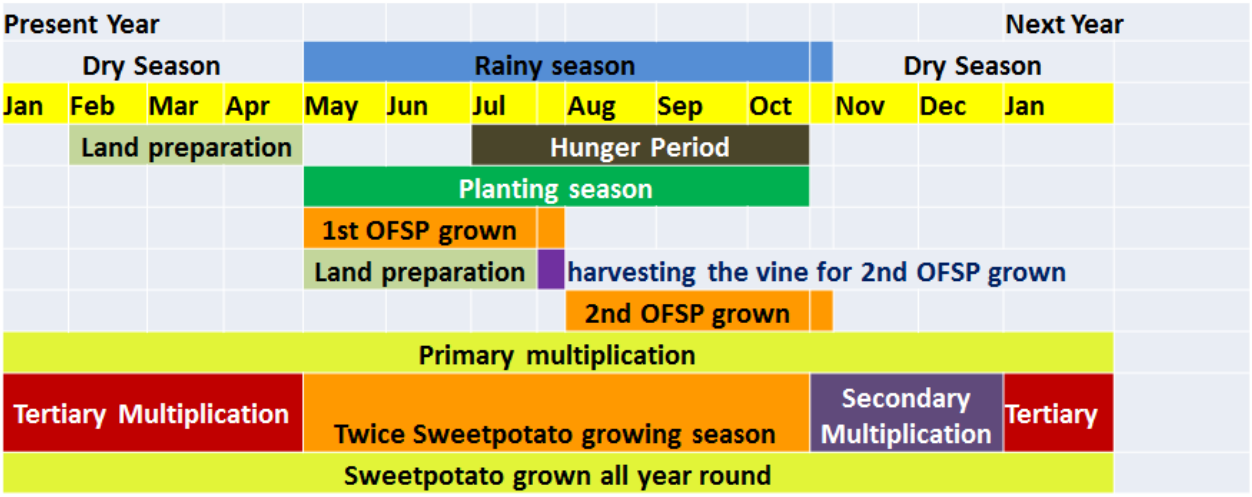
Fig. 36: Actors/partners and outcomes of Jumpstarting project



8.5.1 The sweetpotato crop calendar in West Africa

The project tried to make the sweetpotato calendar in West Africa based on the FewsNet calendar in Nigeria to determine how it would be implemented. Based on the uni-modal rainfall distribution pattern, sweetpotato cannot be grown year-round.

Fig. 37: The sweetpotato crop calendar in West Africa



8.5.2 Elements required for a functioning seed systems (CPPDM = Crop production, pest and disease management)

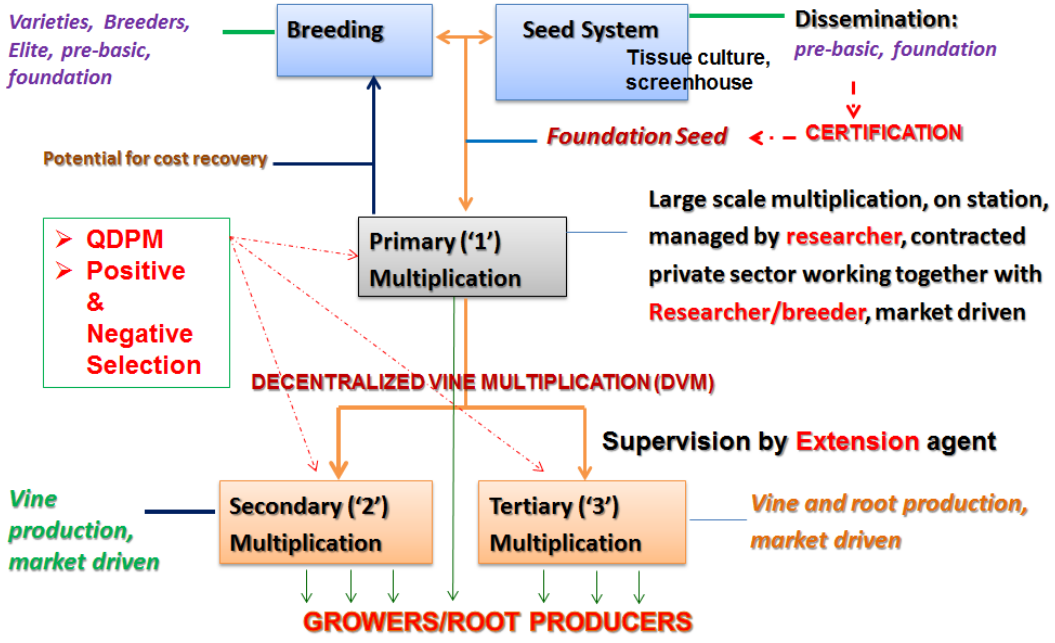
This involves improvement of the seed system through the breeding program; training - including training of trainers on multiplication, CPPDM, post-harvest handling, OFSP processing and utilization and book-keeping; advocacy to create demand for roots and vines - through sensitization and awareness campaigns during trade shows and action research; value chains and creation of market opportunities.

Farmers are very important in the project's design. Therefore, the project has done considerable work to build strong partnership, commitment and ownership among multiple partners.

8.5.3 Overview of the seed flow

The flowchart below shows an overview seed flow with reference to 1-2-3 system, and linkage of seed and breeding programs.

Fig. 38 Overview of the seed flow system



8.5.4 Progress

The table below shows the progress made in promoting vine multiplication and root production in Ghana and Burkina Faso.

Table 13: DVMs and root producers as of July 2015 in Burkina Faso and Ghana

Country	Location	DVM	% Female	% Male	End users (organizations)	Area of vines (ha)	# Root Producers
Burkina Faso (INERA)		97	14	86		16.3	8,650
	Kénédougou Province (Orodara)						
	Sokouraba	52	15	85	Commercial farmers, home-growers, etc.	2.6	
	Mahon	33	15	85	Commercial farmers, home-growers, etc.	1.7	
	Centre-Eastern Region	3	33	67	AGRA project	0.6	
	Eastern Region	7	14	66	HKI	1.4	
	NAFASO Seed Company						
	Comoe Province (Niangoloko)	1	N/A	N/A	Ministry of Agriculture	5	
	Houet Province (Banzon)	1	N/A	N/A	Ministry of Agriculture	5	
Ghana (CRI/SARI)	North, Central and South Ghana	15	0	100	Commercial farmers, home-growers, etc.	8	4,589
Total		112				24.3	13,239 (27% women)

In Burkina Faso, the area under production and the markets in the North Eastern part of the country have been mapped out by iDE. In the Northern region of Ghana, ACDP has already identified potential buyers who will be linked to OFSP producers. In Upper East, Volta and Central regions, the activities undertaken include identifying and contacting processors (yoghurt, juice, baker and food vendors); identifying and building partnerships with supermarkets and hotels; Ghana Health Service related to the antenatal program; University for Development Studies (UDS) is working on bakery products.

14 master facilitators (43% women) were trained in November 2014. A step down training and community health services was done for 35 (40% women) in mid-December 2015. Step-down training is still going on in 34 centres, and counselling including OFSP is still ongoing at the community level.

School feeding was started in eight schools in Kwara and Osun States in Nigeria through O'MEALS. So far, 4,160 children are fed by 60 caterers and plans are underway to scale up the numbers.

Working in a sweetpotato field in Burkina Faso

Action research taking place through internship currently is (a) Gender prospects for an orange-fleshed sweetpotato development in Rural Northern Ghana–Jumpstarting OFSP project by Simone Tijdink – University of Amsterdam and (b) Willingness to pay for Orange-fleshed sweetpotato – Jumpstarting OFSP by Chinonso Etumnu, University of California. Through national agricultural research services action research includes agronomic trials: fertilizer trials, i.e. inorganic- vs. organic fertilizer, various organic fertilizers, etc.; breeding demonstration trials; mother and baby trials for an on-farm advanced trial for varieties to be released.

High level Advocacy: The project representatives met with the Vice President of Ghana and Kofi and Nane Annan and Minister of Agriculture in Ghana. In Nigeria, the team met the Governor of Osun State and leaders at the community level. As a result, the project secured 4,000 USD for both 2014 and 2015. Other results includes the AGRA PROJECT – led by Crop Research Institute and backstopped by CIP-led project Jumpstarting OFSP Ghana, and strategies for OFSP expansion and scaling intervention in Ghana.

8.5.5 Jumpstarting year 3 areas of focus

The following are the areas of focus for Jumpstarting project: Strengthen seed system (QDPM) implementation; continuing learning from Ghana Health Service intervention; expanding and documenting formal and informal markets for fresh roots and processed products; solidify M&E systems; and solidifying and expanding partnerships.

8.5.6 Questions and answers

You are focusing a lot on vine selling, yet vine multipliers obtain the bulk of their revenues not from selling vines but from selling roots.

We are still in a pilot stage so it is difficult to assess the current situation. Currently, vine and root production are combined. The idea is to separate them in future.

9 SESSION SEVEN: GOING TO SCALE

9.1 Scaling out sweetpotato and potato-led interventions to improve nutrition and food security in Tigray and SNNPR, Ethiopia

Haile Tesfaye

Efforts to address high food insecurity and malnutrition through a grain-led approach only (cereals are the predominant staple throughout the country) have not able to keep-up with population increase, climate change and malnutrition.This indicates the need for new approaches, including breaking the "grain mentality" by including production and consumption of less-labour intensive nutrient rich root and tuber crops such as potato and OFSP that can be accessible and affordable by poor people.

The goal of the project is to contribute to improved nutrition and food security in vulnerable households with young children in Tigray and SNNPR through increased production and consumption of micronutrient-rich sweetpotato and potato varieties as part of diversified diets. The focus is on pregnant and lactating mothers and children under the age of five.

9.1.1 The objectives and activities

- Expanded smallholder production of nutritious sweetpotato and potato varieties
- Increased consumption of OFSP and potato as part of more nutritious diets
- Improved and diversified market access for OFSP and nutritious potato
- increased institutional and policy support for nutrition-focused agriculture

The activities are focused on achieving these objectives through supply chain development, creating awareness through awareness and behaviour change communication, creating market linkages and institutionalizing activities within government institutions.

The project was started in 2011 in very few woredas and villages. In 2013, two projects were implemented in 5 woredas (30 kebelles) in Tigray and 5 woredas (15 kebelles) in SNNPR. These have since been staggered under the umbrella of one joint project to 10 woredas (45 kebelles) in Tigray and 10 woredas (30 kebelles) in SNNPR.

The project is implemented by the following partners:

- Tigray: Bureaus of Health, Agriculture and Education, Tigray Agricultural Research Institute (TARI), Mums for Mums, Women Association of Tigray, University of Mekelle, World Food Programme
- SNNPR: Bureau of Agriculture, Bureau of Health, Southern Agricultural Research Institute (SARI), Egna Leegna, Goal, University of Hawassa, Wolayta Sodo University
- University of Wisconsin

9.1.2 Achievements

In the last four years, the area and number of partners participating in OFSP production and consumption has increased. Vine multipliers are not only a source of planting material, but also job creators contributing to increased income.

There are a number of projects implemented directly with the SASHA project with funding from Irish Aid and USAID. This includes pilot cultivation of OFSP, potato and other nutritious crops that are grown in kitchen gardens. There are also a number of crops that are being intercropped with cereals to reduce hunger in the dry months. Through refining of small scale irrigation, root and vine production during off-season has been increased. The project has undertaken a study on validation of cost effectiveness of on-farm vine conservation using the triple 'S' (sand, storage, and sprouting) technology in 30 farmer plots and conducted on-farm trials introducing net tunnels in 22 pilot farmer fields in both regions.

They have the capacity now to produce about 1.4 million cuttings of foundation (basic) material. DVMs i.e. commercial vine multipliers - model farmers who engage in vine production.

Because there is a high turn-over, capacity building is done in government institutions at local level. In addition, model farmers are trained on agronomy, protecting planting material and gender.

Demand creation promotion is done through multiple approaches: radio messages and discussions, documentary film, women to women promotion, extension and technology dissemination, mobile cooking demonstrations, billboards etc.

In one of the campaigns, vine dissemination is done through women to women network and school children. An awareness group went around communities with dance and songs to advocate for people to grow and consume sweetpotato.

