SPHI

Report of the 8th Annual Sweetpotato for Profit and Health Initiative (SPHI) Technical Meeting

Compiled and Edited by Vivian Atakos and Jan Low

SEPT. 24-28 2017

DAR ES SALAAM, TANZANIA

SASHA

UKaid · USAID · Irish Aid · AGRA · Bill & Melinda Gates Foundation

CIP · CGIAR Research Program on Roots, Tubers and Bananas · Helen Keller International · University of Greenwich Natural Resources Institute · Farm Concern International · CRS Catholic Relief Services

FARA · HarvestPlus · NC State University · PATH · Farm Africa

8th Annual Sweetpotato for Profit and Health Initiative Technical Meeting

Acronyms

ABS	Accelerated Breeding Scheme
AGRA	Alliance for a Green Revolution
APA	African Potato Association
AVCD	Accelerated Value Chain Development
BecA	Biosciences eastern and central Africa
BNFB	Building Nutritious Food Baskets
BMGF	Bill & Melinda Gates Foundation
CBO	Community Based Organizations
CHW	Community Health Worker
CIP	International Potato Center
CoPs	Communities of Practice
CRS	Catholic Relief Services
CSIR	Council for Scientific and Industrial Research
DVMs	Decentralized Vine Multipliers
EIAR	Ethiopian Institute of Agricultural Research
FARA	Forum for Agricultural Research in Africa
FCI	Farm Concern International
FGDs	Focus Group Discussions
GAP	Good Agricultural Practices
GHS	Ghana Health Service
GMP	Good Manufacturing Practices
HCA	Hydroxycinnamic acid
HKI	Helen Keller International
IEC	Information, Education and Communication
IPM	Integrated Pest Management
INERA	Institut de l'Environnement et Recherches Agricoles
IYCF	Infant and Young Child Feeding
KEPHIS	Kenya Plant Health Inspectorate Service
MLE	Monitoring, Learning and Evaluation
MPU	Marketing, Processing and Utilization
MSU	Michigan State University
NCSU	North Carolina State University
NaCRRI	National Crops Resources Research Institute
NAFASO	Neema Agricole du Faso SA
NARI	National Agricultural Research Institute
NARS	National Agricultural Research Station
NCRI	National Crops Research Institute
NRCRI	National Root Crop Research Institute
NRI	National Resources Institute
ODK	Open Data Kit

OFSP	Orange-fleshed Sweetpotato
PAC	Project Advisory Committee
PPP	Public-Private Partnership
QDPM	Quality Declared Planting Material
QDS	Quality Declared Seed
RCT	Randomized controlled trials
RTB	Root and Tuber Crops
SBCC	Social and Behavior Change Communication
SARI	Southern Agricultural Research Institute
SASHA	Sweetpotato Action for Security and Health in Africa
SeFaMaCo	Seed-Farmer-Market-Consumer
SEM	Scanning Electron Microscopy
SETSAN	Secretariado Técnico de Segurança Alimentar e Nutricional
SHF	Small Holder Farmer
SNNPR	Southern Nations and Nationalities, and People's Region
SPHI	Sweetpotato for Profit and Health Initiative
SPVD	Sweetpotato virus disease
SSA	Sub-Saharan Africa
SSC	SPHI Steering Committee
SUSTAIN	Scaling Up Sweetpotato through Agriculture and Nutrition
SWOT	Strengths, Weaknesses, Opportunities and Threats
TARI	Tigray Agricultural Research Institute
TOR	Terms of Reference
UDS	University for Development Studies
USAID	United States Agency for International Development

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1 Executive Summary

The 8th Annual Sweetpotato for Profit and Health Initiative (SPHI) technical meeting took place from 24 - 26 September, 2017 in Dar es Salaam, Tanzania. The theme of this year's meeting was ***'Building Resilient Food Systems with Sweetpotato***.' The meeting incorporated a half-day exhibition held at Mlimani City Mall—a popular shopping mall in Dar es Salaam— on the 24th September. During the exhibition, sweetpotato innovations from Tanzania, Kenya, Uganda, Malawi, Rwanda, Ghana and Mozambique were displayed by the International Potato Center (CIP) and partners as well as private sector entrepreneurs reaching over 500 people with successful orange-fleshed sweetpotato (OFSP) based food products. From 25 – 26 September, researchers, donors, policy makers, private sector actors, farmers and non-governmental organizations working along various sweetpotato value chains in 16 countries in sub-Saharan Africa engaged in technical discussions along the meeting theme at Ramada Resort. 105 participants (66 men, 29 women) representing 42 distinct organizations were drawn from 16 countries in sub-Saharan Africa, and Germany, Peru, United States of America and Britain. Finally, selected participants took part in field visits (27 – 28 September) to see first-hand ongoing sweetpotato work by CIP, Farm Concern International, Sokoine University Graduate Entrepreneurs Cooperative (SUGECO) in the Morogoro area and SRI Kibaha and AVCO Investments in the environs of Dar-es-Salaam.

2 Exhibition at Mlimani Mall: 24 September 2017

With a goal of reaching urban consumers, twenty exhibitors (Table 1 for details) manned booths in the parking lot of the largest mall in Dar-es-Salaam, the Mlimani Mall, on Sunday afternoon, from noon to 6 pm. Six of the exhibitors were private sector companies displaying orange-fleshed sweetpotato processed products.

The exhibit was formally opened by Dr. Hassan Mshinda, Director General of Tanzania Commission for Science and Technology (COSTECH). Dr. Mshinda visited all booths. He noted: *Here at this exhibition today, you will learn what amazing things one can do with orange-fleshed sweetpotato. Most Tanzanians eat their sweetpotato boiled or steamed or occasionally fried or roasted. But here we will see that OFSP can be made into biscuits, breads, crisps and juices, just to name a few. We can learn about how OFSP puree which is steamed and mashed OFSP roots can be used as an ingredient in baking to replace 20-260% of wheat flour in baked products. This is a breakthrough for creating markets for farmers, new business opportunities for agro-processors, and golden, beta-carotene enhanced food products for consumers. In 2013, Tanzania imported 793 thousand tons of wheat, costing the country 312 million dollars which at today's exchange rate is 700 BILLION Tanzanian shillings. Just think of the savings if one-third of that wheat could be replaced by a crop that any class of farmer in Tanzania can grow. We also can learn much about how different efforts in different countries are combining innovative ways to increase nutritional knowledge and improve young child feeding practices and household diets using OFSP as a key entry point.*

CIP scientist Norman Kwikiriza organized a skit with colleagues about orange-fleshed sweetpotato and sang a song, accompanied by guitar. Television, radio, and newspaper coverage were present. In total, there were 537 visitors to the exhibition, ably moderated by Ms. Domina Nkuba of Tanzania. Banners were hung inviting consumers in Kiswahili to come and learn about orange-fleshed sweetpotato. Photo highlights are shown on the next page. Newspaper coverage is presented in Annex 4.9.

Dr. Hassan Mshinda visiting Perfect Foods

BMC Products (credit J. Low)

20 Booths at Exhibit (credit J. Low)

Moderator visits Tanzania SRI & VISTA Booth (credit J. Low)

Harvest Plus Booth (credit J. Low)

Hugo Campos & Adiel Mbabu testing Zebra Farm OFSP juice (credit J. Low)

Rwanda booth visited by Valerie Rhoe and Dr. Mashid (credit J. Low)

Malread Petersen of Irish Aid visits Ethiopia booth (credit J. Low)

Receiving OFSP muffin at EIL booth (credit J. Low)

Better Nutritious Food Baskets Booth (credit J. Low)

Table 1. Exhibitors at the Exhibition

No	Description	Responsible
1	Zebra Farm	Lucas Mujuju, Eliah Munda
2	Sokoine University Graduate Entrepreneurs Cooperative	Ravocatus Kimario
3	Genomic Tools for Sweetpotato Improvement	Mercy Kitavi
4	Farm Concern International	Richard Haika
5	Scaling up Sweetpotato through Agriculture and Nutrition	Robert Ackatia-Armah
6	BMC products	Zena Mshana
7	Mozambique sweet that gives health	Temesgen Bocher, Abdul Naico, Benjamin Rakotoarisoa
8	OFSP in Tanzania (VISTA)	Fred Grant
9	OFSP at Kibaha	Kiddo Mtunda, Nessie Luambano
10	FANEL CIP-SSA @BeCA ILRI	Tawanda Muzhingi
11	Going Healthy and Orange in Ethiopia	Mihiretu Cherinet, Birhanu Temesgen
12	Adonijah Food Technology and Mama Metta	Domana Metta, Josephine Mwanjela
13	Scaling out orange-fleshed sweetpotato in Malawi	Felistus Chipungu
14	Jumpstarting in West Africa	Edward Carey, Emmanuel Darkey
15	Sweetpotato for Profit and Health Initiative	Vivian Atakos
16	HarvestPlus	Laira Kyazike
17	Euro Ingredients	Antonio Magnaghi
18	Rwanda Program	Kirimi Sindi, Aime Ndayisenga
19	AFCO Investments Company LTD	Fortunata Mmari
20	Building Nutritious Food Baskets	Joyce Maru

3 8th Annual SPHI Technical Meeting: 25-26 September 2017

Day 1

SESSION 1: Opening

Welcome remarks and introductions: The meeting was officially opened by **Dr. Aggrey Aguymya** from the Forum for Agricultural Research in Africa (FARA)- coleaders of the SPHI. He was also the moderator for the session. He gave an overview of the SPHI and Sweetpotato Action for Security and Health in Africa (SASHA) and the terms of reference for the steering committee. He also introduced members of the Program Advisory Committee for the Sweetpotato Action for Security and Health in Africa (SASHA) project.

The agenda for the meeting was reviewed (Annex 4.4 for details). The meeting was attended by SPHI Steering Committee and SASHA Project Advisory committee members (Annex 4.5 for details) as well as 87other participants (Annex 4.6) for details. Forty-two organizations were represented at the meeting.

Opening Remarks: These (see Annex 4.7 for detailed speech) were made by **Dr. Hussein Mansoor** – Director of Research and Development Division, Ministry of Agriculture, Food Security and Cooperatives in Tanzania. He recognized the timeliness of the theme given the growing complexity and uncertainty of our world. Dr. Mansoor, highlighted sweetpotato's ability to fit into a range of different agro-ecologies and its ability to use water efficiently making it a key ally in building resilient food systems. He recognized the contribution of sweetpotato to Tanzania's food security highlighting that the country is now the second largest producer after Nigeria in sub-Saharan Africa. He further highlighted the contribution of the pro-vitamin A rich OFSP in Tanzania given the countries high vitamin A deficiency rates. He highlighted gains made by Tanzania in supporting biofortification through the revision of key policy documents. Subsequently, since 2012, at least six major national policy and strategy documents on agriculture development and nutrition have included biofortification: a) The National Agricultural Policy of 2013, b) Agriculture Sector Development Strategy II (ASDS-II) of 2014, c) Agriculture Sector Development Programme II (ASDP-II) of 2016, d) National Multi-sectoral Nutrition Action Plan (NMNAP) (July 2016-June 2021) e) The Tanzania Food and Nutrition Policy (2015) and f) the 5-year strategy for the Ministry of Agriculture, Livestock and Fisheries (2016-2020).

Dr. Hussein Mansoor. Credit: A. Ndayisenga

Keynote: Breeding and Seed Systems for Resilience for Different Food Systems in Tanzania & Implications for the East African region: **Dr. Kiddo Mtunda** (Director, Sugarcane Research Institute - Kibaha) delivered the keynote address. Her presentation revolved around the following subtopics: crop improvement, product target, research focus, breeding approaches, objectives, sees systems and examples in seed systems collaboration. She made interesting observations on engagement of breeding program to meet requirements of processors for dry matter and sweetness. She also stressed the importance of including suitability of the leaves for use as a vegetable as a criterion for variety release in Tanzania. SRI is also engaged in developing linkages to promote commercialization of the sweetpotato seed sector. She also highlighted initiatives such as the Fast Track project on sweetpotato variety dissemination where more than seven million cuttings were disseminated through primary schools in Tanzania and Uganda. Other on-going projects in Tanzania include the Building Nutritious Food Baskets (BNFB) and the Viable Sweetpotato Technologies for Africa (VISTA) projects, led by the International Potato Center.

Dr. Kiddo Mtunda making the keynote address. Credit: A.Ndayisenga

Achievements:

- Tanzania officially released 17 SP varieties among those six are OFSP
- Seed regulations of 2017(G.N. 37-2007) includes Cassava, Sweetpotato and Potato
- Provision of pre basic seed-inspected and certified by TOSCI
- Nutrition enhanced through OFSP distribution in 48 districts out of 169 in Tanzania (29%)
- Promotion of OFSP: Good collaboration with media houses -Radio, TV, Newspapers, etc.
- Increased demand for OFSP planting materials
- Established strong collaboration with different partners in the region: CIP, IFPRI-HarvestPlus, World Vision, AGRA

- Locally: Commission for Science and Technology, Sokoine University of Agriculture-SUGECO, UDSM, LGA, Seed Multipliers and farmers, CBOs, Private sector-processors, TAHA, etc.
- Supporting dissemination of OFSP varieties: Ilindi ward, Bahi district, Dodoma, Tanzania-BNFB
- Harmonized seed regulations in East African countries and now SADC countries by May 2017

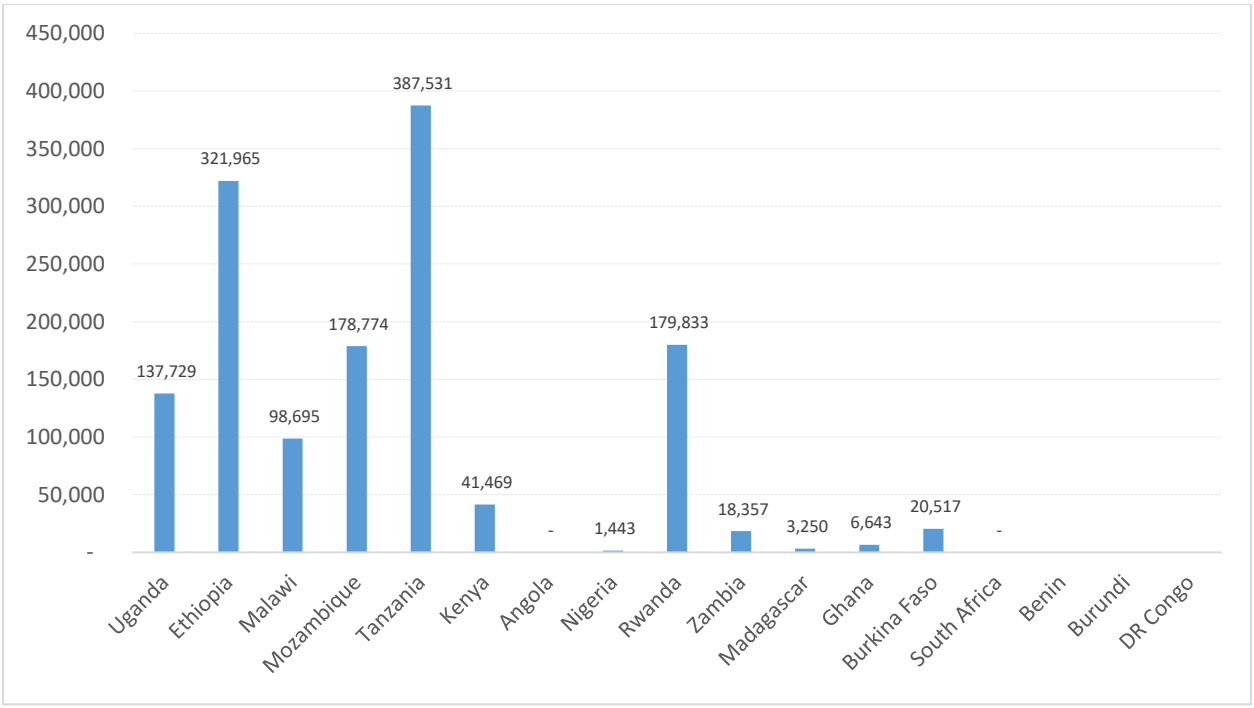
She further reported good collaboration with the private sector, including Matoborwa in Dodoma, AFCO in Dar es Salaam and TAHA. Major constraints revolved around funding for breeding work, drought, inadequate clean planting material, and lack of equipment for micronutrient analysis. Future plans for the center include: continue with conventional breeding, incorporating end-user preferences around market segments; maintain breeder seeds, increase use of molecular markers, nutritional analysis, and genomic selection.