School gardens are used for school feeding, demonstrations and dissemination through children. n Ethiopia, OFSP is mainly processed into flour to produce different local products.

9.1.3 Constraints

There is inadequate access to timely and sufficient quantities of quality planting materials. This is especially problematic during the long dry season. Furthermore, production of sweetpotato is done at a small scale and by scattered producers. This partly contributes to the high seasonality of supply and the uneven quality or roots.

9.1.4 Questions and answers

You have long dry periods that reduce the availability of vines. In the USA, roots have been proven to be a source of superior planting material during the long winters. Do you think it is time to consider this more seriously in Ethiopia?

The difference between the two environments is as follows: In the USA, it is cold, while in SSA, it is hot. During the cold season, the roots survive in dormancy, but in SSA the roots keep sprouting. We also have a long dry period of up to nine months. The Triple S method is being validated in Ethiopia, and roots have successfully been stored for five months. Now, the trial is being made for nine months. If this is successful, the technology will be scaled up as a viable option for scaling up dry season storage maintenance of planting material.

As a breeder, the challenge is to breed for storability, which is connected to dry matter content and freedom from sprouting thus varieties that can be sprouted easily after storage.

In Ethiopia there is high elevation? Is it feasibility to take roots to the higher elevation areas and use passive cooling to have temperatures that are not permissive to sprouting?

That is a challenge because in Ethiopia, sweetpotato production occurs mainly in the lowlands, which is far from the highlands. It may work but it has yet to be tried.

How does China keep their material? They have very extreme weather, but they use roots.

It depends on where one is in China. They do have storage in cellars that are half underground and insulated. Traditional smallholders keep them underground. This is something that should be explored further to learn from them.

9.2 Scaling Up OFSP Through Agriculture and Nutrition – Panel Discussion

Facilitator: Tom Remington

Scaling Up OFSP Through Agriculture and Nutrition (SUSTAIN) is one of the projects implemented by CIP. In this panel, Tom Remington, the country manager for SUSTAIN in Malawi, facilitated the discussion of different scaling up efforts by the SUSTAIN project. Four countries (Malawi, Mozambique, Kenya and Rwanda) were each represented by a SUSTAIN staff, who interviewed a staff from a partner organization. This section captures their interviews, which provided an overview of their organizations and activities to scale up OFSP.

9.2.1 SUSTAIN Malawi: Tom Remington and Johannes Chikarate

Tom: Please introduce yourself.

Johannes: I am Johannes Chikarate, Programme Manager of Food, Income and Markets Program implemented by Concern Worldwide in Malawi.

Tom: Tell us a little bit about Concern Worldwide in Malawi and across Africa.

Johannes: Concern Worldwide: It is an international non-governmental humanitarian organization with the headquarters in Ireland, and offices in the United States, United Kingdom and recently in South Korea. We are dedicated to reduce people's suffering and eradicating extreme poverty. Our mission is to ensure that people move out of extreme poverty in a sustainable way. In Malawi, we started working in Nsanje, and expanded into Lilongwe, Nkhotakota and Mchinji districts. We are operational in 28 other countries in the world.

Tell people how we started this partnership.

This partnership started as collaboration 18 months ago. We were struggling to find a source of vines. We managed to get the planting materials from CIP for only four mother plots and baby plots. As we were getting into the next season six months ago, we decided to enter into a formal partnership and expand to three other districts, based on the successful initial collaboration we had had. At first we worked with 215 farmers and in 12 months, we had established 27 mother and baby plots in four districts. We have grown from 223 famers to 6,400 farmers in Nsanje alone.

Nsanje is in the river belt. They don't grow sweetpotato during the rainy season, but only after the floods recede. Please describe what happened this past rainy season.

Our season starts after the rainy season and we use the residual moisture in the soil. In 2015, Nsanje had floods, therefore the plains were recharged in terms of the water levels. We knew we would have enough moisture. Therefore, as a recovery response, we chose OFSP and distributed planting materials to 6,000 households for them to utilize the residual moisture from the flooding and produce food. By three months, people had sweetpotato roots for consumption and farmers also multiplied planting material on their own. There are some farmers that have spoken of excess of 329 MT for sale. We are working with Universal Industries to process sweetpotatoes. Unfortunately, their capacity cannot absorb all this. Therefore the flood recovery succeeded, but the market is a challenge.

How did you evaluate the varieties in Malawi?

A total of six varieties were evaluated, three did well in Nsanje, like Chipika did so well and it was giving up to 34t/ha in one of the mother trials. The farmers saw for themselves the yields in the mother plots and this made it easier for us to scale up. We would not mind continuing with other trials in the mother and baby plots.

How is Concern Worldwide preparing for the looming food insecurity that may be occasioned by El Nino?

Those plains will always flood, so we will always have residual moisture. All we have to note is the timing. We may either delay or plant early. Once rain water recedes, farmers should plant to avoid water drying up before crop is ready. The other aspect is to ensure availability of planting material. We have 97 registered and trained DVMs to cover this aspect. Sweetpotato is a short season crop. For us that is an advantage.

We are very fortunate to have many donors and projects in Malawi. Some of them are Irish Aid supporting the Rooting Out Hunger project and the USAID funded Feed the Future project. Our plan is to promote OFSP in every EPA-Extension Planning area in Malawi.

9.2.2 SUSTAIN Mozambique: Roland Brouwer and Claudio Gunduana

Roland: SUSTAIN works in three districts and we work with partners. One of our partners is represented here by Claudio.

Claudio: I work for ADEM – an NGO whose core business is to support economic development in Manica province, but we have expanded to the Beira corridor. We have the general assembly and board of ADEM and the executive director is the coordinator of all activities. We work with government agencies and we implement projects in agriculture, agro-processing, micro-finance and advocacy. I am the project officer responsible for health, production and entrepreneurship development and for the coordination of this project.

Roland: Can you explain how the relationship between SUSTAIN and ADEM started?

Claudio: Our relationship started in May-June 2014. We heard that CIP was looking for a partnership with a local organization. We developed our proposal and with their feedback, we improved it and submitted. Many organizations in Manica did the same. After two months, we received an assessment visit, and in the end, my organization won this bid. We received funds and started implementing the project.

What kind of approach is ADEM using to implement the project?

Our working area is seven districts of Manica province. We have six facilitators in each district, that is, we are working with 42 local facilitators, they are trusted in their communities and they are literate. We provide five days of training on agronomy and sweetpotato production, health and extension, because we know that we have a specific target group – women and children. Facilitators need to have a good skill to relate to these people in the field. During this process, CIP also started to establish DVMs in the areas we had identified facilitators and between December and March, we started to distribute vines to the households. We shared resources to enable this. However, we tried to establish DVMs near the households to facilitate access. Four months before planting, we started training people about health and nutrition. ADEM provides to facilitators a subsidy of USD 50, a bicycle and a mobile phone to implement the project. The facilitators and DVMs register the beneficiary households of vines. We reached 10,000 beneficiaries with vines and provided around 300 training sessions in nutrition and health.

What will be your focus for this year?

In this year, we have started to consolidate the results in the area we were successful in and we also extend our activities in to new areas. We will pay more attention to the groups we have been working with so that they continue to use sweetpotatoes. For the facilitators, we will reduce the target group and for new areas, we will continue to implement the same approach, because it is a good one that helps us to reach the people.

To what extent do you think that this approach can be used for scaling up?

Each country is different. For Mozambique, I think this approach works. We use the local people – DVMs and facilitators. We build capacity in the community and we start to create a small business with these people. When we stop giving subsidies, we hope that facilitators will continue to create demand for sweetpotato and DVMs will continue to sell the vines to the households. The important thing is that DVMs continue to provide good quality planting material. This way, households will continue to buy vines and produce roots for sale and bring more income into the community.

Ted Carey: Seed system is a part of sustainability. Is clean planting material part of the business plan?

We supervise DVMs to guarantee the quality of material they provide to households. We also follow production in the households, the diseases, the agronomic practices and so on. We have CIP which is helping us in all these activities.

9.2.3 SUSTAIN Kenya: Penina Muoki and Michael Nyamae

Penina: Please introduce yourself.

Michael: I am Michael Odongo Nyamae. I work with Rural Energy and Food Security Organisation (REFSO), an NGO working in Western and Eastern Uganda. We have been working with sweetpotato since the 1990s. We have been involved in involved in the evaluating some of the varieties and developing strategies to scale up sweetpotato production.

Penina: Please explain some of the strategies and bottlenecks in scaling up sweetpotato.

Michael: Sweetpotato is driven by the market. Whichever approach one applies, issues to do with seed multiplication, production capacities and nutrition and many others can be undertaken, but to address issues of food security and nutrition, there must be mechanisms that enable the movement of produce from the farm to the market. Household income must be addressed to improve purchasing power. Capacity building on issues of nutrition, value addition and processing will also increase consumption of sweetpotato. Normally, boiled sweetpotato is not as attractive as processed products. These are some of the aspects that our organization has been focusing on.

SUSTAIN's approach to commercialization of OFSP was to identify the market and approach NGOs like REPSO to ask if their farmers could supply this market. Could you talk of our successes and challenges?

Last year towards October, SUSTAIN brought sweetpotato stakeholders together and we mobilized farmers in each county – Siaya, Busia, Kisumu, Homa Bay and Migori. We strategized to ensure that each county had a number of farmers. We were then hit by a dry spell, but because we had been working on sweetpotato for a long time, we lost in terms of root production but not on seed, so we were able to start producing when the rains came back. Strategic farmers who had used wetlands for production enabled us to sustain that particular market during the dry spell. The demand is still higher than the supply, so we are finding strategies to get more farmers into production. We work with other partners who do not work directly with CIP so that they can promote sweetpotato with the aim of supplying the processor continuously. Our challenge is meeting the demand that the private sector demands. We have to do more work to scale up root and vine production.

Questions from the audience

How much money did you make?

I did not make money as a person. I only mobilize farmers, and they are making the money. I unfortunately don't have the data on the money made and the consumption rates, but sweetpotato is highly consumed in Western Kenya.

What is the daily requirement of fresh roots for the puree processing factory at the moment? I understand that Tuskys has 54 branches and each requires 1 ton per day?

Tuskys is asking for 2 tons of puree per day, which translates to about 3 tons of roots per day. We are currently meeting only 10% of this demand. We set our targets at 500 kg per day, but the demand is so high that they would like us to scale up.

How many roots make up 1 ton of puree?

1.5kg of roots make 1 ton of puree.

I have heard that we cannot get enough vines to meet the demand of the producers. In a normal market, when demand goes up, prices also go up. Somehow, these market dynamics seem not to be working. How much are we meddling with market prices?

The market is working. In the case of Rwanda, the OFSP roots are double the price of other roots because of the demand. Demand has to be built through communication, you have to push the material, and process. Because of the nature of the crop, and because of dry spells, sometimes it is difficult to meet this demand.

9.2.4 SUSTAIN Rwanda: Sindi Kirimi and Jean Ndirigwe

Kirimi: Please introduce yourself.

Jean: I am Jean Ndirigwe. I am a sweetpotato breeder with Rwanda Agricultural Board (RAB).

Kirimi: What role do you think RAB can play in ensuring sustainable scale up of OFSP?

Jean: RAB has two mandates: research in agriculture and livestock and extension services. We produce pre-basic and basic seed. We produce basic seed for commercial purposes to meet the demand and provide technical support and do participatory evaluation (PVS). Sweetpotato is not a priority crop but it is important for end users.

Do you think the DVM model is sustainable?

RAB alone cannot sustain demand, so we have to work with private sector to meet this demand at the local level.

Can you describe the partnership between CIP and RAB and whether it has helped the private sector grow?

Clean planting material is coming through RAB's partnership with CIP. We are receiving capacity building in many aspects. I am responsible for both potato and sweetpotato, and we are appreciative of the support that we receive from CIP for the sweetpotato activities.

How can we ensure that the quality of seed provided to farmers continues to improve?

Together with CIP we are able to advocate for the improvement of the position of sweetpotato as a crop in the country. RAB has joined hands with CIP and other partners to avail planting material to the farmers. But after

that, we have to ensure that there is access to the market. We also have to address the challenges through the research.

Are you seeing the development of commercial vine market in Rwanda?