Status of sweetpotato in SSA update. **Julius Okello** of CIP, the co-leader of the SPHI Monitoring, Learning and Evaluation Community of Practice group, provided the update. He highlighted 2016 as the year of sweetpotato as evidenced by the numerous awards – 2016 World Food Prize and Al-sumait prize for food security.

Production of improved sweetpotato varieties continues to be a major effort towards reaching the SPHI goal of 10 million households. Four new varieties were released in 2016/17 – one orange-fleshed and three non-orange-fleshed.

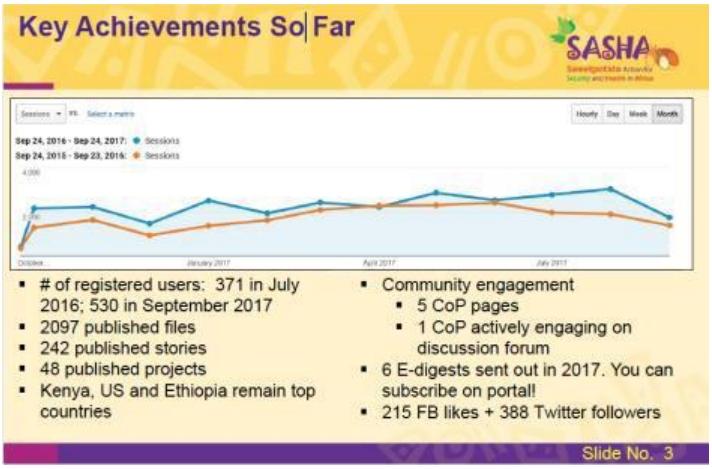
From July 1, 2016 to June 30, 2017, 1,396,206 beneficiary households were reached with good quality vines (see figure below for breakdown by country). Beneficiary is defined as one household receiving vines from the project or partners. Many projects and partners are paying attention to gender.

Number of beneficiary households reached, by country



SPHI partners work with approximately 1,000 vine multipliers in 11 SPHI countries. To date we have reached 4.25 million households out of the 10 million goal for 2020.

Improved Sweetpotato Knowledge Portal: SASHA data manager **Luka Wanjohi** presented on the Sweetpotato Knowledge Portal (www.sweetpotatoknowledge.org) website which provides a venue for sweetpotato scientists, practitioners, and farmers to share, discuss, and generate new knowledge. The figure shown provides current use statistics. For example, there are now 530 registered users of the Knowledge Portal.



The new tool under development for the Portal is a dashboard which will be integrated into the Portal, and will provide and easy and fun way for the community to track progress. Key metrics on the dashboard:

- Progress in reaching 10m beneficiaries
  - Total households reached since 2009 against target (10M by 2020)
  - Total (direct and indirect) by year since 2015/2016
  - Total households by year by lead organization
  - Total households by year by country against target
- Sweetpotato variety release in SSA
  - Total number of varieties released 2010-2017 by flesh color
  - Number of varieties released by major traits by country
- Improvement in access to sweetpotato planting material
  - A map of decentralized sweetpotato vine multipliers (DVMs) disaggregated by gender by country, project and DVM status (active/inactive)

In closing session 1, the moderator reminded participants about the two possible field trips: a ½ trip in the Dar-es-Salaam environs on 27th September, and a two-day trip to the Morogoro area the 27-29th of September. Details concerning the agenda and sites visited are provided in Annex 4.8.

SESSION 2: Post-harvest Advances

Storing fresh sweetpotato roots using evaporative cooking to reduce purée supply chain risks: **Penina Muoki** and **Tanya Stathers** (not present) presented the objective of this work, which focuses on maintaining the quality of stored sweetpotato roots intended for processing during a period of four months in a tropical area in SSA. Ideally, this will be done using solar power, as power from the electric grid is costly and unreliable. The on-going research is important for sustaining the marketing opportunity for OFSP purée in a bakery business through storage of fresh roots to overcome change of fluctuations in supply. Kabode and Vita OFSP varieties were used in the storage trials, testing an evaporative cooling method. Roots were washed gently and carefully sorted, and cured for five days before storing under the two different power supply sources, with a goal of being able to store at 15°C. Sampling was done to ensure good quality roots using experienced personnel and agreed criteria (weevil, sponginess). Analysis of purée from processed roots was conducted to verify quality vis-a-vis fresh root purée.

Findings:

- 30% of roots were discarded after 4 months of storage, hence where shortage is less than four months this was a good result,
- No differences amongst varieties in terms of loss of usability of roots, though Kabode lost more weight than Vita, but subject to more experiments, washing of roots did not affect roots discarded, in terms of general appearance
- Weight for Kabode dropped faster than Vita, whether washed or unwashed. Most of the roots did not look marketable after 4 months
- Weevil damage increased with storage time despite vigorous' sorting
- Higher incidences of weevil in the grid storage maybe due to power outage
- A few roots sprouted, but less occurrence in VITA than Kabode
- Beta carotene: rapid drop in first month but remained within acceptable range at end of storage

Question and Answer session

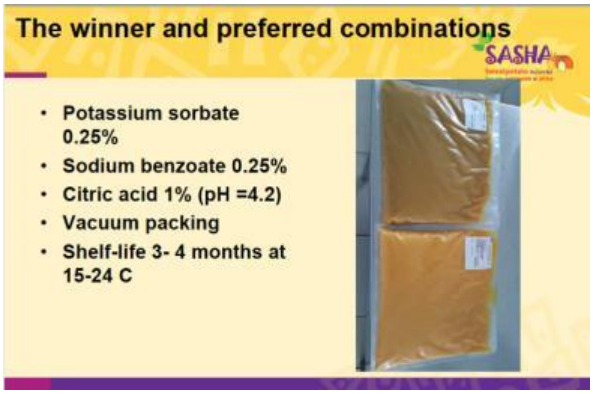
- Kiddo Mtunda: Was sugar content measured during storage?

Response: Yes, analysis is being finalized and results will be shared

- Hugo Campos: What would it take to extend storage period to one year?

Response: A tall order but work in progress, but something the scientists commit to try. *Note that there are two growing seasons in Western Kenya, so year-long storage ability is not needed there.*

Achieving affordable shelf-storable OFSP Purée without refrigeration: CIP Food Scientist **Tawanda Muzhingi** shared that purée is highly perishable hence requires instant utilization. Developing a shelf-stable purée would maximize utilization and benefit many SMEs. The purée will ease fluctuations in supply. There was already demand for the same from bakeries. This shelf-stable purée is prepared by controlling the PH (acid content), removing oxygen (through vacuum packaging) and managing water activity which spur microorganisms action. The team employed "the hurdle principle" of food processing through controlling temperature, water activity, freezing, and packaging when introducing microbes to see if the purée could remain safe. The winning combination entailed use of preservatives mainly potassium sorbate (0.25%), sodium benzoate (0.25%), citric acid (1% pH=4.2), and vacuum packaging. This combination extended the shelf life to 3-4 months at 15-24C. However, this presented new challenges in terms of the quality of the final product (bread), especially in terms of extending the proofing time.



Key recommendations towards solving these challenges entailed reducing the purée in bread from 45 to 30%, increasing yeast from 1 to 2%, increasing baking powder from 0.1 to 1% and adding 0.5% baking powder to reduce acidity.

The way forward: for bakery applications, we can adopt and develop technologies to have shelf-stable OFSP purée with unlimited use, OFSP purée with extended shelf-life has the potential to unlock a multitude of uses for the purée, attracting more commercial/industrial users.

Question and Answer session:

- **Fred Grant**: Did you look at beta carotene content retention in all the treatments? *Response:* Slight decrease with storage with time but at 4 months retained up to 75%.
- **Andrew Westby**: Could enzymatic changes be an issue? *Response:* a lot of enzymatic activity because of hydrolysis of the starch and reducing sugars. However, did not focus on it for as long as it did not affect the bread properties. Also had significant amounts of beta-carotene in the bread so did not factor this in.
- **Robert Ackatia-Armah**: Did you think about chemicals to preserve the color? *Response:* yes, you can but we wanted to reduce the costs of the purée, since the chemicals increased the costs by 4 cents per kg.
- **Mihiretu Cherinet**: What is the harvesting age of roots for achieving affordable shelf-storable OFSP Purée without refrigeration. *Response:* Four months mature roots – achieved it through supplying the vines to the suppliers. This area has warm temperatures and maturity period is variety dependent.
- **Craig Yencho**: Why was there beta-carotene degradation yet roots were stored whole? What could be causing it? *Response:* Storage temperatures were 21 C (ambient) and this spurs enzymatic activity. We hope with the next experiment to get down to 15 degrees Celsius, which could reduce the degradation.

Panel discussion: Getting sweetpotato processed products moving – private sector processors

Jan Low moderated this panel, whose discussants were: Emmanuel Darkey (Ghana), Lucas Mujuju (Mozambique), Zena Mshana (BMC Products, Tanzania), Domana Metta (Perfect foods, Tanzania), Ibok Oduro (KNUST) and Antonio Magnaghi (Euro Ingredients Limited, Kenya)

Panel discussants on Getting sweetpotato processed products moving. Credit: V. Atakos

Some highlights are noted by speaker below:

Emmanuel Darky, Ghana: Began his OFSP enterprise by availing some OFSP bread during a meeting of the CIP-led Jumpstarting project. Participants liked the bread; recipe was provided by Dr. Francis Amagloh (University of Development Studies, Tamale). OFSP was pounded with mortar and pestle before other ingredients were added. He sent some of his people to learn how to make the bread. He innovated by using the local fufu machine to produce the purée (mince the cooked roots), and also developed a local steamer (30-45 min) for the roots and then started making the bread, which has continued until today. The local machine for mincing the purée only costs around $300.

Ibok Oduro, Ghana. Gari, a West African staple is being prepared by Prof Ibok by grinding OFSP and cassava, and drying the mixture. Next, ascorbic acid is added to improve the color. The way forward is to upscale and draft a proposal to aid improving the products and set up the factory.

Lucas Mujuju, Zebra Farms, Mozambique: Was approached by CIP to go into OFSP juice. Lucas was hesitant to do so due to the imminent challenges but later accepted. CIP taught him about the raw materials needed, and created linkages for supply of roots from farmers. The equipment was sourced for juice and cookies and he was trained to prepare juice and cookies, using leftovers from making soy milk and the OFSP juice. There is need to refine the refine the product to fit consumers' acceptability and also prepare a label with the ingredients. Challenges: packaging is bought from outside Mozambique hence high costs of the final product. Zebra Farms incur losses due to purée perishability and is willing to learn from the technology shared here. Zebra Farms promotes its products in fairs.

Domana Metta, Perfect Foods, Tanzania: Business located in Moshi. Domana was initially interested in farming bananas and approached a nursery proprietor who informed her about OFSP; she acquired a few vines for planting. The first harvest was very big but in the market people were not interested to buy fresh roots. So Domana decided to stop growing OFSP. Later a team from Ministry of Agriculture who advised her to grow banana and OFSP although market acceptability remained a constant worry for her. She planted OFSP again at large scale and was advised to learn processing at SUCEGO and then began processing pancakes, flour and crisps. After that she sought registration with Tanzania Food and Drugs Agency. Challenges: promotion through various channels, extending shelf life of purée, penetrating high markets, information on best roots for various products. Currently, Perfect Foods, sells fresh roots to primary and secondary schools.

Antonio Magnaghi – Euro ingredients, Kenya: Company has two streams: innovations and production of juices, muffins and samosa. Why OFSP? There was an opportunity in the market which he strove to seize. In one of our outlets, Antonio made muffins from OFSP and arrow roots and the economic benefit was high. OFSP is a functional ingredient. He also does hot juices, which are very popular in Kenya. He now makes an OFSP cocktail with beetroot and other ingredients. In the next weeks, he will start an OFSP bakery. Contracted farmers ensure consistent supply of roots and some have the capacity to make their own purée and purée for others. Challenge, finding a divide between charity and business. Antonio called on breeders to help with shape of the roots and color of skin to reduce wastage. Sales have gone up by 15% attributed to demand for healthy products. When we use purée, we make more money.

SUGECO: First got involved when trained under RAC and SASHA. Started with multiplication of seed and also processing to increase income streams and provide markets for the farmers. Have developed about 10 products using OFSP. To get to the market, SUGECO developed the farmers brand and also connected roadside farmers to the market. Also looking for optimal equipment and trialing storage options to reduce price fluctuations. SUGECO hopes to supply other processors because they grow OFSP under irrigation. They produce up to 10 varieties grown by the group with ample seed to sell to others.