Yes, we have zero grazing initiative for vines in Rwanda, where people know they can produce vines for animal feed. There is also a market for vines, based on the awareness created among farmers; they know they will double their yields through the use of clean planting material.

In Rwanda, because of the market chain we have crated, the root market is high, OFSP is twice the price of white-fleshed sweetpotato. The roots are demanded by restaurants and bakeries. Vine demand is increasing for NGOs as well. We are following two strategies at the moment. The first is that RAB has the mandate to inspect and ensure that the quality is good. It has not been rolled out yet. We are using the Quality Assured Planting Material. We have started a system of labelling for all the varieties with the grower information and some characteristics. We hope that if there are problems with that material, then one can avoid it. Eventually, we will move to QPDM. But sustainability will be ensured when people decide only to buy from those with quality material.

- If you plant quality vines, you double your yield. That is the best argument that a farmer could have for using clean planting material. We all could make a better case if we used this argument – Craig Yencho

10 SESSION EIGHT: TECHNOLOGY DISSEMINATION TARGETING IMPROVED SEED SYSTEMS AND DIET QUALITY

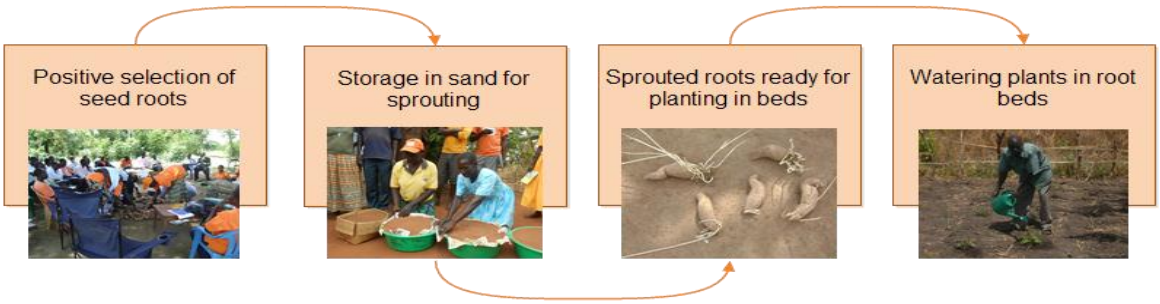
10.1 Experiences in implementing Triple S method in Uganda: Emerging issues and implications to seed systems research

Namanda S., Mwanga R., Kyalo G., Low J., Ball A., Magezi S., Musoke C., & Ssemakula G.

It is estimated that 53% of 904,931 total households in northern Uganda experience serious food shortage during the months of April to July every year. Although many would prefer planting sweetpotato, they fail because of lack of planting material. Because majority cannot afford the cost of planting because vines desiccated during dry period, food reserves are exhausted during off-season and planting material is costly at the on-set of rains.

Triple S (*see Fig. 39*) is a potential alternative. Instead of farmers struggling to keep vines alive during the prolonged dry season, small or medium but healthy roots are stored in dry, cool sand in a container for sprouting. Sprouted roots are then planted in minimally irrigated root beds to conserve and multiply planting material.

Fig. 39: Key Triple S technology protocols, Uganda



10.1.1 Implementation approach

1,506 beneficiaries from six districts were identified and sensitized. A total of 18 Triple S cadres (Community Resource Persons) of implementing partners (World Vision and local Government) were trained on root selection for storage and how to store roots. They received a leaflet on Triple S methods for reference. Participatory Triple S method demonstrations were conducted to validate the technology and participatory progress reviews conducted and suggested modifications discussed.

Table 14: Average number of vines/seed-root and heaps planted

Cost of vines in Gulu at the beginning of first season		
Bundle unit	# of cuttings	Unit price (UGX)
1	83	500
2	50	500
3	35	500
4	65	500
5	80	500
6	62	500
7	75	500
8	60	500
9	80	500
10	60	500
Average	65	500

66 roots were saved and planted 0.6 acres (0.24 Ha) or 2,400 heaps planted x 3 cuttings, amounting to at a total of 7,200 cuttings (about 110 cuttings per root). This enabled early and staggered planting and provided clean planting material.

10.1.2 Questions and answers

What are the opportunities for commercializing Triple S?

It depends on the level of commercialization. There are some farmers who work as a group; they identified possible areas where they could multiply the vines. We undertook demonstration at group level. Those who have the potential are commercializing. This season, they have been a source of planting material to HarvestPlus and individuals have bought material from them. Triple S depends on availability of water, and we have to plan around that. We have Triple S guidelines to aid in adoption of the technology. We made trials from storing in basins to sacks so that we could store more roots. The roots were unfortunately stolen. Moving forward, we realize that people value the roots and so they can be commercialized.

Where are the advantages of Triple S? What is the role of the sand and why can't the roots just be stored in a cool, dry and dark place and have the same results?

We tried different media for storage, including addition of chemicals, sand was found to be the best media. Around the household, there are many rats. In the basin, they cannot reach the roots because of the sand. If the roots are succulent, they release a lot of water. The sand has to be dry and we wrap paper around the containers to absorb any residual moisture in the soil. Sand has temperature insulation and allows for air circulation so that when the roots start sprouting, they get aeration that enables them to grow. Until we come up with low-cost technology to cool the roots and prevent sprouting, Triple S continues to be the most appropriate technology that we have.

10.2 Integrating OFSP as part of Enhanced Homestead Food Production

Mette Kinoti


Helen Keller International was founded 100 year ago. The founder got sick at nine months and resulted in her becoming blind and deaf. That disability did not stop her from fulfilling her dreams. She learnt how to speak and got a Master's degree, and dedicated her life to fighting for justice and human rights. HKI was established to fight against blindness and vision impairment 100 years ago. In the 1970s, a study on Vitamin A deficiency resulted in HKI's focus on dealing with Vitamin A and nutrition and health. One of the things that Helen Keller was famous for was quotes: **Alone we can do so little, together we can do so much.**

10.2.1 Enhanced homestead food production approach

OFSP marketing in the market does not result in increased nutritional status. In Burkina Faso, HKI started with production through vegetables, crops and fruits, and that went well. However, when HKI started talking about nutrition, there was no improvement in nutrition status. Now the approach is to begin with nutrition education, and to ensure that the message has been understood before going into production. Through increased awareness, the beneficiaries increase the uptake of produced foodstuff.

The ultimate goal is to improve the nutritional status of children under 5 years of age, women in their reproductive age, breastfeeding and pregnant women. Through agriculture for nutrition interventions, HKI focuses on women and children, by selecting women as primary beneficiaries through gender mainstreaming.

10.2.2 OFSP and other micronutrient-rich foods

Different foods have different nutrient and micronutrient contents as can be seen in the table below. Additionally research has shown that in animal source foods the micronutrients are more bio-available, meaning that the nutrients are more easily absorbed by the human digestive system.

Table 15: Nutrient contents based on 100 g of food (raw), RDA/AI based on daily needs of adult male

Foods	Calories (kcal)	Vit A (RAE)	Vit C (mg)	Folate (µg)	Iron (mg)	Zinc (mg)
Rice	365	0	0	8	0.8	1.09
OFSP	378	709	19.6	6	0.69	0.32
Liver (chicken)	119	4968	17.9	588	8.99	2.67
Spinach	23	469	28.1	194	2.71	0.53
Egg	143	540	0	47	1.75	1.29
Orange	49	12	48.5	39	0.09	0.06
Cowpea	336	50	1.5	633	8.27	3.37
RDA/AI	2000	900	90	400	8	11

Staple with high energy content (many calories)

≥20-50% RDA >50-80% RDA >80% RDA

HKI efforts

The OFSP delivery data (*Table 16*) excludes recently started projects that have not yet distributed OFSP vines, such as SPRING (USAID-funded) and AGRANDIS (Cargill funded) projects.

Direct beneficiaries are men and women who have received vines from HKI projects, while indirect beneficiaries include documented additional distribution to non-beneficiaries and their families (assuming family size of seven members).

Excluding RAC initiatives, HKI has promoted OFSP by distributing more than a million OFSP vines to more than 12,000 direct beneficiaries and more than 104,000 indirect beneficiaries. This does not include secondary or tertiary distribution of vines from beneficiaries to neighbours etc. Unfortunately, very few projects have tried to document yields and total production of individual households at scale. The CHANGE project documents production at the village model farms and during monitoring of individual households, this data will become available by the end of this year (December 2015) for all four CHANGE countries.

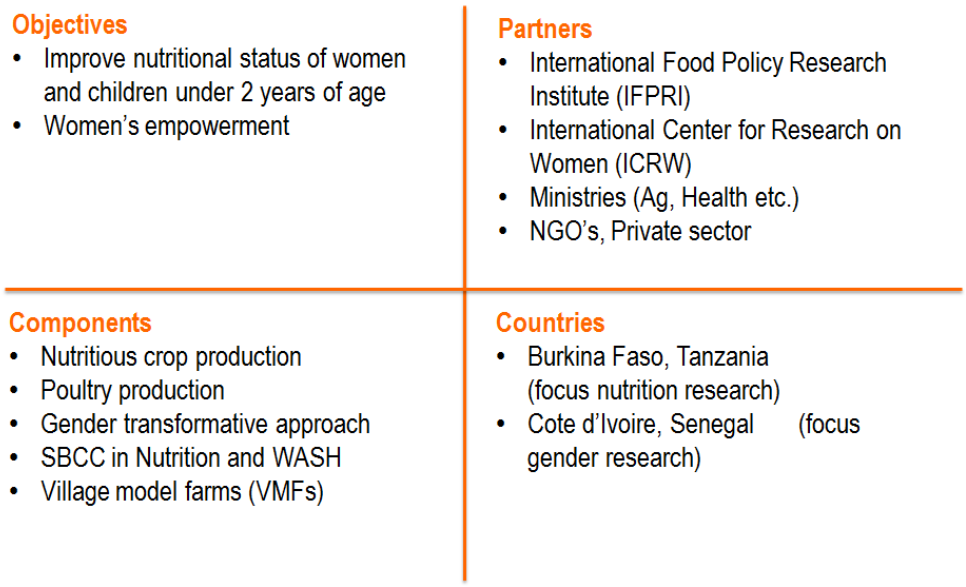
Table 16: HKI's efforts in OFSP delivery (accumulated figures, excluding RAC)

Country (Funding)	Since	Varieties promoted	Vines distributed	Direct beneficiaries	Indirect beneficiaries
Burkina Faso (McKnight, USAID, DFATD, Cargill)	2001	Jewel, caromex, Tiebile etc.	175,314	4,446	33,922
Mozambique (Irish Aid)	2012	Delfia, Melinda, Irene, Gloria, Linda	163,350	1,320	22,869
Côte d'Ivoire (DFATD)	2014	Kakamega, TIB, Bela-Bela	450,000	2,876	21,084
Tanzania (Irish Aid, DFATD)	2010	Jewel, Kabode, Ejumula	141,000	2,569	18,130
Nigeria (Gov. of Nigeria)	2014	Mothers' delight, King J	186,000	1,020	7,140
Senegal (DFATD)	2013	Kandee	820	130	1,330
Total			1,116,484	12,361	104,475

10.2.3 Creating Homestead Agriculture for Nutrition and Gender Equity (multi-country EHFP project)

As an example of an EHFP project, the CHANGE project is a multiple country project that aims to (i) improve nutritional status of women and children under 2 years of age; (ii) promote women's empowerment and (iii) collect evidence of the technical efficacy of the intervention on nutrition and women's empowerment (among others). The project promotes nutritious crop production all year round and animal production for income and home consumption.

Fig. 40: Overview of the CHANGE project



In Burkina Faso, more than 15 OFSP varieties (>15) were tested with farmers over long periods (between 2005 and 2012). There was a strong focus on scientific evaluation of yield and organoleptic properties (taste) of OFSP varieties. Vine production was promoted through village model farms, producers and schools. The yield averaged 7-12 t/ha, ~43 kg of OFSP per beneficiary. 11% of women consumed OFSP in last 24 hours (July 2015, 3-4 months from new harvest). There are strong indications that social and behaviour change communication is increasing consumption of OFSP and nutrient rich foods in general and there is a visible increase in women dietary diversity.

In Cote D'Ivoire, CHANGE is working with the national agriculture research institute to promote vine production. There is evidence that OFSP production has spread to the neighbouring villages. Productivity is at 15-25 t/ha at VMF level and over 50 kg per beneficiary per year. 42 VMFs are producing OFSP vines for re-distribution in 2015. 22% of women consumed OFSP in the last 24 hours (July 2015, 3 months before new OFSP is harvested) and gender work focuses on changing gender roles. Things are moving faster in Cote D'Ivoire, probably because there is a stronger component of marketing. The result is that a higher amount of OFSP is being consumed.

10.2.4 Successes, constraints and recommendations

Some of the successes that have been identified were:

- High productivity of OFSP, particularly in Cote d'Ivoire
- The combination of nutrition education, awareness raising about OFSP benefits and on-farm testing to encourage adoption
- Adoption in many areas is evident and vines are spreading well beyond targeted beneficiaries (even villages)

Some constraints are:

- Non-availability of land for women to cultivate OFSP (particularly in dry land areas, such as Burkina Faso)
- Late distribution of OFSP vines relative to the start of the rainy season, sometimes leading to crop failure (rain ends before roots swell up and mature)
- Livestock damage has been a serious problem in Cote d'Ivoire, Mozambique and Burkina Faso in general for vegetable production, but OFSP leaves are particularly attractive to livestock so damage is worse on this crop
- There has been a too little documentation of OFSP adoption by non-direct beneficiaries and the spread of OFSP to neighbouring villages. In addition, in areas where sweet potato is generally grown, the ratio of surface areas planted with white fleshed, to orange fleshed sweet potato needs to be measured as an indication of adoption of OFSP.

There should be more focus on local awareness raising (cooking demos etc.). In order to promote early start production, the project envisages investing more in irrigated vine production. Furthermore, it is recommended that documentation of the rates of adoption, yield, consumption and sale be improved.

10.2.5 Questions and answers

How did you get the number of indirect beneficiaries for 2014 and what is the definition of indirect beneficiaries?

The direct beneficiaries are the ones with whom we did interventions. Indirect beneficiaries are the ones that get the vines that are produced by the farmers that we worked with. The challenges faced are with regard to the indirect beneficiaries. We tend to monitor the direct beneficiaries more closely

You were working together with CIP and INERA. When you go through the direct and indirect beneficiaries, how can you distinguish between those reached by the different partners?

We have various partners and donors. There are risks of double counting, and this is an area where we have to work together to streamline how we measure.

Have you gone back to the communities to see if changed behaviour has changed adoption rates in the long-term?

This is something we would love to do but donors rarely fund that. The way we work, we go to new communities and look into new research areas, so we have not gone back to evaluate adoption rates.

10.3 With orange-fleshed sweetpotato in Rwanda, CRS and partners are improving the living conditions of vulnerable populations

Zacharie Manirarora

CRS was established in Rwanda in 1960. Since then, the organization has supported various initiatives aimed at improving food security and nutrition and reducing poverty among vulnerable Rwandans.

To achieve its objectives, CRS uses integrated approach combining interventions related to agriculture (using farmer field school approach and bio-intensive agriculture system); nutrition and sanitation (using Positive Deviance Health approach); and economic strengthening (using Saving and Internal Lending Communities approach-SILC). These combined interventions enable vulnerable people to have sustainable food security while increasing their resiliency to different shocks, including effects of HIV/AIDS, chronic malnutrition, poverty and other social challenges.

10.3.1 Achievements

Since 2008, CRS Rwanda has promoted OFSP through six different projects which supported 62,000 farmers. Currently CRS promotes OFSP in two districts (Karongi and Muhanga) through the project that provides support in reducing the stunting among children under two years of age, funded by the Dutch Government. In collaboration with Ministry of Agriculture/RAB Research Directorate, farmers are provided with seeds (vines) of OFSP. With partners, beneficiaries are educated through Village Nutrition Schools, a modified version of the PD/H approach, on how to prepare balanced diets using local foods, including OFSP rich in Vitamin A. Other highly nutritious crops such as beans rich in iron, maize rich in proteins, and vegetables are also promoted.

In collaboration with RAB, beneficiaries have been trained on processing technologies for incorporating OFSP into different products including doughnuts, cake and biscuits.

10.3.2 Success stories

Chantal Bonane from Kamonyi district participated in food processing trainings in 2013. Putting these new skills to practice, she obtained a contract of 80,000 RwF per month with a mining corporation in her area to prepare tea breaks with OFSP doughnuts, soy milk tea and juice for its employees. For a fee of 1,200 RwF per session, she provided food processing lessons upon request to interested members of her community.

Fortunée Mukaberwa from Nyagatare district became a vendor of doughnuts processed from OFSP and generated income that allowed her to buy eight rice plots which produce 200 kilos of rice per harvest. She has been paid 100,000 RwF by a local NGO to conduct a two-day food processing training for its volunteers.

10.3.3 Conclusion

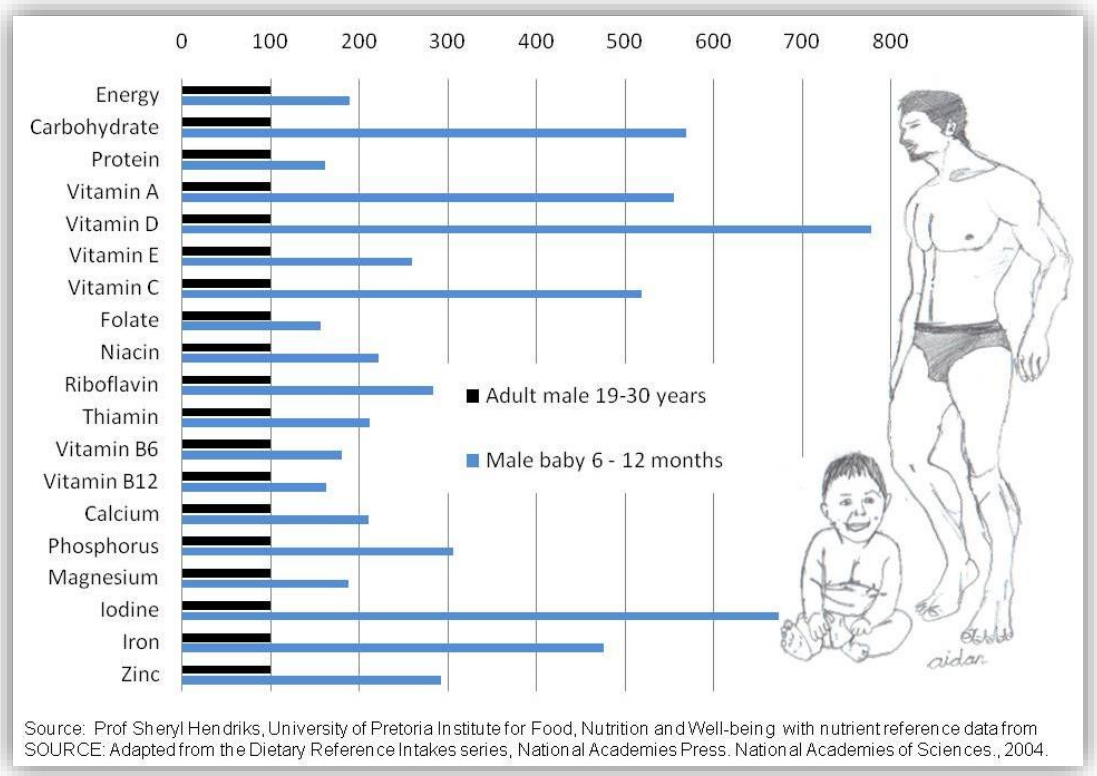
The promotion of OFSP in the community, in combination with bio-intensive agricultural support, nutrition education and economic strengthening interventions, has shown a positive effect on the living conditions of vulnerable populations in enhancing access to highly nutritious food and to the improvement of nutrition status. Some beneficiaries have been able to increase household income from OFSP-processed products.

10.4 Half of the "1,000 Days" depends on the Mother's Health

Katherine Dennison

A baby, who is one third the size of a grown man, needs so much more nutrients per kilogram of body weight (Fig 41).

Fig. 41: Comparative proportional nutrient requirement per unit body mass

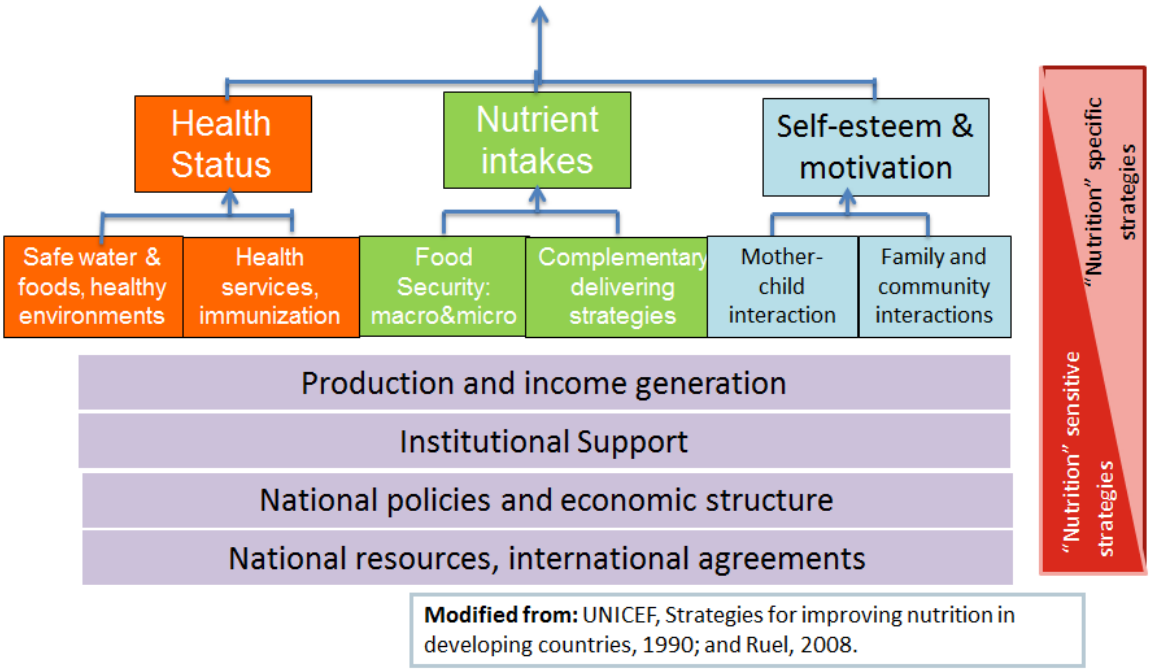


Source: Prof Sheryl Hendriks, University of Pretoria Institute for Food, Nutrition and Well-being with nutrient reference data from SOURCE: Adapted from the Dietary Reference Intakes series, National Academies Press. National Academies of Sciences., 2004.

Vitamin A is extremely critical. This is because when the foetus starts to develop, the gut is not yet developed. In case of diarrhoea or other infection such as parasites, the child will not be able to absorb nutrients and will also be immune-compromised and likely to get other infections.