Question and Answer session

Sylvia Magezi: Have you managed to achieve certification by the Tanzanian Bureau of Standards (TBS)? Responses: **Zena Mshana** started with registration, but TBS are in the process. Requirements are cumbersome and need a lot of money. But if we get certified then we will move in leaps and bounds. Antonio noted that some standards were not available so they apply in the generic category, like bread, to ensure food safety.

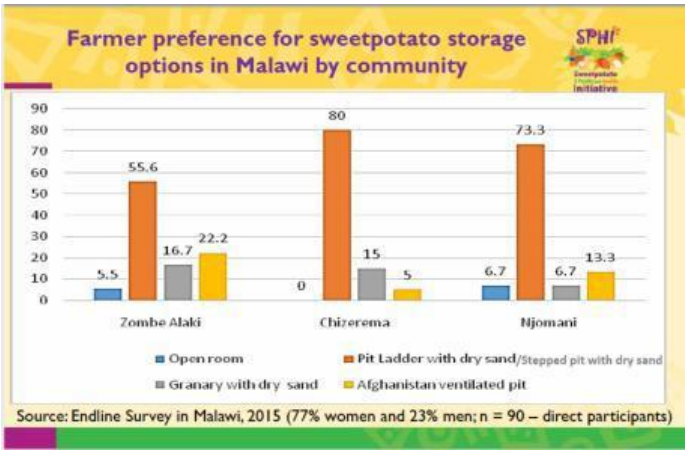
Maria Andrade: BMC group, how do you ensure products retain deep orange color? **Response:** it is the variety we use (Bella and Jewel).

Joycelline Kaganda: Tanzania food and nutrition center: Can this business be linked with the laboratory since scientists can get funding to help in this? Also, it is important to ensure nutrition is preserved. Need a forum on biofortification. Also can use FANEL.

Prices as relatively high, and why? Will they reduce in the future? Price is high if you use dried products because of the conversion rate (fresh root to dried product), but now we can use purée in the future. Urban community can afford to buy the products if purée is used. **Emmanuel Darkey**: believes the prices are fair because farmer makes about 50% profit. **Lucas**: the price of juice is high because the bottles are bought from Zimbabwe and South Africa. Buys roots from farmer associations which were linked to him by CIP.

Temesgen: What is your job employment contribution to the youth, and how much money are you making? Response: **SUGECO** has 5 entrepreneurs and many farmers. Darkey in Ghana works with about 5,000 farmers**. BMC:** good business but the flour is not very profitable, but making crisps is profitable although some varieties do not produce good quality crisps. **Antonio:** profitability is quite good and the product is cheaper if you are using purée because you can substitute up to 60% as opposed to 20% for flour; does hire youth.

Extending Access to Sweetpotato Roots using Stepped Pit Stores and Sand boxes: **Erna Abidin** shared lessons on storage and extension of OFSP shelf life in Ghana (sand boxes) and Malawi (stepped pit). These technologies enabled sweetpotato to be stored up to four months in Ghana and six months in Malawi. Farmers in Ghana preferred the sandbox technique to the traditional moistened pit; this later contributed to high demand for OFSP varieties.



In Malawi, OFSP was stored for six months with losses of less than 40%. Least losses from stepped pit. Beta-carotene retention in roots was high even after six months of storage. The outcomes include: improved OFSP production through good agricultural practices and extended the shelf-life of sweetpotato roots through locally improved sand storage technique leading to improve food security, nutrition and incomes of vulnerable households including women and children; second there was improved sweetpotato seed systems in the drought-prone northern Ghana and Burkina Faso through storage in sand and sprouting (Triple-S) method followed by proper multiplication management of OFSP planting materials. A journal article was published on the results of this work.

Phase two has been funded by USAID using only stepped pits and sandboxes in Ghana for food self-sufficiency. Will promote Triple S (for seed) and Double S (for consumption) in the one-year project.

Questions and Answer session: Are you collecting data on price change during harvest and after storage? **Response**: Prices are low at harvest, then increase a bit. After 6 months, prices go up significantly, which changed people's perception because they had food and more income.

How much can be stored and sold? **Response:** In Ghana started at small amounts targeted for food but if there is a surplus, can sell. Medium to big size sandbox store 200 roots to 100kg of roots.

In areas with longer dry seasons, this helps with hunger since children eat the roots meant for seed if there is no stored stock for consumption.

Lessons learnt from pilot market-led value chains in West Africa (Jumpstarting Project). **Souleimane Adekambi** highlighted lessons from the Jumpstarting project that focused on different market outlets to stimulate nutrition value chains. In Burkina Faso, the focus was mainly on informal markets, with focus being on four urban fresh markets (Bobo, Ouagadougou, Dori, Kaya and Sikasso in Mali). In Nigeria, the O-Meals Homegrown School Feeding Program in the state of Osun was the main market outlet targeted. In Ghana, a mix of markets was targeted. The focus was on local and urban fresh markets and processed products, particularly baked products made using OFSP purée as a wheat flour substitute) and formal markets (through community-based interventions with the Ghana Health Service and the Ghana School Feeding Program). Case studies in the three countries showed that: OFSP production and marketing were profitable contributing to success of overall efforts to create wealth and health. Lessons learned are as follows:

- Adopting market-led approach is crucial in promoting OFSP value chains. Evidence showed that farmers will respond to demand where there are markets.
- Improving farmers' access to knowledge about OFSP varieties and their benefits plays a significant role in driving adoption.
- It is important to improve access to quality planting material through a well-organized seed system.
- There is need for further institutional support to significantly increase OFSP awareness and adoption rates.
- It is important to promote OFSP varieties appropriate for different agro-ecologies.
- Training DVMs as well as farmers on best practices will help improve the quality of planting material as well as storage roots. The frequency, content, and type of trainings, as well as their relevance, are very important in influencing knowledge retention.
- Creating awareness of nutritional value of OFSP using suitable methods such as large-scale campaigns to promote high quality planting material and other OFSP-based products is crucial in increasing adoption.
- Approaches for OFSP promotion should be country specific.
- Commercially-oriented vine multiplication schemes are preferable because the profits they generate make them more sustainable.
- Comprehensive nutrition messaging e.g. through adult education approach and farmers' field schools, is effective in facilitating large-scale OFSP adoption.
- Engaging all the project members in the monitoring and evaluation activities is important. All the members of an implementation team should engage in an informative monitoring and evaluation

system, implying that they should have good skills in recording data, managing data, and reporting progress on project implementation.

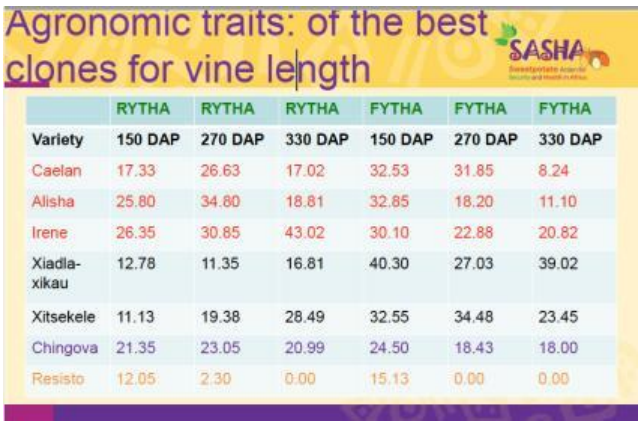
Question and Answer

Graham Thiele, RTB: How do you define adoption? **Response**: We focused on one production season and based adoption on the number of farmers growing orange-fleshed sweetpotato.

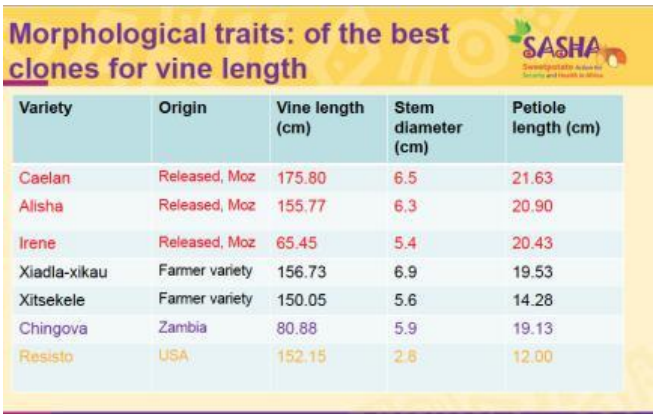
Valerie Rhoe, CRS: Why was there a lower Return on Investment (ROI) in Burkina Faso compared to Ghana and Nigeria? **Response**: In Burkina Faso, the target market was informal and not well developed therefore low demand. The crop was also affected by a long dry period. **Jan Low**: It is important to note that Burkina Faso had the highest cost of production accruing from fertilizer and irrigation. However, it also had the highest yields compared to the other two countries which augments the importance of inputs. The roots might have entered the market at the same time therefore reducing the market price.

SESSION 3: The Challenge of Drought-prone Areas

Integrating vine survival and sprouting ability into breeding programs: **Maria Andrade** noted there is considerable amount of genetic variation for vine survival. However, an integrated approach that combines both agronomy and breeding is needed. CIP scientists have been assessing vine survival in different sweetpotato varieties in Mozambique. Trials were established at three different sites: Umbeluzi and Nwalate in southern Mozambique; and Gurué in central Mozambique. Thirty-seven varieties [7 farmer varieties from southern Mozambique; 18 released varieties in Mozambique from 2 different accelerated breeding scheme (ABS) cycles and 12 varieties from other countries (Peru, USA, Africa)]. Traits measured included vine length (cm), petiole length (cm), stem diameter (mm), storage root (t/ha) and vine yield (t/ha). Use of storage roots as planting material was also evaluated. The size of the storage roots influences the number of sprouts as well as the quality of the sprouts produced. Small roots are not good in sprouting hence not recommended for conservation as planting material. Release of improved varieties with characteristics related to vine survival is a key step towards improving the quality of planting material and increasing the utility of sweetpotato. Vine survival during dry periods is influenced by stem diameter and vine length. Cultivars with thick stems had better survival rate during prolonged dry spells. Cultivars with strong, short stems and few small leaves are better than cultivars with long thin stems with numerous leaves.



	RYTHA	RYTHA	RYTHA	FYTHA	FYTHA	FYTHA
Variety	150 DAP	270 DAP	330 DAP	150 DAP	270 DAP	330 DAP
Caelan	17.33	26.63	17.02	32.53	31.85	8.24
Alisha	25.80	34.80	18.81	32.85	18.20	11.10
Irene	26.35	30.85	43.02	30.10	22.88	20.82
Xiadla-xikau	12.78	11.35	16.81	40.30	27.03	39.02
Xitsekele	11.13	19.38	28.49	32.55	34.48	23.45
Chingova	21.35	23.05	20.99	24.50	18.43	18.00
Resisto	12.05	2.30	0.00	15.13	0.00	0.00



Variety	Origin	Vine length (cm)	Stem diameter (cm)	Petiole length (cm)
Caelan	Released, Moz	175.80	6.5	21.63
Alisha	Released, Moz	155.77	6.3	20.90
Irene	Released, Moz	65.45	5.4	20.43
Xiadla-xikau	Farmer variety	156.73	6.9	19.53
Xitsekele	Farmer variety	150.05	5.6	14.28
Chingova	Zambia	80.88	5.9	19.13
Resisto	USA	152.15	2.8	12.00

Going forward, it is important to consider synthesis of glycine betaine. Increased production of glycine betaine (GB) improves plant tolerance to various abiotic stresses without strong phenotypic changes. The gene encoding betaine aldehyde dehydrogenase (BADH) is involved in the biosynthesis of GB in plants. Also, there is need for

better understanding of nitrogen metabolism. Additionally, there is need to further understand root structure and architecture and accumulation of proline therein.

Triple S: Why participatory testing and local adaptation is necessary: **Mihiretu Cherinet** noted existing practices of sweetpotato conservation during the dry season are largely dependent on availability of water and soil moisture retention. However, the ever-increasing temperature, shortage of irrigation water in dry season and competition for wet land has posed a great challenge for sweetpotato seed conservation. Triple S (Storage in Sand and Sprouting) offers an opportunity for conservation of seed during the dry season. The technology was developed in Uganda over three years and validated in Tanzania over five months. It is important to disseminate the method to areas with harsh and long dry season. Triple S was tested in the Southern Nations, Nationalities and People's Region (SNNPR) of Ethiopia. There is a big difference between the original context and the new area including differences in farming systems. In adapting the technology to Ethiopia, one stage is excluded i.e. transplanting is done at the onset of rainfall instead of planting and irrigating starting several weeks before the start of the rains.

The technology was compared with local methods for vine conservation through a participatory approach. This ensured that the farmers owned the process. Two methods were combined to fit Triple S in prolonged dry areas (9 months of drought). The two were: a) Cyclic sprouting and (b) de-sprouting. Medium to large roots were recommended for use in areas with long dry seasons such as Tigray. Small roots are only good for short periods. Farmers were trained on how to develop calendar of activities based on the length of the dry season in their localities. In addition, further research showed sprouting of roots is highly influenced by genotype followed by temperature and humidity. Currently, Triple S is being tested among 120 farmers in 6 districts in two Ethiopian regions. There has been an improved uptake by NGOs and the government.

Lessons learned from scaling the Triple S Technology in Uganda: Sam Namanda began the presentation by highlighting the potential for Triple **S** which involves involves **S**toring sweetpotato roots in **S**and and **S**prouting. The objective is to initiate development and growth of healthy shoots for timely production of clean planting material. The root is the only part of the sweetpotato plant that can survive desiccation and can therefore be used to develop shoots that grow into vines after a period of dormancy during long dry season. Factors contributing to successful uptake of the technology include: strong partnerships, be beneficiary-driven, well-planned sensitization, ensuring that farmers understand the Triple S calendar, learning through demonstrations, Triple S tool box (practices to make the method more efficient, review workshops, monitoring at local level).

% total number of respondents on suitability of Triple S method under different production constraints

Response	Different production constraints		
	Drought areas	Roaming animals	Many thieves
Very poor	0	6	10
Poor	0	10	20
Fair	3	27	20
Good	40	47	47
Excellent	57	10	3
Total (N= 30)	100	100	100

Source: Early adoption of Triple S study in Uganda 2017 (unpublished)

Triple S highly appreciated for producing planting material in areas with long dry season

Sam presented recommendations for further adaptive research as follows:

- Additional studies on recommended root size. Although Ray 2011 indicated the there is no

difference in number of cuttings produced by different root sizes, Agili 2017 (unpublished) reported that bigger roots produce more material.