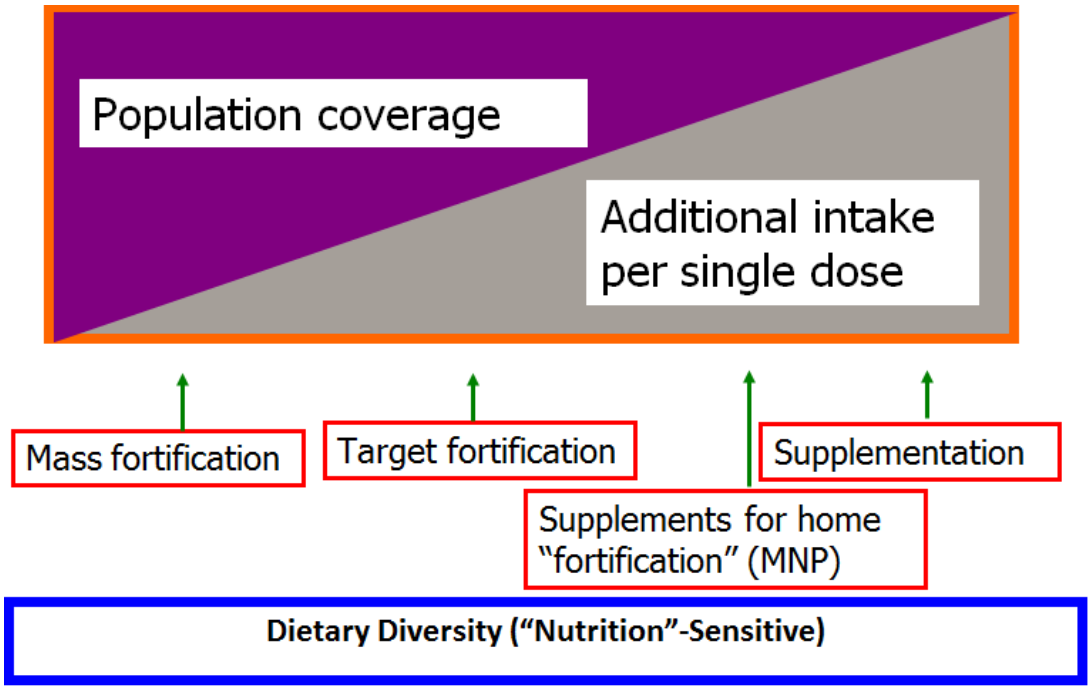
Stunting is the process in which the body cannot grow beyond a certain stature because it does not receive adequate nutrients. It is a survival mechanism in which the body is able to exist on the little there is to eat. This can be mitigated through mother's milk, which the baby's body recognizes easily. To break that cycle after two years, animal protein is also very important for the bone structure of the body.

Fig. 42: Causal determinants for physical, mental and social development



In nutrition interventions covering large populations, the approach commonly used is mass fortification. When this is not possible, supplementation in the form of pills are used. These are more expensive.

Fig. 43: Approaches to nutrition interventions



It is hard to change people's behaviour when it comes to diet, because food forms part of the tradition and value system. It is not easy for people to add new foods into their diet because they may not like the taste or may not know how to cook it.

10.4.1 Questions and answers

Are we thinking of possible fortification of OFSP products?

This includes biofortification. The thing with fortification is that there usually is a vehicle, e.g. oil, flour, sugar etc. I would not recommend over-processing of foods and adding the nutrients. The more natural the food, the better it is.

You mentioned that it is hard to change behaviour, but people have changed their diet. How do we market quality food more sufficiently and which age group would be most appropriate to get behaviour change?

The biggest impact is with the youth. As we get older, we become set in our ways. Younger people are more willing to try new things; they also want to have fun and like things that are catchy and enable them to interact socially. However, parents determine what goes on the table, and this makes it slightly challenging to influence a change in behaviour within this younger target group.

11 SPHI Poster Competition

A poster competition was held as part of the SPHI Annual Meeting. There were 23 posters entered into the competition across a range of science and research topics.

The posters were on display during the SPHI meeting. On September 29 2015, official judging was conducted over 1 hour. The first round of judging saw each poster author provide a 3- minute oral presentation about the poster to a panel of three judges. Six finalists were announced and a second round of judging was held including a 3-minute oral presentation from each author.

The judges were: Adiel Mbabu, Marc Ghislain, Andrew Westby, Francis Mwatuni and Hans Adu Dapaah.

The following prizes were awarded:

- 1st Prize: Penina Muoki SUSTAIN Kenya Baseline Survey: Preliminary Findings and Implications for Effective Implementation
- 2nd Prize: Mihiretu Cherinet: Sweetpotato grafting: New approach of vine conservation in dry areas
- 3rd Prize: Jan Kreuze: Improving Sweetpotato Virus Diagnostics
- 4th Prize: Mihiretu Cherinet: From seed security to food security: validating 'Triple S' seed conservation technology in new contexts

The winners were announced during the closing ceremony of the SPHI I Love Sweetpotato Exhibition.

12 Exhibition report

The 'I Love Sweetpotato' exhibition was held on 1 October 2015 at Hotel Villa Portofino in Kigali, Rwanda as part of the week long 6th Annual Sweetpotato for Profit and Health Initiative meeting led by the International Potato Center. It was a public event where 29 exhibitors (Table 17) displayed their work on orange-fleshed sweetpotato. The event included prominent guest speakers, entertainment including a Rwandan dance troupe as well as official I Love Sweetpotato booth competition.

Table 17. Organizations/Projects with Booths at the I Love Sweetpotato Exhibition 2015

◉ Harvest Plus	◉ RTB Endure
◉ Farm Concern	◉ VISTA Sweetpotato activities in Tanzania
◉ Catholic Relief Services	◉ One Acre Fund
◉ NRI (not included in competition)	◉ Integrating Orange in Zambia
◉ North Carolina State University	◉ Sweetpotato in Ethiopia
◉ Scientific Lab Services	◉ Orange fleshed sweetpotato in Nigeria

◉ Quality Seed, Happy Farmers ◉ Going Orange with Sweetpotato in Malawi ◉ Orange fleshed sweetpotato made in Mozambique ◉ Nutrition & Food Security ◉ Orange fleshed sweetpotato in Kenya: A Healthy Diet ◉ My orange sweetpotato: my health, my wealth (Rwanda) ◉ Rwanda Agricultural Board ◉ SINA Gerard ◉ IMBARAGA Farmers Group ◉ YWCA	◉ Sweetpotato Partnerships - Ghana & Burkina Faso ◉ Celebrating CIP & RTB ◉ Euro Ingredients ◉ Reaching Agents of Change ◉ I Love Sweetpotato Video ◉ SASHA Phase 2 ◉ SPHI

An advertisement was included in the local newspaper http://www.newtimes.co.rw/ in the 10 days leading up to the event. A radio ad was played during the three days leading up to the event and the exhibition was also advertised on social media before and after the event. Unfortunately, this did not result in a large public turnout, most likely due to the location not being in a very well-known public venue.

The exhibition was officially opened by the Research Director for RAB, Dr. Patrick Karangwa on behalf of RAB's Director General and the Director General of CIP, Dr. Barbara Wells. The event was closed by a special guest, the Director of the FARA and new SPHI co-leader, Yemi Akinbamijo. The Master of Ceremonies for the event was Robert Ackiatah-Armah from CIP Rwanda. All booths taking part in the exhibition were automatically entered into the SPHI Booth Competition. The judging panel for the competition included representatives from the donor community and from the SPHI steering committee. The judging took place between 9am and 11am just prior to the official opening of the event at 11am on October 1.

Each booth coordinator(s) was asked to prepare a 5 minute presentation about their booth and the country/project they represented to share with the judges. Each booth was evaluated by two different judges. A judge was not able to evaluate a booth which they were linked to by organization. The SPHI, Sweetpotato Video and SASHA booths were not included in the official competition.

Judges:

- Katherine Dennison (USAID)
- Hans Adu-Dapaah
- Stanley Mwangi
- Jim Lorenzen (BMGF)
- Barbara Wells (CIP)
- Anna-Marie Ball
- Lauren Good (BMGF)
- Christiane Gebhardt
- Ibok Oduro

Winning booths:

- 1st prize – US$150 CIP in Ethiopia
- 2nd prize – US$100 CIP in Rwanda
- 3rd prize – US$75 IMBARAGA

A selection of photographs from the exhibition can be viewed and downloaded from the following link: https://www.flickr.com/photos/106872707@N03/collections/72157659611981216/

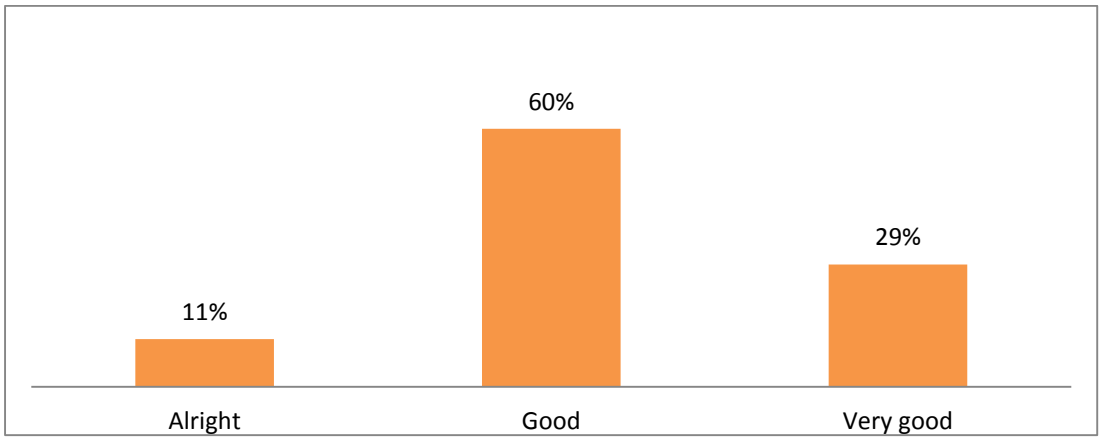
13 MEETING EVALUATION

The 2015 SPHI annual meeting participants were requested to fill out a questionnaire to evaluate the organization, components and content of the meeting. 70 participants responded. These participants range from 22 to 55 years of age, with the average participant age being 37. The breakdown is as follows: More than 50 years – 14%; 40 to 50 years – 32%; 30 to 40 years – 29%; and below 30 years – 15%. 66% were female and 34% were male.

13.1 Content

Participants liked the contents of different presentations. About sixty percent of the participants felt that the contents of the presentation were "good", about 10% felt the contents were "alright", and about 30% rate the contents as "very good".

Fig. 44: Rating of presentations in terms of contents



Source: Evaluation of SPHI meeting, 2015 Kigali, Rwanda, response from 63 participants

Presentations: In terms of the topics, about 20% indicated that commercial sweetpotato production and marketing session was the most useful part of the meeting. This figure was driven by the popular presentation on commercial sweetpotato production in South Africa. The other preferred sessions were value chain findings from different countries. Delivering OFSP (18%); good nutrition and using drones to measure area coverage under the sweetpotato attracts (17%). Participants were also requested to state the part of the meeting that they felt was least useful and that would require improvement in future. More than one-fourth of the participants indicated the panel discussion by SUSTAIN, under title "Going-to-scale" as the least important part of the meeting. This result is also reflected in positive question of the "most useful part of the meeting" where only 5% of the participants indicated the session as useful. A review of this session will be necessary to determine how it can be improved.

Panel discussions: About half of the participants felt that the panel discussion concerning Community of Practice groups was good (47%), 17% felt that it was very good, 30% felt that it was alright and only 3% rated it as poor. In spite of ranking the SUSTAIN Going-to-scale panel as least useful, many participants ranked it well. The panel ranked as very good (about 10%), good (45%), alright (30%) and poor (13%).

Skit on sweetpotato abuse: One of the conference events that attracted the attention of the participants was the stage performance. Most of the respondents rated it either as very good (40%), good (38%) or alright (22%).

Exhibition: Based on the response from the 38% participants involved in the opinion surveyed, more than 85% took part in a booth exhibition, which was held on the 1 October 2015. 39% felt that the content and quality of the exhibition was good, while 61% of the participants felt that it was very good. These respondents also made suggestions for improving the exhibition. About one third of the participants strongly suggested improving the participation by the public in order to increase the awareness creation on sweetpotato. Some of the participants suggested organizing the exhibition in an open space, especially on weekends so that many people can have access to the information displayed in the booths. The following booths emerged as the favourites among exhibition participants: CIP Mozambique (35%); My Health My Wealth (19%) and Ethiopia (10%). The winning booth selected by the judges was Ethiopia.