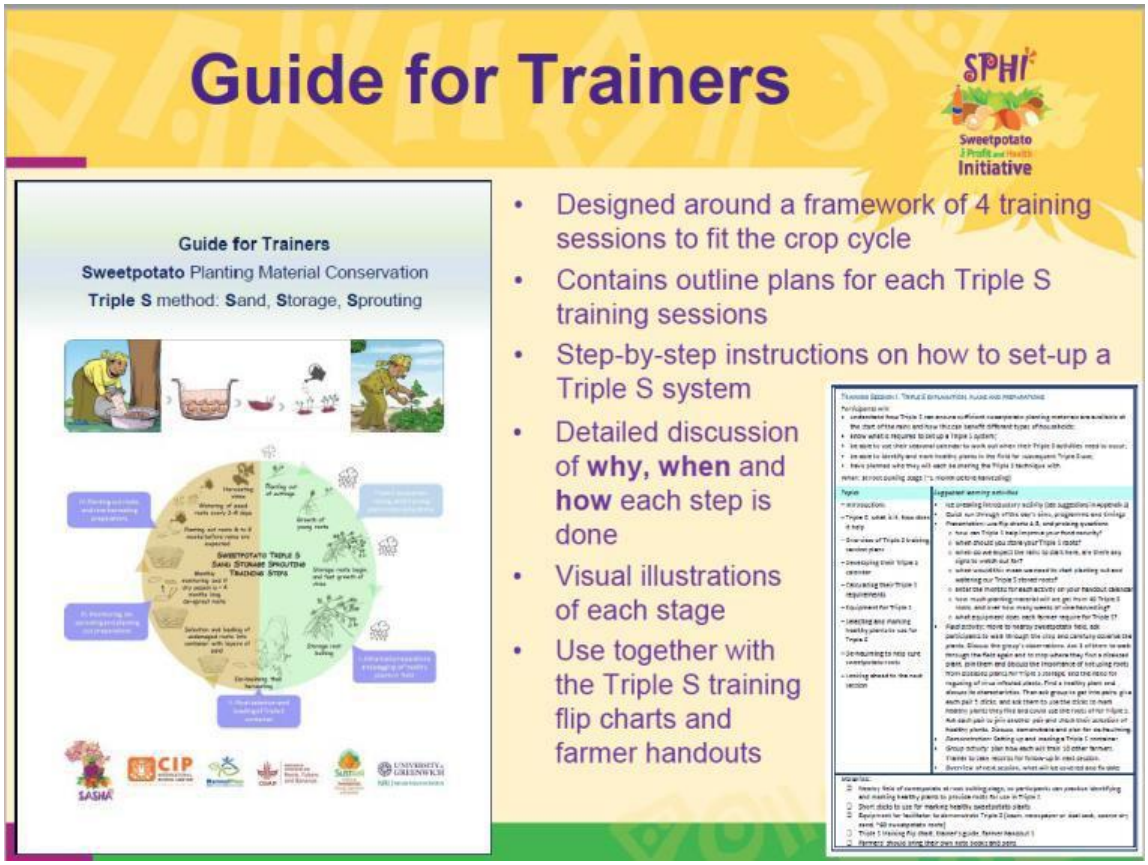
- Precise description of storage conditions including actual temperature and relative humidity. Findings may guide on building storage structures without grass e.g. timber.
- Strategies on how to build on the growing commercialization of both vines and roots.
- Strengthening technical messages.
- Strengthening agronomic skills and record keeping. What is the appropriate spacing on-farm? After how long should farmers go back to the same source of material? Any soil amendments? How should early sprouting be inhibited rather than de-sprouting? What is the effect of de-sprouting on vines produced? Duration between de-sprouting and re-sprouting for different varieties etc.
- Cross-crop-cross technical approaches. For instance, sweetpotato farmers think *Solanum* potato ambient stores might work for them. Potato farmers have also discovered that extended storage in ambient stores influences good sprouting for seed.
- How to do we convince the environmentalists that Triple S complements efficient wetland management and does not significantly interfere with wetland ecology. Need to bring on board policy makers.

Emerging opportunities include: climate change (dry periods becoming longer and rain becoming increasingly unreliable); resilience and yield comparative advantage (yields of other crops especially cereals and even cassava collapsing very fast); increasing appreciation of OFSP varieties as a nutritional strategy; increasing commercialization of both vines and roots - psychologically raises the hope for food and incomes; potential for scaling by partners, e.g. Mercy corps and FAO; increasing availability of training and reference materials.

How do we get Triple S to Scale? **Margaret McEwan noted that** going to scale requires getting good training materials out. CIP has been working with NRI to develop training materials on Triple S. The technology has been tested across eight countries in SSA with a lot of interest. The technology seems to be very complicated requiring several steps over a year. Therefore, there is need to come up with standardized principles that can guide people in different countries to adapt the technology in their contexts. Three types of training materials have been produced so far:

- A guide for trainers: In the guide, the technology is divided into 4 key steps so rather than focusing on months, you look at the steps. It has an outline for training sessions of the four steps which include why the technology is needed, what step, when and how? There is an illustration of each stage.
- Training flipchart

The Triple S calendar can be used as a basic tool for adapting into different contexts. There is also a suggestion to integrate with Double S (Sand Storage) to allow storage roots to be stored for longer hence take advantage of peak market periods. There is need to continue building an expanding network of interested partners and use mass communication to reach more people. Audience-specific messages can be shared through participatory videos and social networks - which are often women-focused. The SPHI network platform provides a good platform for scaling.

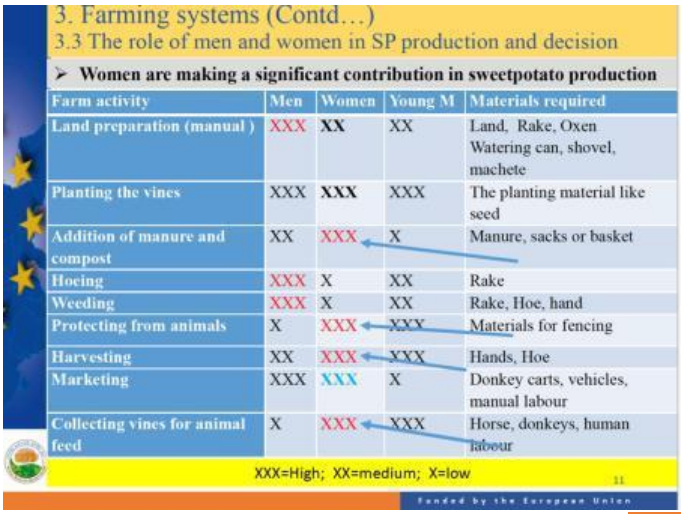


Understanding gender roles in sweetpotato value chains to design better interventions in Ethiopia: **Birhanu Biazin**

Temesgen shared results from the EU-funded Sustained Diet Quality Improvement with Climate-smart, Nutrition-Smart Orange-fleshed Sweetpotato (OFSP) project. He noted that OFSP production interventions need to build upon the existing white-fleshed sweetpotato production systems (intercropping, sole cropping and overlay cropping) and kitchen garden.

He highlighted key points as follows:

- In the coffee and enset agroforestry systems of Gedeo, sweetpotato intercropping could be associated with promotion of improved recipes using leaves as root yields are very low.


3. Farming systems (Contd…)

3.3 The role of men and women in SP production and decision

➢ **Women are making a significant contribution in sweetpotato production**

Farm activity	Men	Women	Young M	Materials required
Land preparation (manual)	XXX	XX	XX	Land, Rake, Oxen Watering can, shovel, machete
Planting the vines	XXX	XXX	XXX	The planting material like seed
Addition of manure and compost	XX	XXX	X	Manure, sacks or basket
Hoeing	XXX	X	XX	Rake
Weeding	XXX	X	XX	Rake, Hoe, hand
Protecting from animals	X	XXX	XXX	Materials for fencing
Harvesting	XX	XXX	XXX	Hands, Hoe
Marketing	XXX	XXX	X	Donkey carts, vehicles, manual labour
Collecting vines for animal feed	X	XXX	XXX	Horse, donkeys, human labour

XXX=High; XX=medium; X=low

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Funded by the European Union

- The low participation of women in the current extension techniques requires use of new approaches.
- Participatory recipe (both men and women) development and adapting sweetpotato to the existing culinary system (Kocho and Injera) is recommended.
- Gender-awareness training should be integrated in agricultural and health extension services to promote household level decision making.
- Select women as hosts of demonstration plots where other farmers come and learn about improved OFSP production techniques.
- Target women-headed households to be among the DVMs.
- Information on markets should be disseminated through women-friendly channels as they are active participants.

Discussion: **Jude Njoku:** Do you think there is any other thing we need for scaling up Triple S and Double S?

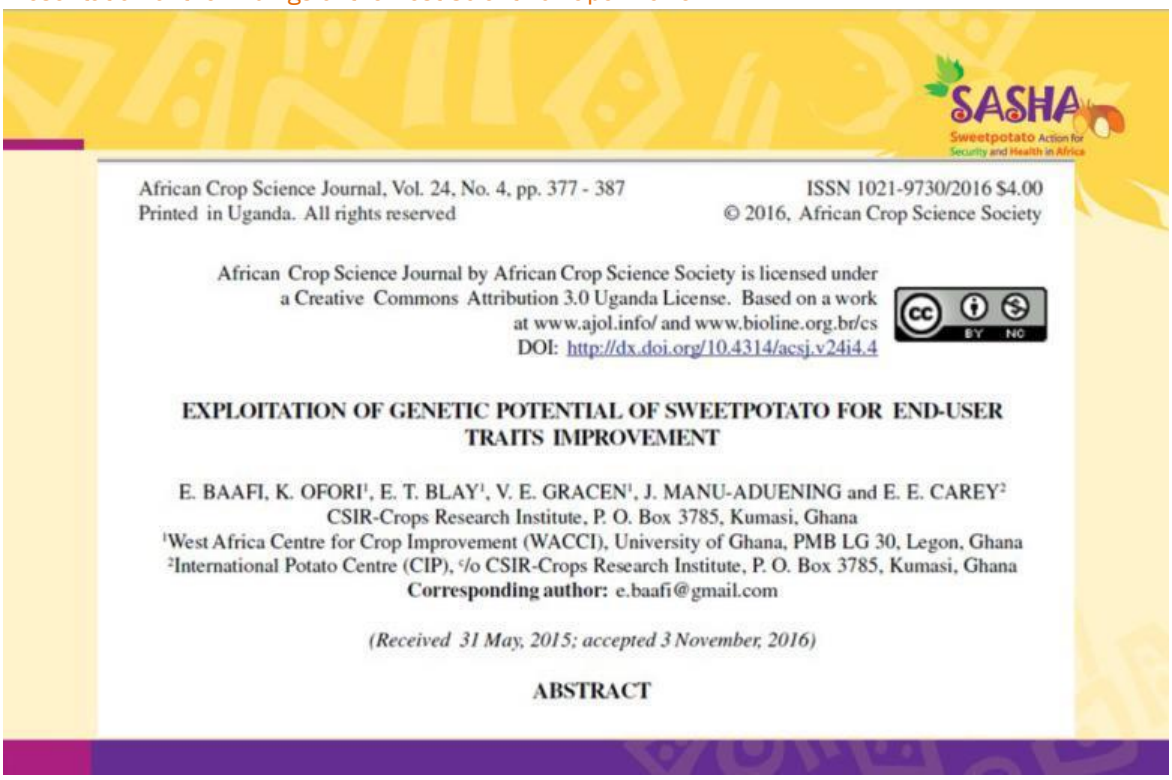
Responses: Maria Andrade - Experience from Niassa showed that the best way to disseminate technology is to use trainer of trainers who will then reach out to more farmers. **Sam Namanda:** We are currently scaling the technology in liaison with interested partners e.g. Mercy Corps and HarvestPlus. The strategy is to make the learning materials available and involve farmers in the entire process. **Birhanu Temesgen**: Consider more inclusion of women in the training because the Triple S is mainly implemented within the homesteads and women can be good change agents.

SESSION 4: Best Sweetpotato Scientific Paper Award and Listening to Speedbreeders

Awarding of the Best Sweetpotato Scientific Paper of 2016: Hugo Campos explained that this is the first year of the annual Excellence in Sweetpotato Award for best scientific paper possible due to and endowment fund set up by Jan Low with her award money from the World Food Prize. Encouragement for scientific publications began as early as 19th Century by Michael Faraday who postulated 'work, finish and publish'. The fund began this year for best scientific paper related to OFSP technology published in 2016. Dr. Campos, CIP's Director of Research and head of the selection committee clearly described the criteria for qualification for the prize and the composition of the selecting team. Some of the criteria included quality of the research, partnerships in research, number of downloads and citations at ResearchGate as well as the impact factor of the journal were the parameters. The prize for the winning paper was US$500.00. Twenty papers were received in total and the winning scientific paper was authored by Ernest Baafi and co-authors from Ghana. This paper was published in Africa Crop Science Journal. The abstract of the paper is provided in Annex 4.1.

Ernest Baafi (right), winner of the best paper. Credit: V. Atakos

Presentation of the findings of the Best Scientific Paper 2016:



African Crop Science Journal, Vol. 24, No. 4, pp. 377 - 387
Printed in Uganda. All rights reserved
ISSN 1021-9730/2016 $4.00
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DOI: http://dx.doi.org/10.4314/acsj.v24i4.4

EXPLOITATION OF GENETIC POTENTIAL OF SWEETPOTATO FOR END-USER TRAITS IMPROVEMENT

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(Received 31 May, 2015; accepted 3 November, 2016)

ABSTRACT

Ernest Baafi explained the study emanated as a follow up study to the baseline study done in Ghana by the national program and International Potato Center. The major point highlighted in the presentation was the negative correlation between beta-carotene and dry matter (DM).

Question and Answer

Mihiretu Cherinet: The dry matter (DM) and beta-carotene are negatively correlated. What is the maximum DM and beta-carotene can we achieve in one variety? **Response:** Robert Mwanga gave a history of sweetpotato breeding in Africa. Apart from South Africa, Rwanda national program was the best sweetpotato breeding 20 years ago. They tried to combine high DM with high beta-carotene content with little success to the point of disserting this objective. It appears these two traits reside on different chromosomes and assort independently during meiosis. This linkage breakdown during recombination makes the job tough of combining high DM and high beta-carotene together. DM content is also affected by agronomic management and the environment. For example, growing sweetpotato in swamps decrease DM content while drought raises the DM content. In addition, cooking also affects the DM content as well. Maria Andrade supported the content given by Robert Mwanga. She gave an example of Ejumula, a variety from Uganda has a DM content of 32% in Mozambique and which gets affected by cooking methods.

Jim Lorenzen: Through discussions with one nutritionist, it was claimed that CIP generated an artifact between starch or DM and beta-carotene. Is it possible that selection done before release of varieties give rise to this negative relationship between DM and beta-carotene?

Response: Craig Yencho: Evidence is available from molecular data, the quantitative trait loci (QTLs) for DM and starch are negatively correlated with QTLs for beta-carotene. However, it is possible to have a variety high in dry matter and good culinary characters with high vitamin A content. Also, the objective in sweetpotato is not to increase DM to levels above 40% like in cassava.

"World Cafe" Poster Session on Breeding Progress for Different Agro-ecologies & Food Systems: Ten breeders (five from CIP; five from National Programs) and the SASHA data manager hosted a poster session. Each participant was encouraged to visit 3 posters, with the breeder at each poster providing a 5-minute overview of key findings, then answering questions for an additional 5 minutes. Posters are presented in Annex 4.10.

Bernard Yada describes breeding for weevil resistance (credit J. Low)

Sunette Laurie explains selecting for nematode resistance (credit J. Low)

Maria Andrade explaining heterosis validation (credit J. Low)

Jean Ndirigue describes how they capture farmer's concerns in Rwanda (credit J. Low)

Feedback on poster session on breeding progress: Hugo Campos noted that the poster which attracted more attention and can be a game changer is the one on 'Validating Heterosis in Sweetpotato Breeding' by Wolfgang Gruneberg and co-authors. In breeding, separation of genepools and selection of good parents leads to rapid development of varieties meeting end-user's needs and tolerant to biotic and abiotic stresses at a reduced cost. Calculation of variance components allows selection of appropriate parents to be used as testers for next breeding populations. Virus is the top ranking abiotic stress in sweetpotato and breeding for virus resistance is important. Virus resistance could be addressed effectively through heterosis exploiting breeding schemes. One poster highlighted screening of nematodes. Craig Yencho advised sometimes development of one assay could also serve to screen for other traits. In this situation, an assay for nematode resistance could potentially be effectively used to screen for early bulking and drought tolerance in sweetpotato.

SESSION 5: Learning from Experiences in Diverse Settings Across Different Countries

Fostering change: Lessons from HKI's work in nutrition-sensitive agriculture across four diverse African settings: **Mette Kinoti** presented the goals and objectives of the project. The project was implemented in Northern Cote d'Ivoire, Eastern Burkina Faso, Lake district of Tanzania (rural), and Dakar in Senegal (urban). It was funded by the Government of Canada, Department of Foreign Affairs. The ultimate goals of the project were to improve on the nutritional status of children under five years of age and women of reproductive age, especially breastfeeding or pregnant women. The objectives included increased productivity and diversity of nutrient-rich foods, improved intake of nutritious foods, improved health and hygiene practices. The project was thus multi-sectoral in nature. Achievements included:

- The number of villages/neighborhoods that had access to OFSP vines increased from 25 villages at the beginning of the project to 232 villages.
- The dietary diversity increased; for example, the number of households consuming more than 5 or more food groups increased from 14% to 48% in Tanzania; 32% to 60.5% in Burkina Faso; 21.4% to 64.3% in Cote d'Ivoire and 60.5% to 70.2% in Senegal.
- Other outcomes of the project were increased number of age appropriate children breastfed, improved knowledge of mothers on breastfeeding, improved discussion between spouses, etc.
- In Burkina Faso, integrating the WASH component lead to a decrease in anemia. This was not observed in Tanzania, possibly because the period the project operated in Tanzania was short (less than 3 years). Stunting was not affected by WASH, but feeding on supplements significantly reduced stunting.

Conclusions drawn from the study:

- It is important to integrate WASH with nutrition-sensitive programs although it is challenging and needs dedicated resources.
- Agriculture can be used as a platform for multi-sectoral projects, especially in addressing nutrition issues.
- Women's empowerment is very critical in bringing about community transformation
- There is more progress in achieving goals if projects supply quality inputs
- Water should be part of the nutrition-sensitive and agriculture-related interventions.
- Much effort is needed in improving livelihoods of the urban poor, especially their nutrition
- For the effectiveness and sustainability of interventions, government involvement is paramount. This is the conclusion drawn from Burkina Faso, where Government supported the OFSP initiatives and there was tremendous adoption of OFSP.

Question and answer session

Margaret McEwan: Your project was for three years. Three years is a short time to change behaviors. How many behaviors were you trying to change? What three behaviors would you target for changing if you were to implement the project elsewhere?

Response: It is true the number of behaviors we intended to change were many. The three behaviors that could be given priority are improved dietary diversity of children and women; intake of nutritional food to ultimately address anemia, stunting, body mass index etc. and changes in behaviors in production, for example, the number of practices to be adopted.

Srini Rajendran: How was sampling done? What were the primary indicators? What level of randomization was done?

Response: Randomization was done at a village level.

Robert: What specific type of illness was the project concerned about?

Response: Preventive illness and nutria-sensitive illness

Jan Low: Your project had quite many intervention, requiring different expertise of the extension personnel. How many different extension personnel did you work with? To what extent were they able to deliver?

Response: The project had two categories of extension staff; the Agriculture extension staff and the health volunteers. We also worked with NGOs in the communities and usually, their extension staff are trained to deliver in the multi-sectoral settings. Our extension staff were also given short training on the aspects they were not familiar with. The focal persons were health workers, and these were concerned with issues in the household.

Getting markets working for sweetpotato in different agro-ecological settings: Experience from SeFaMaCo:

Harold Mate from Farm Concern International began his presentation by elaborating that SeFaMaCo is an acronym for Seed, Farmer, Market, Consumer; and is thus a commercialization and market access program. It has eight partners, with Farm Concern as the lead partner. Their activities were funded by the Bill & Melinda Gates Foundation. The main objective of their interventions was to increase market access for banana and sweetpotato through creating partnerships with retail outlets, health/medical institutions, schools etc. SeFaMaCo used the commercial village model in its interventions. The commercial villages had between 200-500 households. In their commercial villages, farmers were trained to understand how the markets work, and how to ensure they sold quality products. SeFaMaCo encouraged and enabled the aggregation of produce in the commercial villages. Aggregation was done in two ways; one, farmers brought the produce to one location; two, farmers bulked produce together. Aggregation was helpful to the buyers in sorting problems of uncertainty. The project developed complementary value chains for other three common crops in each country they operated, in addition to Sweetpotato and Banana. The project trained seed entrepreneurs and input suppliers and created partnerships between the two groups. The projects output includes improved market access, creation of 1,242 commercial villages, 981 partnerships between retail outlets and consumers. The project also worked to empower the traditional informal wholesaler aggregators through advancing cash to agents who purchase on their behalf, as well as selling on credit to retailers and other formal actors such as supermarkets. The traditional informal wholesale buyers bought over 85% of the produce, and were therefore regarded as important change agents in the communities. Transport costs were accounted for 43% of the marketing costs. It is the transport costs that SeFaMaCo attempted to reduce through aggregation. Mr. Matte concluded the presentation by indicating key learning points for sweetpotato marketing. These were; reduction of sourcing cost for buyers, increasing margins for farmers, understanding the cultural setting, and taking into consideration differences in varieties.

Question and answer

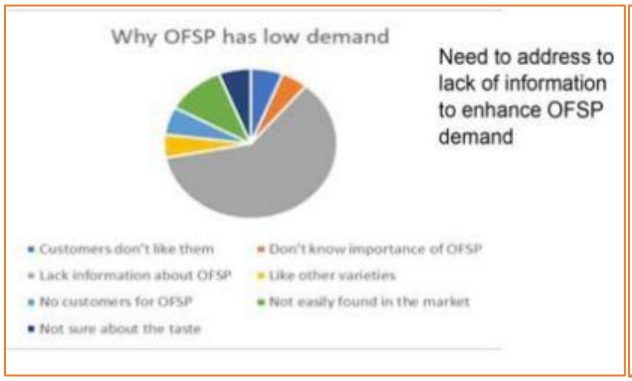
Lebris Laizer: Your project aimed at addressing transaction costs. However, in the presentation, transaction costs appear to be a big challenge, especially in selling the sweetpotato roots. What was novel with SeFaMaCo intervention in reducing transaction costs?

Response: The project intervention reduced transaction costs by reducing the transport costs of the wholesalers through aggregation. However, it is not possible to eliminate transaction costs.

Josephine Mwanjela: There is need to change behavior by projects and scientists and to know our language as business people. As business people, we may be producing one product because it is what the market wants. There is need to invest on how we can create markets for our products.

Rapid market assessments in different settings in Tanzania: can they help us target different food systems and value chain actors better? **Sarah Mayanja** presented findings of a study that was part of the VISTA project in Tanzania: "Expanding production and utilization of nutritious OFSP" which was funded by USAID. The other specific objectives of the project were to promote financially viable sweetpotato seed and root enterprises and strengthen evidence base for promoting OFSP. The outcome of the intervention would lead to improved dietary diversity, food security, incomes. The study was conducted in seven districts in Iringa and Morogoro regions, and in each district, two markets were surveyed. The study involved traders and consumers, and all together, they were 328 respondents that were interviewed.

Key findings:



- Importance of Sweetpotato
  - Sweetpotato was found not to be a priority crop, but tends to be consumed more in Ramadan
  - Some communities, especially the Sukuma, preserve and use the sweetpotato in the dry season
  - In Iringa, sweetpotato was found to be resilient in the face of weather changes
  - "Deji", a local variety, was the most popular variety in the markets
  - Few farmers know about OFSP

- Sweetpotato trade
  - Commercialization efforts for sweetpotato were just commencing in the study areas
  - There were more women traders and consumers than men
  - Iringa was the biggest market
  - Double taxation was a problem to the traders
  - There were no formal agreements between farmers and the wholesalers
  - OFSP were less traded and the main reason for less trade in OFSP was lack of information about OFSP

- The most important trader perceptions were on the flesh color root size and taste; while for consumers, the most important perceptions were on skin damage, root size and nutritive value.
- Men traded more sweetpotato volume than women. Most women traded in heaps. but there were more women traders than men. Farmgate selling was the most popular method for men.
- Men used pickups to transport their sweetpotato and therefore traded higher volumes, while most women used the head.
- Farmers producing OFSP in off-season earn more money.
- Sweetpotato was eaten most in Morogoro although Iringa has a high market potential. Varieties with the red and pink skin colors and yellow flesh were the most preferred. Medium to large roots were also the most preferred.

- Consumers
  - Root entrepreneurs should focus on markets with high demand but with low OFSP sale.
  - The sweetpotato and banana market should be segmented.
  - Farmers should be helped to develop business plans.
  - Women traders should be targeted and supported to ensure continuous year-round sales.
  - Projects should establish and build relations with traders, market masters and other value chain actors
  - There is need to promote OFSP by giving opportunities for people to taste OFSP varieties and promote its nutritive value

Day 2

SESSION 6: The Challenge of Sustainable Seed systems and Fighting Viruses

Developing, implementing and institutionalizing a sustainable business plan for basic seed production.

Florence Munguti from KEPHIS in Kenya reported that with help from SASHA and RTB CRP funding, a model for sustainable sweetpotato pre-basic seed production has been developed using a revolving fund mechanism, with a revolving fund management committee. Selling prices are different for NGO and private sector multipliers (cheaper for private sector); early orders cheaper (starting at 10 KSH per vine to 30 KSH). Total sales since Dec 2015 are worth 30,170 USD. This money has been utilized for rehabilitation and expansion of the site (15,000 USD) with current savings in an account (14,000 USD). There are plans to further invest in infrastructure. Different mechanisms are being put in place to improve sustainability and continue producing pre-basic seed planting material as the SASHA project reduces financial support for sustainability as the project winds down. Strategies to become more cost-efficient are being put in place (real-time costing, reducing invitro multiplication, increasing screenhouse multiplication.

Questions and answers:

Regis: operating in a government system may be very difficult. How do you overcome problems with managing funds etc. as a business?

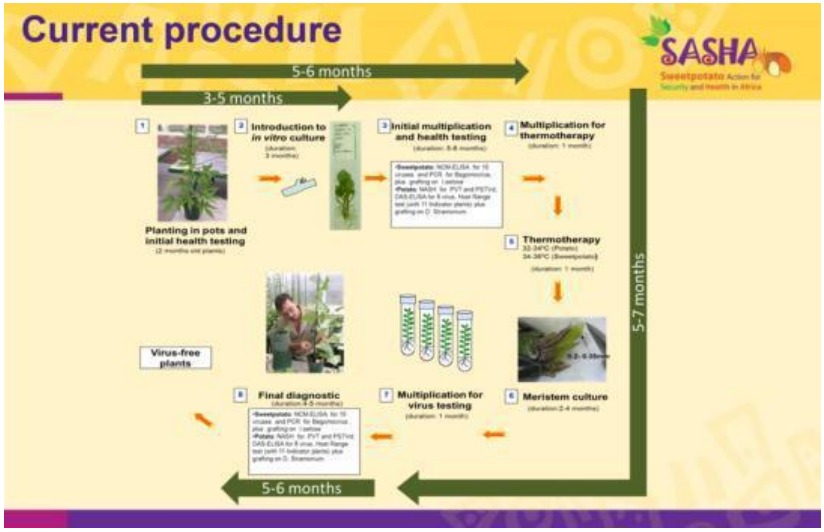
Response: We identified the challenges as a government institution. With the committee in place, it took some time to get them in the right mindset to work towards sustainability. We convinced our committee to contribute to the business model and make the process efficient. We convinced the procurement department to fast-track procurement processes. We are not fully efficient yet, but the committee helps us improve efficiency.

Christiana Gebhardt (Germany): In your cost calculations, do you include personnel cost? If you would include personnel cost, would that increase the production costs considerably?

Response: If we had to factor in our salaries, the price would become prohibitively expensive. The objective of the funding is to recover recurrent costs (such as materials and casual labor costs), not all personnel costs.