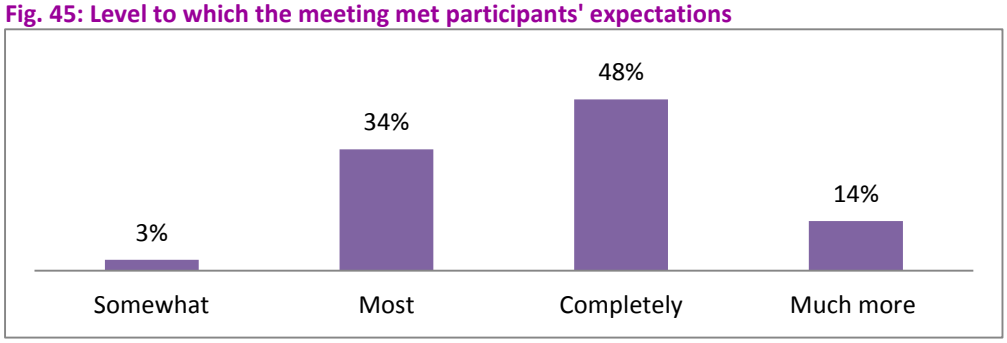
Field trip to view the drone demonstration: Only 20% of the conference participants visited the drone field trip. Out of these participants, 43% rated the quality and importance of the field trip as very good, 29% thought it was good, 21% said it was alright and 7% felt it was poor. The team had challenges in getting transport to and from the demonstration site to stay on time.

Sweet potato knowledge portal training: About 45% of the participants took part in Sweetpotato Knowledge Portal training, which was conducted on 28 September 2015, one day before the main meeting. About half of the participants missed this training due to the flight arrangement or other reasons. Among those who participated 40% thought it was good, and another 40% thought it was very good. The remaining 20% thought it was alright.

13.2 Level to which the meeting met participants' expectations

More than 95% of the participants replied that the meeting had met their expectations to a certain extent (see figure below). These results are higher than that of last year's similar meeting where respondent indicated that the meeting matched (51%) or exceeded (21%) their expectations.

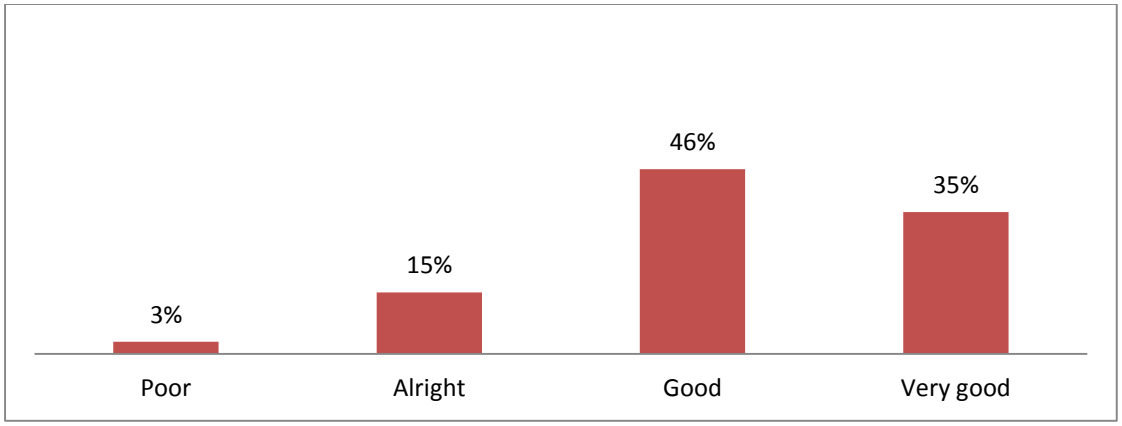
Fig. 45: Level to which the meeting met participants' expectations



13.3 Meeting organization and recommendations for improvement

Logistic arrangement, hotel, flight and organization over all were considered poor (3%), alright (15%) good (46%) and very good (35%). Which is comparably below than last years were, the organization was rated very good (51%) or good (44%), with 5% considering them just alright. The major issue was the use of a spillover hotel, which complicated logistics. Also, the Rwandan CIP administrative team has much less experience managing a major meeting than the Nairobi team does.

Fig. 46: Rating of the meeting in terms of organization



Source: Evaluation of SPHI meeting, 2015 Kigali, Rwanda, response from 65 participants

26%, of the participants complained about the sound system in the meeting hall, and recommended improvement in the future. A little above 10% of the participants suggested increasing time for discussion and indicated the meeting was too loaded and congested. They suggested allocating enough time by reducing the number of presentations on similar topics. Reducing the number of presentations and getting feedback on submitted abstracts each suggested by 6%.

14 ANNEXES

14.1 SPHI Poster Competition Entrants

1. Benjamin Rakotoarisoa: Nutritious sweetpotato for Niassa - 2013–15 Progress in 8 Districts
2. Benjamin Kivuva: Screening cold tolerant dual purpose sweetpotato in Kenya
3. Bramwel Wanjala: Ensuring safe international exchange of sweetpotato accessories and germplasm management
4. Eliah Munda: Influence of nitrogen fertilizer on yield and nutritional quality of 15 released OFSP varieties in Mozambique
5. Erna Abidin: Sand Storage – An innovation to extend the shelf life of fresh sweetpotato for home consumption and market sales
6. Frank Ojwang: Sweetpotato sensory evaluation
7. Haile Tesfay: The impact of school nutritional campaigns on OFSP adoption and food security among smallholder farming households in Tigray region, Ethiopia
8. Haile Tesfay: A food based approach to reduce Vitamin A deficiency in Southern Ethiopia: A cross sectional study of maternal nutrition and health indicators
9. Jude Njoku: Growth and yield responses of OFSP varieties to propagules sources in rainforest and savannah zones of Nigeria
10. Justus Lotade: Jumpstarting OFSP in school menus: Intricacies of a single market and indications of a baseline study
11. Mihiretu Cherinet: Sweetpotato grafting: New approach of vine conservation in dry areas
12. Penina Muoki & Julius Okello: Does information on biofortification influence consumption of OFSP
13. Temesgen Bocher: Consumers preferences and willingness to pay for sweetpotato juice in Rwanda: Does the nutritional information matter?
14. Kwame Ogero: Can farmer multipliers meet QDS standards
15. Jan Kreuze: Improving Sweetpotato Virus Diagnostics
16. Mihiretu Cherinet: Validating use of affordable net tunnels for prolonged maintenance of virus clean planting material in Ethiopia
17. Sam Namanda: Triple S method: assuring availability of sweetpotato planting material in Northern Uganda
18. Mihiretu Cherinet: From seed security to food security: validating 'Triple S' seed conservation technology in new contexts
19. Kwame Ogero: Sustainable uptake of insect proof net tunnels among farmer multipliers: What do we need to consider
20. Margaret McEwan: Tackling the pre-basic seed system
21. Penina Muoki: SUSTAIN Kenya Baseline Survey: Preliminary findings and implications for effective implementation
22. Sarah Mayanja: Performance of orange fleshed sweetpotato chain in Mukono District, Uganda

14.2 Welcome remarks on behalf of the the Minister of Agriculture and Animal Resources, Dr. Geraldine Mukeshimana

Remarks made by Dr. Louis Butare, Director of the Rwanda Agricultural Board

May I warmly welcome all participants to the 6th Annual Sweetpotato for Profit and Health Initiative Technical Meeting. I understand that there 100 scientists and practitioners will be participating in this regional event. It is truly regional, with attendees working in 4 countries in West Africa, 5 countries in East Africa, and 5 countries in Southern Africa, plus participants traveling from the United States, England, Germany, and Peru.

You all have come to beautiful *Land of 1000 Hills* and I can assure you that on any hill that is not in a protected national park, sweetpotato is being grown. Sweetpotato has long been a critical food security crop in our country. Our 2014 national survey found that in terms of production sweetpotato is number one in Rwanda – over 941,000 metric tons produced or 88 kgs per capita. Given our high population density—472 persons per square kilometer, the fact that sweetpotato provides high energy output per unit area is its true strength and the reason it is so critical to our food security.

But our farmers do complain about lack of markets for their sweetpotato roots. After all, if most are growing their own, who is there to buy? Right now, only 19% of Rwanda's population lives in urban areas and urban dwellers tend to eat more foods like bread instead of sweetpotato because of their convenience. Here in Rwanda, we are pleased to be at the forefront of working with the International Potato Center and other non-governmental organizations in developing new diversified uses for sweetpotato. Over the past five years, the Rwanda Agricultural Board, which is tasked with both research and development mandates, has been collaborating with partners in the development and the private sector to develop sweetpotato processed product value chains. This has required investment in human and financial resources all along the chain. First, appropriate varieties had to be available. With support from the Alliance for a Green Revolution in Africa, RAB released 5 varieties in 2008 and 7 new sweetpotato varieties in 2013. Ten of these varieties were bred by Rwandan scientists and are very well adapted to Rwandan conditions.

Second, we had to get our seed system upgraded and moving. Sweetpotato is grown year-round in Rwanda and as a consequence virus build-up over time truly lowers yields. At our Rubona station, a major investment has been made in modern tissue culture facilities. With support from the Sweetpotato Action for Security and Health in Africa project, our tissue culture lab produces over 4,000 disease-free plants per month and screen houses have been constructed for assuring the supply of quality pre-basic seed to be provided to vine multipliers located and trained in target districts. When farmers access this quality seed, yields increase 50-200% in their fields.

Third, our RAB food scientists collaborated with food technologists from Euro Ingredients Limited and Urwibutso Enterprises to develop sweetpotato processed products, such as biscuits, bread, and doughnuts that are popular with consumers and cost the private sector operator less money to make than the 100% wheat flour product.

And finally, under the umbrella of the Rwanda Super Foods project, the commercially viable Golden Power Biscuit was developed and sold by Urwibutso Enterprises, a first for sub-Saharan Africa.

While sweetpotato is a fundamental source of energy and micronutrients, beans are the meat of the Rwandan countryside. Rwanda is strong supporter of the Scaling Up Nutrition movement and is committed to improving the quality of the diet of its citizens. It recognizes the potential contribution of biofortified crops, like iron rich beans and pro-vitamin A rich, orange-fleshed sweetpotato to address iron and vitamin A deficiencies, respectively. Given that these two crops are widely grown in Rwanda, the potential for positive impact on human health is enormous. Rwanda hosted the 2nd Global Biofortification Conference with over 300

participants in April 2014. It is a signatory to the Kigali Declaration that emerged from that conference that commits the country to invest in the development and promotion of biofortified crops. Promotion of biofortified crops in now a part of our recently approved Food and Nutrition Policy.

I understand that the Sweetpotato for Profit and Health Initiative has an ambitious goal of reaching 10 million households with improved sweetpotato varieties and their diversified use by 2020 in 17 sub-Saharan African countries, including Rwanda. With the end of the first phase, which was to prove the potential, the steering committee for the SPHI has been reorganized because in this current phase the goal is to achieve the potential. So far, nine organizations represented here today and 5 donors have joined hands to commit to this vision. At the present time, slightly over 2 million households have been reached and so there are 8 million to go. I have no doubt that this kind of broad coalition can achieve this ambitious goal with such a resilient crop that can simultaneously contribute to improving diet quality while enhancing food security in this time of increasing unpredictability of our climate. I hope that many of you will be able to take home valuable lessons learned from our experience to date in Rwanda.

With these words, I officially open the 6th Annual Sweetpotato for Profit and Health Initiative Technical Meeting and wish you the best during your deliberations. A warm welcome once again to Rwanda.

14.3 Speech by Barbara Wells - Director General of CIP

Welcome to the 6th Annual Sweetpotato for Health Initiative Technical meeting. This is my second time to attend this meeting and it is my first visit to Rwanda. It is both a pleasure and an honor to join you here today in a country where CIP's two mandate crops sweetpotato and potato make critical contributions to food, nutrition and income security of so many people.

In 2009, SPHI was launched at the NaCRRI in Uganda, at which time we set the ambitious goal of improving the lives of 10 million African households in 17 Sub-Saharan African countries by 2020 through improved sweetpotato varieties and their diversified use.

The first five-year phase of SPHI focused on "Proving the Potential". During this phase, CIP and over 26 collaborating partners have focused on breeding adapted varieties and testing several different models for effectively delivering sweetpotato. One of those models, a value-chain model that links smallholder farmers to an agro-processing company, was undertaken here in Rwanda, the Rwanda SuperFoods project. The result of that work can be seen today in the exhibition booth of SINA Enterprises, where Golden Power Biscuits are on display and in the booths of YWCA, Imbaragga and CRS.