Ted Carey: It appears important to show the value of the cleaned seed material to our clients. I feel we are not doing a good job showing the advantage of buying clean seed. Are we showing the advantage of using cleaned vines and how?

Response: Jude Njoku: In Nigeria, if we don't maintain high quality seed, the farmer will not notice that they are getting a better yield. We have had stakeholders meeting where we show how and where we maintain the seed. Demonstration in the facilities. At the farmers' level, we demonstrate the advantage in the field and we have published data on the yield advantage. **Nessie Luambano**: We have different methods to communicate the advantages (Whatapp groups and radio in which phone numbers are being given for farmers to learn where they can get quality vines). **Jean Ndirigue**: We use mass media to show advantages of good quality vines (radio, DVMs and events to reach more persons).



Speeding up Virus Removal: ClonDiag vs Grafting: Jan Kreuze noted that detecting viruses is key, but the bio-assay and ELISA analysis takes about 5 months. Then you have to clean the material and test it again, so this will take about a year. How could we speed up this process? When SASHA began, Ian Barker (now working for Syngenta) started the search for speeding up this procedure using ClonDiag Arrays that are capable of sensitive detection of multiple viruses. The evolution of the virus array until now has had four iterations, and discovered 19 viruses. We evaluated samples of 11 countries. The fourth iteration is the final one, developed an App to analyze array plate data with a smartphone. Validated the fourth iteration array with KEPHIS (25 samples with healthy control), split up samples to do parallel analysis in CIP-Lima and KEPHIS. KEPHIS had 100% consistency with the biological indexing for infection status. But this was not always consistent with individual infections and specific viruses. CIP-Lima, had only 96% consistency. Repeatability of samples was good.

The Question: Can we replace biological indexing? Cost of ClonDiag tube arrays cost about 70 USD, versus 153.71 USD per sample for biological indexing. This could be a good replacement for the 1st round of indexing. Next generation indexing is coming with a complementary project funded by BMGF.

Questions and Answers:

Craig Yencho: Can you bring down the cost to 7 USD so that it can be used in the field? **Response:** Not yet, the quantity of samples is too small to bring it down to that level (we could bring it down to about 40 USD with larger samples. The new technology with the microfluidic LAMP could become much cheaper.

Jan Low: What is the economic importance of different viruses and how does that influence the type of testing we want to do? **Response**: We can take out analysis for viruses of which we are confident that they do not cause measurable negative effects on plant growth.

Lessons learned from scaling the net tunnel technology: **Kwame Ogero** noted that the net tunnel technology allows farmers and vine producers to maintain clean vines and do field multiplication in the field for two cycles, before returning to the net tunnels. The technology is being piloted and results from Tanzania and Nigeria show that more vines are coming from net tunnel multiplication than from farmer field schools and other sources. There have been several different adaptations to the design. Three models are available: (1) using wood, (2) PVC pipes with zipper, (3) reinforcing iron bars or rods for frame with a full zipper closure. A bottleneck is the limited supply chain for insect proof netting.

Launching of the revised Net Tunnel brochure: The SASHA Seed System team, led by Margaret McEwan, official launched the revised version of the brochure on how to construct, plant, and maintain a Net Tunnel. The net tunnel technology was developed during SASHA Phase 1 and the 1st edition of the brochure produced in December 2012. Since then, several additional countries have been testing the use of net tunnels. Three different models of tunnels have emerged and instructions are provided in the 2nd edition for each of these approaches. CIP scientists Kwame Ogero (Tanzania), Mihiretu Cherinet (Ethiopia), and Jude Njoku (Nigeria) were the major technical contributors to this new brochure. Copies were distributed to all meeting participants.

Launch of new net tunnels brochure during the meeting. Mihiretu Cherinet (center) holds small-scale mode. Credit: V. Atakos

Questions and answers:

Graham Thiele: Great program and evidence of scaling. We need string evidence of the technology and how it links to the larger sweetpotato value chain (starting with extended vine multiplication and production value chain. **Response:** We are currently working with colleagues in Uganda and Tanzania to identify true costs and benefits in the vine multiplication value chain.

Jim Lorenzen (BMGF): From one net tunnel you could get about three quarters of a hectare (33,000 plants per hectare). Tanzania will be close to 1 million hectares of sweet potato. That would imply that you need a couple of thousands of these tunnels. I think there may be competing issues of efficiency and cost-benefits between using these decentralized vine net tunnels and doing more centralized pre-basic vine production in a centralized and isolated virus free site.

Srini Rajendran: You need to test the technology in different locations and countries to make sure it is viable for scaling. **Response:** What we have done is an estimate with the cheapest versions. All my colleagues in the countries are doing the costing in the different sites with their adapted models. This model is best to use in high virus pressure areas.

Mercy Kitavi: Owing to the size of the net tunnels, do multipliers plant only one or multiple varieties in one tunnel? What do the multipliers do with the tunnels in times that there is low demand (e.g. dry season)? **Response**: The recommendation is one variety per net tunnel. It is actually a good way to maintain vines materials in the dry season and creates a means to maintain it over a dry season.

Temesgen Boscher: How can this be scaled up at the farmer level, because farmers are very poor? Can this be adapted? **Response:** This tunnel is meant for vine multipliers, NOT for individual farmers. So this is really a technology for vine multipliers.

Hugo Campos: Do we have experience using Charro/shade nets to reduce evapotranspiration in very dry areas? **Response**: We have not yet tested these net-tunnel in dry environment, but it does create a micro-climate that is favorable for maintaining moisture.

Jan Kreuze: When you harvest vines you just cut the plants, probably with time you get physiological ageing and less vigor. **Response:** Issues of physiological ageing has been observed. We have done an experiment where we have removed all old plants and replanted the same material to increase vigor.

Lembris Laizer: Do you have an inventory of DVMs who are using and benefitting from the technology? **Response:** The net tunnel (NT) technology is being used in three areas in Tanzania. We have information about drop-outs. We need to add an indicator whether DMVs are using NT technology in our Africa-wide M&E system that maps DVMs.

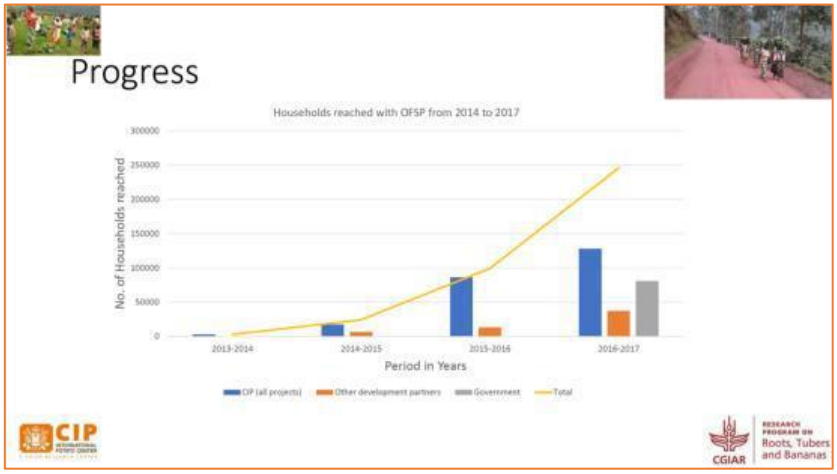
Jan Low: Even research stations have been taking up the NT technology, and there have been many ways in which the technology is being adapted and adopted. The big trade-off of this model and the larger, centralized vine isolation and multiplication site with low virus pressure also has to take into account the transport issues (cost and loss of viable vines). We must show the yield advantage at all levels of pre-basic, basic and DVM vine production and sales. **Craig Yencho**: Great work, in the US we have a pretty sophisticated seed system but we still struggle to provide quality vines to 100% of farmers. Sensitizing farmers on the number of cycles of production before you need new vines is vital.

Nessie: Virus inspection and management. When you close the tunnel, you are not allowed to open the tunnel until the vines are cut. How do we do inspection? **Response:** The vine multiplier can open the netting when necessary but make sure he sprays with insecticide after opening the net tunnel. Inspection of vine quality can be done from outside the net tunnel.

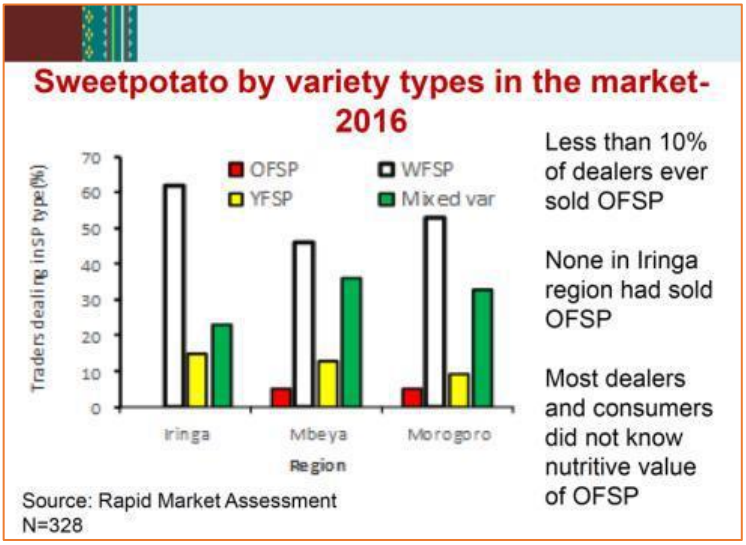
Thomas van Mourik: The cost-benefit calculation is based on the assumption that all vines will be sold, but in reality, this is often not the case. How to take this into account in the cost-benefit analysis and what percent of vines needs to be sold to break-even in the first production cycle? **Response:** Market is very important, so the key component included in training is the cropping calendar to make sure the material is available at the right time and combine the vine production with root production to spread risks.

SESSION 7: Making a Difference in the Tropical Highlands

Going national in Rwanda in close collaboration with government extension: **Kirimi Sindi's** highlighted the policy environment as being initially hostile with initial focus being put on cereals and pulses. Many farmers did not allocate land to sweetpotato due to postharvest losses. The approach entailed focusing on the nutrition component of OFSP - referred to in Rwanda as the Super Food project. The team worked in collaboration with the government and developed a locally based seed system. All partners involved including development partners were part of the planning. They adopted a value chain approach, conducted effective capacity development and trainings, made a business case for development of products, aligned with government policy requirements, designed simple behavior change communication messages while engaging the media. The project has reached 150,000 households.



Strengthening seed and root entrepreneurs in the southern highlands of Tanzania: **Fredrick Grant** highlighted the districts where VISTA was working, the objectives and targets. Prior to project implementation, a market survey was conducted. Emerging lessons from the intervention are as follows: OFSP still has low occurrence in the target districts, OFSP seed systems were still dominated by home saved seed, the market for OFSP planting material is still emerging. Uptake of OFSP will depend on aggressive promotion and sustained supply of planting material. More actors in seed system in Southern Highland Zone enlisted than before and will need support and follow up to grow, It is too early to make conclude on fresh OFSP root adoption since production is just picking up, and success will depend on what we do after VISTA Tanzania.



Breeding for cold tolerance and dual purpose in the East African Highlands:

Robert Mwanga shared the background and the progress made so far on breeding for cold tolerance. The key drivers are that population is growing and there is limited arable land. Growing dual purpose (leaves for forage and roots for food) sweetpotato is important in the highlands. Robert highlighted two examples of Kenya and Rwanda as good targets for selecting for dual purpose sweetpotato. The process involves germinating seed of new clones at low attitudes; then taking them to high attitudes; then advance those that survive. Five varieties in Rwanda are rating high/have the right attributes for dual purpose use. A similar process ongoing in Kenya and they will be released if they pass the national performance trials in early 2018.

Commercialization of OFSP value chain in Tanzania: **Jacqueline Mkindi** presented the Tanzania Horticultural Association (TAHA) case on commercialization of OFSP that could be scaled up. The aim was to demonstrate to the farmer that OFSP growing for export can be commercialized/money making venture. The company's OFSP commercialization strategy entailed: market research to identify strategic partners, signed contract to work together with a company in Israel. They also established a production and marketing company and identified a production model. TAHA sourced planting material from the bioscience laboratory in Arusha. Once contracted

farmer harvested 37 tons of OFSP. Yields ranging 35-40 tons per hectare are required by the buyer to make a deal. Average smallholder farmers harvest 7-10 tons per hectare. The company has a logistics wing that is the largest perishable handler in Tanzania. They already export fresh roots and have taken up OFSP value addition.

General discussion

Questions/comments for Kirimi Sindi:

Irish Aid representative Malread: commended the results and the work done in Rwanda for getting governments involved. This was a big opportunity for scaling up OFSP and ensuring food security in Rwanda.

Joyce Maru: Are there any specific policies influenced for ensuring sustainability? There's ongoing talk to revise the priority crops and OFSP will be included as a priority crop. Are we prepared for that? The impact of that would be huge and may not cope with the demand as a result.

Christine: There's need for good publicity. It should be possible for scientists to tell a good, factual and precise story to the media - in 250 words precisely the right message. **Response:** It's important to give the media a brief with the correct information which is their approach in Rwanda to ensure the the media are reporting accurately.

Jan Low: Clean planting materials are important. How do they ensure this is happening?

Participant from FCI: Can Kirimi share his experience relating to seed and the distribution. Key is to ensure as many DVMs as possible can access quality planting materials which is key for scaling up.

Hugo Campos: Acknowledged the importance of communication and awareness creations. We should not make assumptions. We should learn from Rwanda – as a very successful model

Questions/comments for Robert Mwanga:

Mihiretu Cherinet: We are interested in breeding for dual purpose in Ethiopia especially in the Northern highlands. The results seem to be very high than average per acre. Can the varieties available in Ethiopia that are already surviving above 2,000 meters above sea level survive in Kenya and Rwanda/highlands so that there's no need to reinvent the wheel. **Response**: in Kenya and Rwanda, testing is being done at a maximum altitude of 1800. Varieties in Ethiopia need further trials to test if they can perform well.

Graham Thiele: How do you prioritize when breeding for cold tolerance. Is it about the yield gain/economic analysis? **Response:** These are short term solutions. As for long-term solutions; we need to measure other parameters including the economic gains.

Have the breeders factored in climate change/how will that affect our economic analysis?

Response: Climate change – there will still be demand for cold tolerance varieties irrespective of the changes; so still important to still breed for cold tolerance.