The second five-year phase of SPHI is focused on "Achieving the Potential" of orange-fleshed sweetpotato and reaching our goal of improving the lives of 10 million households. To date, while we have reached nearly 2 million households, we still have just over 8 million households left to reach over the next 4 years. This is a lofty yet achievable goal. We are all very optimistic that together we will meet this goal. We have adapted varieties of sweetpotato in place or in the pipeline for release in the next couple of years in most of our target countries and our seed systems, value chain and nutrition work is also progressing well. All these factors play a critical role.

We have a big task ahead, which is one reason why we are very pleased today to announce our new SPHI Steering Committee for the second Phase. It consists of organizations that see themselves as part of the "coalition of the willing" as Jan Low likes to say. Those who are committed to going to scale with improved varieties of sweetpotato to make a difference to people's lives. We are very pleased that the Forum for Agriculture Research for Africa has agreed to co-lead this initiative alongside CIP. This will strengthen the

initiative's regional profile and will help promote the crop's profile at the country level. In addition, other members of the Steering Committee include HarvestPlus, The Natural Resources Institute, Farm Concern International, Helen Keller International, PATH, North Carolina State University, the Roots, Tubers, and Banana Research program of CGIAR lead by CIP, Irish Aid, UK AID, USAID, and the Bill and Melinda Gates Foundation, all of whom are committed to orange-fleshed sweetpotato's impact on peoples' lives. This is an impressive group and we expect to see the number of organizations expand year over year as the impact of sweetpotato is making on peoples' lives becomes more visible to governments in the region.

No one organization can do this alone. It is not only going to take a village, it is going to take this coalition of committed practitioners and scientists to make it happen.

At CIP we have a special commitment to the development and promotion of disease-resistant orange-fleshed sweetpotato varieties that are very rich in pro-vitamin A. Rates of vitamin A deficiency are still very high in Sub-Saharan Africa, 48%, while research in Mozambique, Uganda and South Africa has clearly shown that by using an integrated approach of providing OFSP alongside effective nutrition education of both men and women caring for children, vitamin A intakes increase substantially and the prevalence of Vitamin A deficiency is reduced.

From a CIP standpoint, one of our key strategic objectives is to reach 15 million households with OFSP by 2023 across not only Sub-Saharan Africa, but India, Bangladesh and Indonesia and Haiti as well.

When I addressed this audience last year in Kenya I was still relatively new to CIP. I was inspired by the enthusiasm and expertise of this group. Today I am even more inspired and motivated in knowing that we are in fact achieving our objective and making a collective difference.

As we all know, through our combined efforts we all will continue to see significant reductions in child blindness caused by Vitamin A deficiency and see that more and more mothers in Sub-Saharan Africa have enough sweetpotato to feed their families and sell to their neighbors and local processors. The 10 million figure is more than a number. It is the tipping point whereby sweetpotato is contributing to the profit and health of a food, nutrition and income secure Sub-Saharan Africa. This is the challenge that the new SPHI steering committee will be committed to and I commend each member for taking on such a noble challenge.

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And with that said, I now have the pleasure of awarding the prizes for the best exhibition booth. A panel of 9 judges evaluated all booths excluding the contest organizer's booth, the Mama SASHA project. The winners are

- 3rd prize – US$75 IMBARAGA
- 2nd prize – US$100 CIP in Rwanda
- 1st prize – US$150 CIP in Ethiopia

14.4 Speech Made on Behalf of the Director of the Rwanda Agricultural Board, Dr. Louis Butare

Made by Dr. Patrick Karangwa, RAB Research Director

The Rwanda Agricultural Board has as its general mission to develop agriculture and animal husbandry through reform and the use of modern methods in crop and animal production, research, agricultural extension, and education and training of farmers in new technologies. So, today, I am very pleased to be at the I Love Sweetpotato (*Nkunda Ibijumba*) Exhibition, because this captures how we want to modernize sweetpotato production in this country. Sweetpotato is a critical food security crop in Rwanda. But we can upgrade how we utilize sweetpotato in this country. RAB is collaborating with the International Potato Center and many NGO partners to:

1) Promote the use of biofortified orange-fleshed sweetpotato. RAB has released 4 OFSP varieties since 2008. These are full of pro-vitamin A and given the amount of consumption of sweetpotato in this country—88 kgs per capita annually— widespread adoption of OFSP would mean sustained access to an excellent source of vitamin A. Vitamin A is critical for strong immune systems and good eyesight. RAB envisions itself as a leader in this kind of nutrition-sensitive agricultural programs like biofortification. It also strongly supports the development and dissemination of iron rich beans. In addition, trials are underway for iron rich *Solanum* or Irish potato and we hope to be the first country to release an iron enriched potato variety. At the national level, the Ministry of Agriculture and Animal resources is a co-chair of the Food and Nutrition Steering Committee (SCF&NSC) under the Prime Minister's Office.

2) Promote the development of new markets for sweetpotatoes. Sweetpotato can be produced throughout Rwanda but farmers complain about lack of markets. We are excited that Rwanda is the first country to have a commercial OFSP biscuit—the Golden Power Biscuit that is on display here by Urwibutso Enterprises. Substituting a significant percentage of wheat flour for baking, much of which we have to import, with orange-fleshed sweetpotato puree, which we can produce locally is a win-win for farmers, processors, and policy makers seeking to save foreign exchange.

3) Improve the yields of sweetpotato through investing in modern tissue culture labs, pre-basic production systems at our stations, and getting improved seed system management technologies to farmers. Our modern tissue culture lab at Rubona produces over 4,000 disease-free tissue culture plantlets per month. After multiplying in a protected screen house, these quality cuttings are supplied to vine multipliers who have been trained on how to use *net tunnels* to keep a stock of quality planting material protected against insects carrying yield lowering viruses. Yields increase 50-200% when quality cuttings are used, enabling smallholder farmers to maximize the use of their land and producing enough sweetpotato roots that there is some to sell.

We also recognize that Rwanda is a country that loves cattle. We are committed to making our dairy industry grow. Protein-rich sweetpotato vines are an excellent supplementary feed to increase milk output. And dual purpose sweetpotato varieties, that produce good quantities of vines and roots at harvest time is something we also breed for. Since 2008, RAB has released 7 additional non-orange fleshed sweetpotato varieties, most of which can be used for food and feed.

Rwanda has shown its strong commitment to the CAADP objective of sustained investment in agriculture, having surpassed the 10% CAADP requirement for public spending during the last seven years, except for 2007 when it dropped slightly to 9%. Rwanda joined the *Scaling Up Nutrition* movement in December 2011 that now has 55 participating countries worldwide. We recognize in particular that healthy children are critical for our future economic growth and well-being. Our Ministry of Health is strongly committed to reducing chronic malnutrition or stunting among children under five years of age in this country from the high of 44% in 2012 to 24.5 percent in 2018. I am happy to report that we are well on our way. The recent Demographic Health Survey of 2014-2015 found stunting has already dropped to 38%. But we are not complacent—stunting in

rural areas is much higher, 41%, than stunting in urban areas—24%. We see the use of OFSP as an entry point for working with rural mothers and fathers to diversify their diets and learn better young child feeding practices. This we believe will also contribute to increasing the minimum acceptable diet for children aged 6-23 months. Efforts are underway to fully integrate OFSP into our vegetable garden programs and community level nutrition education efforts.

I should also note that at the 2nd Global Biofortification conference, hosted here in Kigali in 2014 and attended by 300 participants from around the global, the Rwandan government made a strong commitment to investing in biofortification and it is living up to the commitment.

So now you understand why at RAB, we love sweetpotato. We welcome the delegates traveling from 16 countries as well my fellow Rwandans to enjoy learning about advances in sweetpotato science and delivery here at the *I Love Sweetpotato (Nkunda ibijumba)* exhibition today.

14.5 Statement of Executive Director, FARA - Dr Yemi Akinbamijo

Protocols

It is a great honour and privilege for me (and FARA) to co-Preside over the present SC Meeting of the SPHI. I am here today in my joint role as the Executive Director for the Forum for Agricultural Research for Africa or FARA and as one of the co-leaders of the Sweetpotato for Profit and Health Initiative or as it is sometimes referred to as the SPHI.

FARA as the name suggests, is a continental forum of all stakeholders with interest in Africa's agricultural research for development (AR4D) serving as an agenda-setting organization rallying stakeholders around a common vision for Africa's agricultural transformation, and mobilizing stakeholders to respond to the Comprehensive Africa Agricultural Development Program (CAADP), STISA, Post Malabo IS&R and the Science Agenda for Agriculture in Africa (S3A). FARA serves as a knowledge repository and observatory in the area of agricultural research for development.

FARA seeks to forge and promote alliances, collaborations, and partnership with African and international stakeholders to mobilize capacity for implementation of agreed actions and commitments based on innovation systems paradigm as the organizing principle. The SPHI is an example of such an alliance. The SPHI is promoting the building of an effective community of practice at country, sub-regional and even regional levels.

FARA has long recognized the potential of biofortification to address the serious problem of micronutrient malnutrition, or *hidden hunger.* As part of its broader strategy to support how to upscale technology use through innovation platforms, orange-fleshed sweetpotato seed system and marketing chains were supported by the Dissemination of New Agricultural Technologies in Africa (DONATA) project FARA obtained financing for. The successful experiences from that project which ran from July 2008 through December 2014 have been published in several books in addition to living proofs and testimonies of improved livelihoods.

FARA recognizes the strong contribution that agriculture can potentially make to enhanced nutrition. Under the revised African Regional Nutrition Strategy (ARNS, 2015-2025), FARA is already supporting His Majesty King Letsie III of Lesotho in his role as the African Union Nutrition Champion by facilitating the development of advocacy instruments.

Over the next few years, FARA intends to lead regional policy engagement and advocacy on biofortification and has been working with partners to raise funds to establish a regional advocacy platform on biofortification - an African Biofortification Forum (ABF). We see our role as helping to convince national governments to create the enabling environment for biofortification to flourish, including committing funds for research and dissemination efforts.

FARA's role as co-leader of the SPHI naturally aligns with what FARA already does. The pathways, networks, mandate and legitimacy bestowed on FARA makes upscaling of promising technologies a routine. FARA has great interest in promoting diversified cropping strategies and a diversified diet. In this context, we see the Sweetpotato as a resilient crop in the face of climate change. It also recognizes its potential as an agro-

industry crop with the ability to be transformed into various processed products with good commercial potential as demonstrated here today.

Just coming from the 1st African Agribusiness Incubators Network Conference, it is clear that we have no business going hungry on this continent. Mainstreaming agribusiness elements and incubator start-ups for initiatives of the SPHI as we have it today, changes the dynamics of youth unemployment, wealth creation and food and nutrition security.

Finally, I am aware that we all understand that there is a hungry world waiting for the decisions to be reached by the SPHI Steering Committee. Such is the gravity of the responsibility vested on us. It is my hope and aspiration that we will be a force to be reckoned with. Make yourself heard, make your voice count and together we will tame this mammoth called hunger and poverty.

So FARA as an organization promoting innovation and knowledge sharing also Nkunda Ibijumba (loves sweetpotato).

On this note, I wish all to bring to a close this fruitful Exhibition demonstrating what the sweetpotato community of practice is achieving.