Jan Low commented about the initial stages of the breeding for dual purpose process. She remarked that they tried breeding pure forage varieties; however, the farmers rejected the breeding for forage only varieties and preferred dual-purpose varieties. The milk industry in Kenya and Rwanda is very important in the agriculture value chain. Can we learn from Sunette Laurie (breeder in South Africa) about breeding for frost tolerance in South Africa? (follow-up with her directly).

Robert Mwanga: There are still challenges for making silage from sweetpotato. This is a great business opportunity.

Wolfgang: Peruvian winter very cold – could we explore their existing varieties that are already adapted? With respect to animal feed – making it palatable is important. Explore China case study in respect to animal feeds and why their model was not successful. Could learn lessons. Wolfgang feels pelleting is critical.

Questions/comments for Jacqueline Mkindi:

Hilda Munyua: How will you empower the smallholder farmers/growers? **Response:** Honduras experts will build local capacity as part of their ToR. TAHA will also establish a serious extension system.

Participant: This is a great example of developing something for export but what are benefits for Tanzania? TAHA targets 70% export 30% domestic consumption. **Response:** Project will work to trigger local market to encourage Tanzanians to consume OFSP. They will work particularly with women to ensure that they know how to cook OFSP, i.e. more innovative and creative with the recipes. TAHA's Gender and Nutrition department is already conducting training on recipes and value addition to various stakeholders.

Participant: How will TAHA export OFSP – by air or by sea and how long will it take. **Response:** By sea and it will take 19 days. This has already been tried and tested through their logistics company TAHA fresh.

Darkey: Can you share ideas with West Africa? **Response:** Later as the company grows.

Participant: How do you keep the volumes so high? **Response:** The package or the model ensures volumes are high, e.g. using irrigation is most helpful.

Temesgen - Why is it that some varieties did not pass the required criteria- you started with more than 3 varieties? **Response:** They have to align to the market requirements and specifications.

Participant: Are the three varieties that they are working with organically produced and is it a requirement for the export market? **Response:** TAHA is going the conventional way but ensuring compliance with standards as guided by the market. We also work with local authorities and experts from the Ministry of Agriculture to ensure compliance. They will develop training materials and document lessons learnt.

Alexandra Furtado: What's the business model for the nuclear farm? **Response:** It's a dual model including nuclear farm and smallholders through contracting farmers.

Kwame Ogero: Question for breeders – how do we deal with the varieties rejected for export in this case? Response: some of the available varieties preferred for export market are not preferred by the local market. Varieties with low dry matter varieties have the highest yields – preferred for export. Change of attitude required for local consumption. Jan followed up with a comment that varieties with Low dry matter are excellent for processing industry – they've excellent shapes preferred for processing. The linkage required is processing with the varieties that are not locally consumed. We need to focus more on how we can utilize these varieties through processing.

Kiddo Mtunda: Why is TAHA is not involving local experts in their design as they work with Israel. Also need to further analyze local varieties. **Response:** TAHA plans to work well with government colleagues. They are currently working with LGAs especially in capacity building.

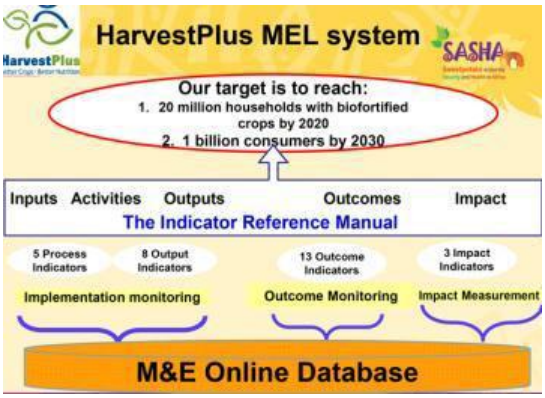
Sylvia Magezi: To what extent have you consulted CIP/what role can they play to drive this initiative forward? No need to reinvent the wheel. **Response:** TAHA consulted Jan Low when developing their business plan and visibility study. Would like to borrow expertise from CIP – will follow up later.

Participant: Do you use pesticides and how do you control pesticides residue? **Response:** TAHA uses integrated pest management practices (IPM). They follow government guidelines. Only those recommended by the market and WHO

Wolfgang: There are 2 varieties in competition – can they try a range of varieties already developed. At least another 4 varieties are available that are equally competitive.

SESSION 8: Capturing our Efforts

HarvestPlus global model for measuring beneficiaries: **Bho Mudyahoto** gave the vision and mission of HarvestPlus and also mentioned their goals which is to target 20 million households with biofortified crops by 2020 and a billion consumers by 2030 using the Theory of Change. By the end of 2016 more than 140 varieties – of 10 biofortified crops–had been released in over 30 countries worldwide & grown in 60 countries.



Challenges in measuring reach included: different variables, metrics and definitions, cost of getting data, complexity and multiplicity of players, data sharing in a multi-sectoral context, double or multiple counting. Key messages from this presentation included need for common variables, metrics, methods and tools; common databases and coordination for data sharing; data sharing and mainstreaming biofortification indicators at IP and adapting Monitoring, Evaluation, and Learning (MEL) systems for scaling up biofortification.

Capturing core information for projects with sweetpotato interventions: **Julius Okello** highlighted the goals of SPHI. They include reach 10M households by 2020, increase income by 15% and improve diet quality by 20%. An M&E manual has been developed by the CIP Monitoring, Learning and Evaluation team containing 10 modules. The manuals are applicable in vine dissemination, household surveys, yield estimation, among others. It's quite simple to use with ready to go questions. It is easily adapted to use in varied situations.

Questions for Bho Mudhyahoto:

How you measure nutrition across period? **Response**: we have geographic monitoring location to look at the outcome indicators on annual basis. We created random sampling frame for tracking outcome indicators.

What is the share of Africa in your total targets? **Response:** 18 out of 30 countries are from Africa. We have more than a half coming from Africa.

Is M&E model nutrition mapped at the country level to achieve target? **Response:** the main objective of this work is to bring mainstreaming of biofortified crops. We are closely working with FAO to mainstream biofortified indicators to align with national statistics. We also try to separate biofortified and non-biofortified crops. We are also advocating with government to integrate the bio fortified crops in the national statistics (Agricultural annual survey).

How will you account for the change in household size over time? **Response from Bho:** we use latest national statistics to get average household data at every point of the year. **Julius:** we also use same statistics. **Jan:** every donor requires different indicators and have resources. But there are some indicators that might be easily applied. M&E is an important aspect of the project and it is well recognized in the project. For example, we need to know how many HH are growing OFSP, and received vine by gender. We have categories exclusively bio fortified crops in the dietary diversity score. Because bio fortified crops are special due to the fact that they combined calories and micronutrient. So, if we don't do this, we will lose the impact on their dietary diversity. Therefore, our manual will incorporate these changes to capture the impact of biofortified crops on dietary diversity index. When working with partners, we must not to put too many indicators which might create low quality on the results as compliance will be difficult.

Questions for Julius Okello:

Every project has their own agenda and make their own database and different methods so how do we harmonize the database platform in the near future? **Response:** In order to define and measure SPHI indicators, we have developed an M&E manual through help of several organizations involved in achieving goals of SPHI. HKI, Farm Concern and HarvestPlus contributed to this manual. If we get standardized and harmonized data, we will be happy to work together.

SESSION 9: Panel Discussion on Building the Enabling Environment for Going-to-Scale

Panelists: Hilda Munyua, Kiddo Mtunda, Ibok Oduro, Margaret McEwan, Valerie Rhoe Davis, Graham Thiele
Moderator: Adiel Mbabu, CIP regional director for Sub-Saharan Africa

Key points made by the panelists:

Advocacy for biofortification: **Hilda Munyua** introduced the Building Nutritious Food Baskets (BNFB). BNFB's contribution to an enabling environment is as follows:

- Advocacy for policy change in Nigeria and Tanzania – for inclusion of statements on biofortification – to help prioritize biofortification in national policies, strategies and implementation plans. 5 policy documents given as examples, including Tanzania's National Multi-Sectoral Nutrition Action Plan for Prevention of Micronutrient Deficiencies and National Policy on Food and Nutrition in Nigeria.
- Advocacy to raise new investment to support programs and projects on biofortified crops (>$329,000) – from governments, private sector and development partners - Examples: FMARD – support to ARMTI; Government of the Republic of Tanzania;
- Awareness creation – a series of promotion and sensitization events on biofortified crops. Examples: Nane Nane show;
- A range of advocacy and communication materials developed – different formats;
- Built the capacity of national and regional advocates and champions from diverse backgrounds and institutions to support advocacy efforts (50 – 13 regional, 21 TZ, 16 NG);
- ToT manuals / updating OFSP manual – EYEWTKAS;

- SITAN study and advocacy strategies developed to guide advocacy efforts;
- Strengthened the capacity of national and community institutions to produce and consume biofortified crops - deliver ToT courses to secondary trainers along the value chains of the 4 crops and step down;
- Mainstreamed biofortification in national programs;
- Fast track the release of biofortified crop varieties;
- Strengthened the capacity of seed companies to ensure availability of clean planting materials, and processors – e.g. AFCO, Matoborwa
- Crop-specific platforms e.g. OFSP stakeholders' platform

Going for the long term: Integrating OFSP knowledge into the school systems: **Kiddo Mtunda** shared lessons on disseminating OFSP using primary school children in Tanzania and Uganda. Aim is to impart nutrition knowledge to school children who are future parents. The children provided a neutral ground and the vocational skills subject availed a great opportunity. Also, with poor extension services, children were instrumental in reaching more families. 75% of OFSP and 25% non - OFSP varieties were distributed. Children received a starter pack of 130 cuttings. Each variety had 30 cuttings. We had a ToT of the school teachers and also sensitized the communities. Demonstration plots were set up in schools and in the communities. Main achievements:

- We have reached 15 districts in Uganda and Tanzania, 156 primary schools (200 pupils in 156 schools), approximately 32,000 primary school children (grade 3 to 6).
- Intervention at policy level helped to facilitate enabling environment. Books for the school curriculum have been approved in Uganda and in Tanzania curriculum review is ongoing.
- Project has a culture of exchanging vines. Households received 120 vines and distributed 240 within 6 months to others.
- Reached 61,000 households through direct dissemination during two planting seasons in 2015 and 2016.

Institutionalizing the training of trainers course in Ghana: **Ibok Oduro** said that the ToT course has been conducted by KNUST twice in collaboration with CIP and CRI. The first course held in 2016 attracted 33 participants while the second one in 2017 had 18 participants. On completion of the course, a platform is set up for continued learning. Ministry of Food and Agriculture and NGO's are key partners. University students are part of the facilitators hence youth are part of the training and will continue with this initiative when we leave. A key opportunity arose when the new vice chancellor set up a short course center under his office. They have expressed interest to take up the ToT course and we are engaging on the same. Also, we have requested for land to grow OFSP from the horticulture department and the reception is quite positive. KNUST has allocated space for a snacking joint where we will sell OFSP snacks. We also set up a lot of exhibitions incorporating OFSP during graduation ceremonies reaching both students and parents. With CRI and partners, we will continue to step down the course. We are looking for sponsors as this is an expensive venture.

Stronger seed regulations: a help or a hindrance for getting quality seed to farmers: **Margaret McEwan** noted that building an enabling environment is crucial in reaching the remaining five million households as per the SPHI goal. Quality planting material is the first point of contact in reaching the target. Getting the seed and quality right is critical. In terms of the regulatory framework for seed, in SSA, over the last eight years, sweetpotato (roots and vines) is moving from the informal to the formal sector. We are becoming commercialized. We have many stakeholders with different perspectives at play. For instance, do farmers understand the importance of good quality seed and are they willing to pay? For the multipliers – what are the costs of getting to seed certification? We have challenges in terms of how current seed regulatory frameworks were developed vis -a-vis the nature of our crop (vegetatively propagated crops). For instance, centralized seed production may not be appropriate for sweetpotato yet current seed regulatory frameworks go for this.

Rationale for justification for isolation in vegetatively propagated crops is different from that of grain crops. Land size also matters. Land for isolation and to practice isolation is crucial for sweetpotato.

Therefore, we must determine whether it makes sense for farmers to use certified or quality declared seed. This means farmers must have better harvests when they use certified seeds and they should be linked to ready markets. For multipliers, what is the cost of production of quality seed and what are the barriers to registration and inspections? We must continue consultations using the right evidence base to ensure appropriate seed regulations for sweetpotato and other vegetatively propagated crops. We can lobby for QDS type approaches which allow for decentralized inspections which fit our seed production models and emphasizes the source of seeds. We should join other vegetatively propagated crops that face the same seed challenges as sweetpotato for stronger advocacy. Regulatory bodies don't have experience dealing with our crops, we therefore must continue building capacity of both multipliers and inspectors in the regulatory bodies. Also, we should continue building awareness and understanding of the benefits of clean seed, how farmers can maintain it and what is appropriate levels of regulation.

Integrating OFSP into CRS led multi-crop interventions and nutrition programs: **Valerie Rhoe Davis** highlighted that CRS' OFSP programming is tackling constraints across the value chain from the farm to the consumer with the intention of diversifying diets using vitamin A-rich foods that contribute to improved nutritional outcomes of individuals (children, women of reproductive age, orphans, and vulnerable children). Since 2010, Catholic Relief Services has incorporated OFSP into at least 12 projects spanning 8 countries: Ethiopia, Ghana, Kenya, Rwanda, Timor-Leste, Togo, and Zambia. Currently, there are six projects being implemented with numerous partners. Previous CRS-led projects focused on agriculture-specific innovations in production, storage, and marketing while ongoing projects have expanded their programming to focus on both agriculture and nutrition with vine dissemination, plant materials, crop management, and nutrition education. Although many projects support OFSP production and consumption on the farm, there is new activity beyond the farm, with direct support in OFSP processing and small business management.

For an organization like CRS to integrate OFSP into its integrated programming, there are 5 key points:

- There are competing demands for approaches and therefore, there is a need to sell the Idea of OFSP to those who are designing and implementing nutrition-specific and nutrition-sensitive programming.
- In order to sell OFSP to those designing and implementing projects, guidance should be developed that includes the following information
    - Evidence-base on its contribution to nutrition, marketability, etc,
    - 1-2 case studies,
    - List of training resources that are available with links
    - List of available tools/technologies/practices for each value chain player with links to resources
    - Vine dissemination: Location of vine disseminators and information on whether farmers are buying or being given clean planting materials
    - Varieties: information on what varieties are released by country and their characteristics (drought-tolerant, b-Carotene levels, dual purpose, etc)
    - Insights on scaling strategies, particularly on sustainable seed systems for vines and markets
    - Information on Country level status including policy environment, status of seed release, regulation, technologies tried and evidence on them in the country,
- Staff and partner capacity: Remember OFSP is integrated mostly into integrated, multi-sector programming or more nutrition focused programming so staff capacity will vary and so there is a need to increase staff capacity in OFSP production, storage, processing, and utilization of OFSP.