14.6 SPHI meeting agenda

6th Annual SPHI
Technical AND STEERING COMMITTEE MEETING
VILLA PORTOFINO HOTEL
KIGALI, RWANDA
Technical: 29 September - 1 OCTOBER 2015
STEERING COMMITTEE: 2 October 2015

Date	Time	Subject	Responsible (s)
27 & 28 Sept		Participants arrive in Kigali	Diana Niyonizeye & Emily Ndoho
28 Sept Monday	14-17:00	*Pre-meeting workshop:* How to use the renovated Sweetpotato Knowledge Portal	Luka Wanjohi & Christine Bukania
	17-19:00	Registration Open	Diana Niyonizeye
29 Sept Tuesday		**Session 1. Opening, Breeding, and Part 1 of Value Chain Findings** Moderator: Hans Adu-Dapaah, Interim SPHI Steering Committee Chairperson; Rapporteurs: Ted Carey & Christine Bukania	
	8:30	Welcome remarks & Introductions	Hans Adu-Dapaah
	9:00	Measuring genetic gains in applied sweetpotato breeding programs: More than one way to peel a sweetpotato!	Maria Andrade
	9:20	Practical approaches to the systematic exploitation of heterosis in sweetpotato breeding: How far?	Robert Mwanga
	9:50	*Questions*	
	10:00	Opening Address by the Minister of Agriculture and Animal Resources	Honorable Geraldine Mukeshimana represented by Dr. Louis Butare, Director of Rwanda Agricultural Board
	10:25	Findings from the Rwanda Super Foods Value Chain Project	Kirimi Sindi
	10:50	*Group Photo*	
	11:00	*Health Break & Voting on the People's Choice in the Photo Contest*	Sara Quinn
		Session 2. Value Chain Findings, Part 2 Moderator: Jan Low Rapporteurs: Tom Remington & Christine Bukania	
	11:30	Performance of the OFSP chain in Mukono District, Uganda	Sarah Mayanja
	11:45	Sweetpotato value chain and market analysis in Burkina Faso	Ibrahim Koara
	12:00	Factors affecting women's participation in sweetpotato vine marketing, marketing of fresh sweetpotato roots and processed products in Phalombe and Chikwawa districts in Malawi	Netsayi Mudege
	12:15	Discussion	
	12:45	*Lunch*	
29 Sept Tuesday	14:00	**Session 3. Biotechnology, Genomics & Virology** Moderator: Francis Mwatuni (KEPHIS) Rapporteurs: Robert Mwanga & Christine Bukania	

Date	Time	Subject	Responsible (s)
	14:00	Weevil resistance in sweetpotato using biotechnology	Marc Ghislain
	14:15	The Genomic Tools for Sweetpotato (GT4SP) Improvement Project - Building a modern breeding platform for sweetpotato improvement	Craig Yencho
	14:30	Questions	
	14:40	DNA viruses of sweetpotato: Harmless co-inhabitants or unseen ravagers	Jan Kreuze
	14:55	Assessing virus degeneration of clean sweetpotato planting materials multiplied in insect-proof net tunnels under farmer management	Kwame Ogero
	15:10	Chitosan improved *in vitro* growth, leaf ultrastructure and acclimatization of micropropagated sweetpotato	Mihiretu Cherinet Hundayehu
	15:25	Questions	
	15:30	*Health Break & Poster Judging (22 posters);* Each presenter has 3 minutes to present	Judges: Andrew Westby, Hans Adu-Dapaah, Francis Mwatuni, Francis Amagloh, Marc Ghislain, Adiel Mbabu
		Session 4. Post-Harvest Handling & Utilization Moderator: Francis Amagloh Rapporteurs: Madjaliwa Mzamwita and Christine Bukania	
	16:30	*Skit: Can we stop sweetpotato abuse?*	Penina Muoki, Kirimi Sindi & Sarah Mayanja
	17:00	Developing good post-harvest practice and storage facilities to facilitate the all-year round supply of OFSP	Andrew Marchant
	17:15	The effect of different storage conditions, packaging and preservative treatment on the OFSP puree quality	Tawanda Muzhingi
	17:30	Current sweetpotato research at the Natural Resources Institute	Andrew Westby
	17:45	Discussion	
	18:00	Close for day	
30 Sept Wednesday		**Session 5. Delivering OFSP and Good Nutrition & Remote Sensing to Capture Area under Production** Moderator: Anna-Marie Ball Rapporteurs: Robert Ackatia-Armah & Christine Bukania	
	8:00	Findings from the Longitudinal Study of Mama SASHA	Fred Grant
	8:20	Developing and delivering biofortified crops in Uganda: Monitoring & Evaluation system	Ignatius Abaijuka
	8:40	OFSP in the school feeding program of Osun State, Nigeria	Olapeju Phorbee
	9:00	Remote sensing as a monitoring tool for smallholder cropping area determination in Tanzania & Uganda using sweetpotato as a pilot crop	Elijah Cheruiyot
	9:20	Discussion	Anna-Marie Ball
	9:30	*Community of Practice Panel*	*Margaret McEwan & leaders of the CoPs: Breeders: Robert Mwanga & Craig Yencho Seed Systems: Jude Njoku & Jean*

Date	Time	Subject	Responsible (s)
			Ndirigwe *Marketing, Processing & Utilization:* *Francis Amagloh & Madjaliwa Mzamwita* *Monitoring, Learning & Evaluation: Julius Okello & Justus Lotade*
	10:30	*Health Break*	
30 Sept Wednesday	11:00	**Session 6. Commercial Sweetpotato Production & Markets Driving Sweetpotato Uptake** Moderator: Kirimi Sindi Rapporteurs: Roland Brouwer & Christine Bukania	
	11:00	Commercial Sweetpotato Production Methods in South Africa	Kobus Risseeuw
	11:30	SeFaMaCo Model (Seed Farmer Markets Consumer)	Antony Masinde
	11:55	Integrating orange in Zambia: Farmer-to-farmer linkages to sustain access to a vitamin A rich food that earns income	Felistus Chipungu
	12:15	Interactive radio for OFSP promotion	Karen Hampson
	12:30	Jumpstarting orange-fleshed sweetpotato in West Africa through diversified markets	Erna Abidin
	12:45	Discussion	
	13:00	Lunch	
		Session 7. Going-to-Scale Moderator: Maria Andrade Rapporteurs: Felistus Chipungu & Christine Bukania	
	14:00	Scaling-out sweetpotato and potato interventions to improve nutrition and food security in Tigray and Southern Nations Nationalities, and Peoples	Haile Tesfay
	14:20	SUSTAIN Panel on Going-to-Scale	Malawi: Tom Remington & Johannes Chikarate Mozambique: Roland Brouwer & Claudio Gunduana Kenya: Penina Muoki & Michael Odongo
	15:30	*Health Break*	
		Session 8. Technology Dissemination Targeting Improved Seed Systems & Diet Quality Moderator: Adiel Mbabu Rapporteurs: Margaret McEwan and Christine Bukania	
	16:00	Triple S method ensures sweetpotato planting material and food security in Uganda	Sam Namanda
	16:15	Integrating OFSP as part of Enhanced Homestead Food Production	Mette Kinoti
	16:35	With OFSP, CRS and partners are improving the living conditions of vulnerable populations	Zacharie Manirarora
	16:55	Key points about the nutritional needs of young children & the role of vitamin A	Katherine Dennison
	17:10	Questions	
	17:20	Wrap-up and evaluation of last 2 days	
	17:30	Close of day session	
	17:30-20:30	Time to set up Exhibition Booths	

Date	Time	Subject	Responsible (s)
1 Oct Thursday	7-9	**Final setup of the Exhibition booths for I Love Sweetpotato Exhibition**	Sara Quinn
	9-11	Judges visit the booths	
	11:00	Opening to the public & invited guests	
	12:00	*Speeches* Dr. Louis Butare, RAB Director Dr. Barbara Wells, CIP Director General	
	12:45	Awarding of prizes for the photo competition, the poster competition, and the exhibition competition	
	15:45	**Closing Speech**	Dr. Yemi Akinbamijo, FARA Executive Director
	16:00	**Closing of the Exhibition**	
	18:00	**Cocktail for Meeting Participants**	Diana Niyonizeye
2 Oct Friday	09:00-12	**SPHI Steering Committee Meeting**	Jan Low & Yemi Akinbamijo
	13:30-17:00	**SASHA Project Advisory Committee Meeting**	Jan Low
	13:30-17:00	Other meetings between USAID, Irish Aid, DFID and the projects they support	To be finalized on 28th September

Note: Detailed agenda for Friday, 2nd October will be circulated to the relevant participants

14.7 List of Participants at SPHI 2015 Meeting

#	First Name	Last Name	Gender	Title	Organization	Address	City	Country	Telephone	Mobile	Email
	SSC & PAC Committee										
1	Yemi	Akinbamijo	M	Director General	Forum for Agricultural Research in Africa	12 Anmeda Street, Roman Ridge, PMB CT 173	Accra	Ghana	+233 302 774838 | 302 744888		yakinbamijo@faraafrica.org
2	Anna-Marie	Ball	F	Strategic Alliances for Africa	HarvestPlus	P.O. Box 28565	Kampala	Uganda	+256 414 287107	+256 774 016904	a.ball@cgiar.org
3	Allison	Bingham	F	Program Advisor / Senior Research Specialist	PATH	2201 Westlake Ave, Suite 200, Seattle, WA 989441	Seattle	USA	+1 206 285 3500	+1 509 674 8912	abingham@path.org
4	Mark	Davies	M	Livelihoods Advisor	DFID/UKAid		Kigali	Rwanda			Mark-Davies@DFID.gov.uk
5	Katherine	Dennison	F	Nutrition Specialist/Advisor	USAID/Bureau of Food Security		Washington, DC	USA	+1-(202) 712-4584		k.dennison@usaid.gov
6	Christiane		F	Group Leader/ Senior Scientist	Max-Planck Institute for Plant Breeding Research	MPI for Plant Breeding Research, Carl von Liune Weg 10, 50829	Cologne	Germany	+49 221 5062 430		gebhardt@mpipz.mpg.de
7	Mette Kjaer	Kinoti	F	Vice President Africa	Helen Keller International	Box 29898 -Yoff	Dakar	Senegal	+221 338 691 063	+221 771 210 144/ +254 700 520 181	m.kinoti@hki.org
8	Jim	Lorenzen	M	Program Officer/Agricultural Development	Bill & Melinda Gates Foundation	P.O. Box 23350	Seattle	USA		+1 206 661 3491	jim.lorenzen@gatesfoundation.org

#	First Name	Last Name	Gender	Title	Organization	Address	City	Country	Telephone	Mobile	Email
9	Jan	Low	F	Agriculture Economist/ SASHA Project Manager/ SPHI Leader	International Potato Centre (CIP)	Old Naivasha Road, ILRI Campus, P.O. Box 25171, 00603	Nairobi	Kenya	+254 20 4223601	+254 733 411010	J.Low@cgiar.org
10	Antony	Masinde Kilwake	M	Senior Program Manager—Capacity Development	Farm Concern International	KARI Campus, Waiyaki Way l P.O Box 15185-00100	Nairobi	Kenya	+254 707 156 180	+254 721 617 010	Antony.masinde@farmconcern.org
11	Adiel	Mbabu	M	Regional Director, SSA	International Potato Centre (CIP)	Old Naivasha Road, ILRI Campus, P.O. Box 25171, 00603	Nairobi	Kenya	+254 020 422 3682	+254 711 309374	a.mbabu@cgiar.org
12	Stanley	Mwangi	M	Associate Director, Business Models	Farm Concern International (FCI)	KARI Campus, Waiyaki Way l P.O Box 15185-00100, Nairobi	Nairobi	Kenya	+254-20-262 6017, +254-20-262 6018	+254 715 408 650, +254 720 286 279	stanley.mwangi@farmconcern.org
13	Ibok	Oduro	F	Head of Department of Food Science & Technology	Kwame Nkrumah University of Science and Technology	Kwame Nkrumah University Of Science & Technology, Private Mail Bag, University Post Office, KNUST - Kumasi	Kumasi	Ghana		+233 244 288 315/ +233 209161906	ibok.oduro@gmail.com
14	Barbara	Wells	F	Director General	International Potato Centre (CIP)	Av. La Molina	Lima	Peru	+511 349 6017		cip-dg@cgiar.org
15	Andrew	Westby	M	Director, Professor of Food Technology	Natural Resources Institute, University of Greenwich	Medway Campus, Central Avenue, Chatham Maritime, Kent ME4 4TB, UK	Greenwich	UK	+44 (0)1634 880088		A.Westby@greenwich.ac.uk
16	Dagmar	Wittine	F	Program Manager	Roots, Tubers and Banana CRP		Lima 12	Peru	+ 51 1 317 5335		d.wittine@cgiar.org
	Technical Committee										

#	First Name	Last Name	Gender	Title	Organization	Address	City	Country	Telephone	Mobile	Email
17	Jacobus Nicolaas	Risseeuw	M	Large scale private sector sweetpotato producer	Lion Valley		Marble Hall	South Africa	27-132611516	27 82 825 9420	admin@lionvalley.co.za
18	Ignatius	Abaijuka	M	Monitoring and Evaluation Specialist	HarvestPlus	P.O. Box 28565	Kampala	Uganda		+256 782 395 348	i.abaijuka@cgiar.org
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