- Creating lesson plans for agriculture and nutrition field agents and volunteers similar to the Triple S brochures. This material needs to be simple and be designed for males and females who are illiterate and it should be available when needed.
- Provide evidence or guidance on making OFSP a business for our farmers including support for end processors to have viable businesses.

From the perspective of the roots, tubers and banana consortium research program: Graham Thiele highlighted RTBs scaling center stage phase II strategy. A scaling fund has been set aside – 1 Million USD targeting technologies for scaling. Entails a five stage plan:

- Make your technology visible. Clarify scaling readiness status, where are we on the scaling pipeline?
- Develop scaling strategies engaging scaling partners, and considering an enabling environment
- Learn about what scaling strategies work
- Build compelling evidence base and business case- does scaling add value? Powerful for advocacy
- Engage national and regional fora for foresight and priority setting such as appreciating the impact of climate change and urban growth on food production or the science agenda for Africa and CAADP processes.

Question and Answers:

Participant: How does BNFB strengthen capacity for advocacy? **Response from Hilda:** We identify champions and advocates who do the work. We train them, provide tools for them to do the advocacy. We include private sector, civil society, government and civil society
Participant: When building an advocacy strategy for Tanzania, did you involve the private sector
Response from Hilda: Yes, we did. Identified key partners.
Participant: How do you access impact of the work with school children? **Response from Kiddo:** We conducted a baseline survey prior to the start of the intervention, a midline survey and will do an impact assessment next year.
Srini: How do you assess readiness for scaling? **Response from Graham:** An innovation is only as scalable as its weakest link. We have avenue for tailored training.

The Going-to-Scale Panel (left to right): Hilda Munyua, Kiddo Mtunda, Ibok Oduro, Valerie Rhoe, Margaret McEwan, Graham Thiele (credit J. Low)

SESSION 10: Evaluation and Close of Meeting

Jan Low reiterated the gains made by the SPHI community in 2017 and the way forward for the remaining two years. Thereafter participants, under the guidance of Luka Wanjohi, SASHA data manager, undertook and evaluation of the meeting.

Introduction

The 2017 SPHI participants were requested to evaluate various components of the annual meeting namely: The exhibition, presentations at during the main technical meeting sessions and meeting organization and recommendations for improvement. A total of 76 participants responded to the evaluation call. 48.7% of these evaluations were submitted electronically via an Open Data Kit (ODK) web based form and 51.3% using paper.

Participation by age, gender and organization

The age of the participants at the 2017 meeting ranged from 28 - 66 years, with 4 respondents refraining from disclosing their age. Majority of the were between the age of 35-55 years at 61.8% of the participants (Fig. 10.1). Partition by the same age group in the previous year's meeting in 2016 stood at 62%. Participants below 35 years comprising of 10.5% only. 22.4% of the participants were above 55 years. There was an increase in the number of female participants at the 2017 meeting from 25% in the previous year to 38.2%. Majority of the participants indicated they were from research organizations, with those from other types of organizations such as development and private sector making up 25% of the total.

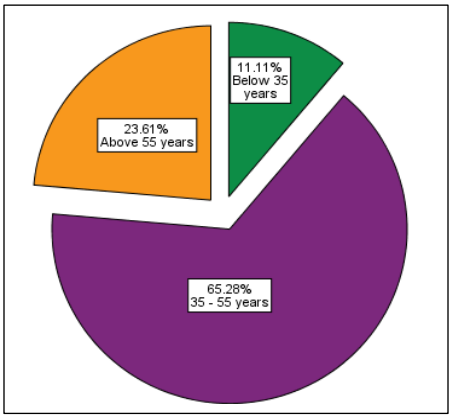


Figure 10.1 Participants' age distribution

Exhibition

Majority of the participants said the exhibition was either good or very good (Fig. 10.2). 5% of the participants said the exhibition was alright. 60.5% of the participants agreed completely that it was effective having the exhibition in an urban mall (Fig. 10.30. The exhibition was mentioned 20 times as one of the most useful parts of the meeting. 5 future improvements mentioned advertising the exhibition well in advance to increase public participation. Other recommendations related to the exhibition were to have the venue moved to more populous locations with a mix of both urban and rural populations. 14.5% of the total respondents did not attend the exhibition.

Figure 10.2 Rating of the Quality of the Exhibition

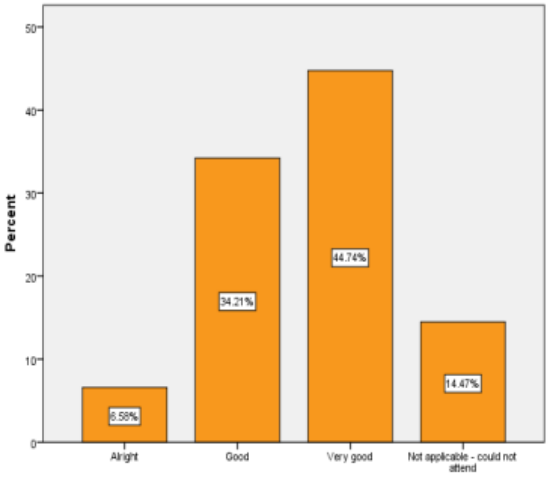
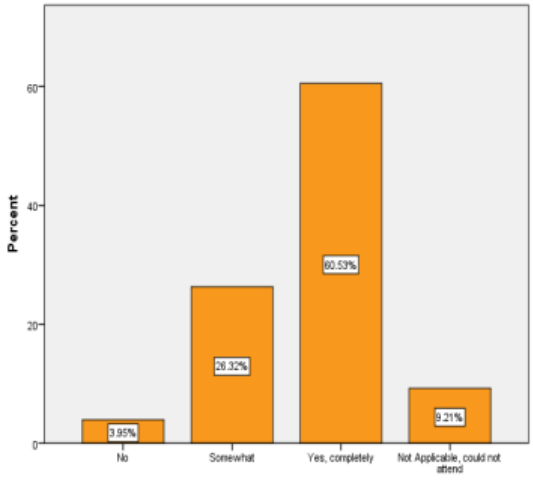


Figure 10.3 Effectiveness of being in an urban mall



Technical Presentations

Most of the participants agreed that the technical meeting had met their expectations, with 14.7% of the participants stating that the meeting had exceeded their expectations (Fig. 10.4). Equally, majority of the participants voted the quality of the presentations in terms of content as either good or very good (Fig. 10.5). Four respondents did not attend the first day of the technical meeting. All respondents participated in the second day of the technical meeting.

Figure 10.4 Rating on whether technical meeting mached expectations

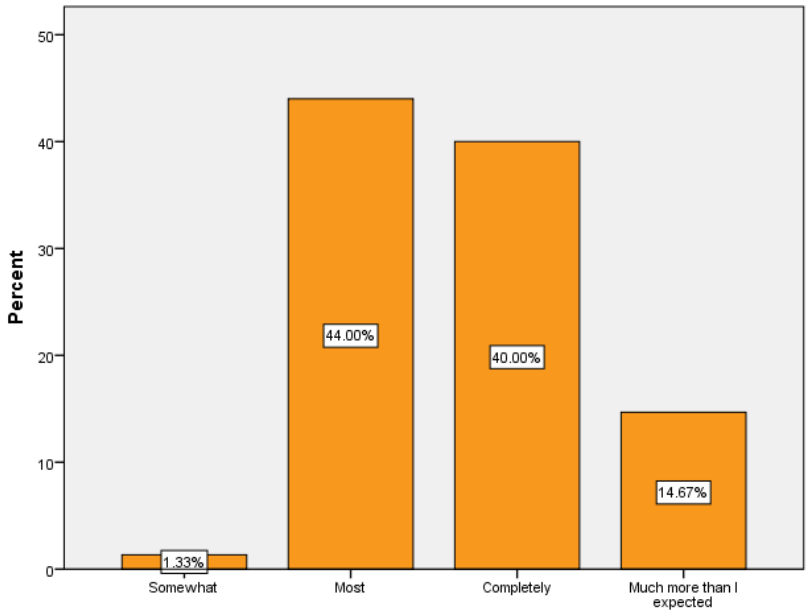
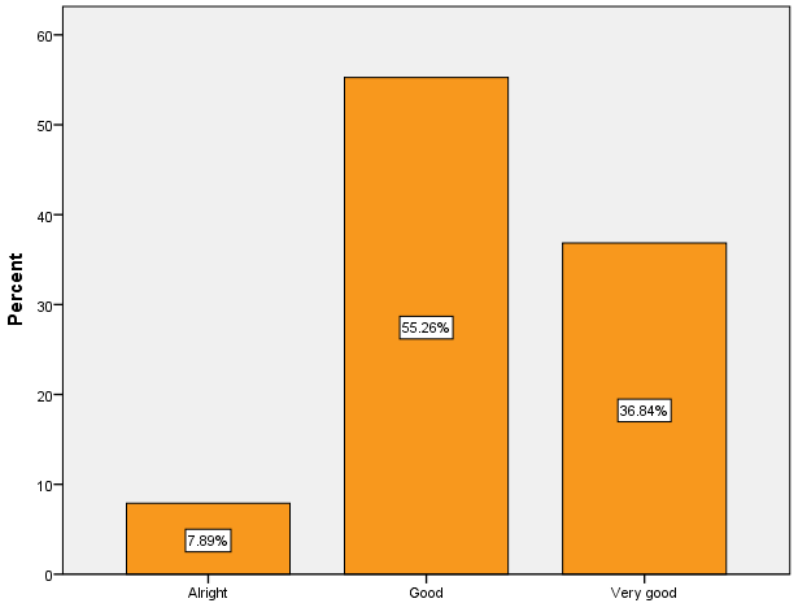


Figure 10.5 Quality of presentations in terms of content



Panels and Breeding World Café Sessions

Both panels and the breeding poster session were rated as either good or very good by most of the participants (Fig. 10.6). Only 1.3% of the participants rated the panel on getting processed sweetpotato products moving and the poster session on breeding as poor. The panel discussions received a total of 41 mentions as being the most useful parts of the meeting.

Figure 10.6 Panels and Breeding Poster sessions

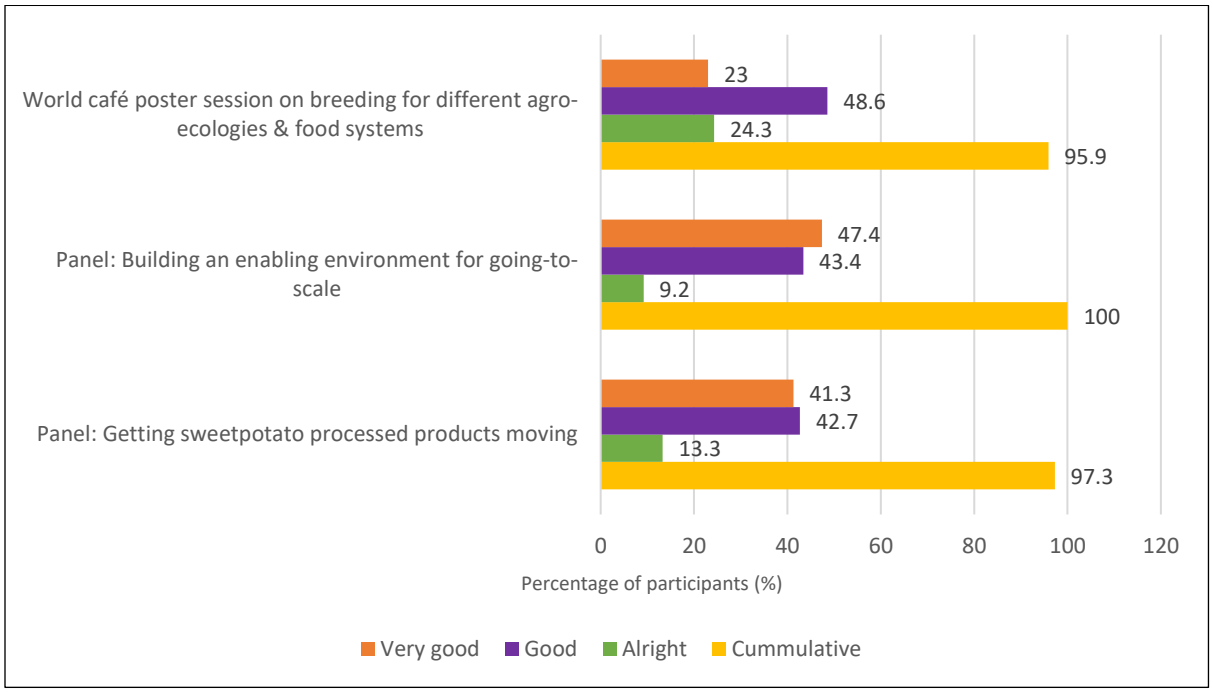


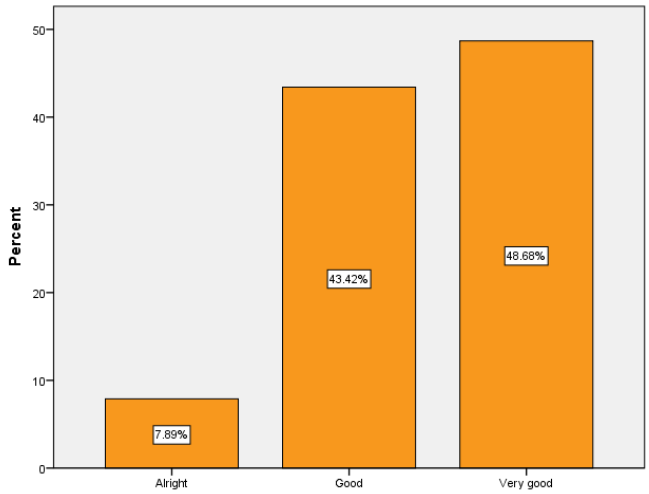
Figure 10.7 Tag cloud of most useful part of the meeting

The two panel discussions were clearly very popular. Figure 10.7 is a tag cloud generated from comments submitted by participants on the part of the meeting that they found most useful.

Meeting organization (logistics and communication)

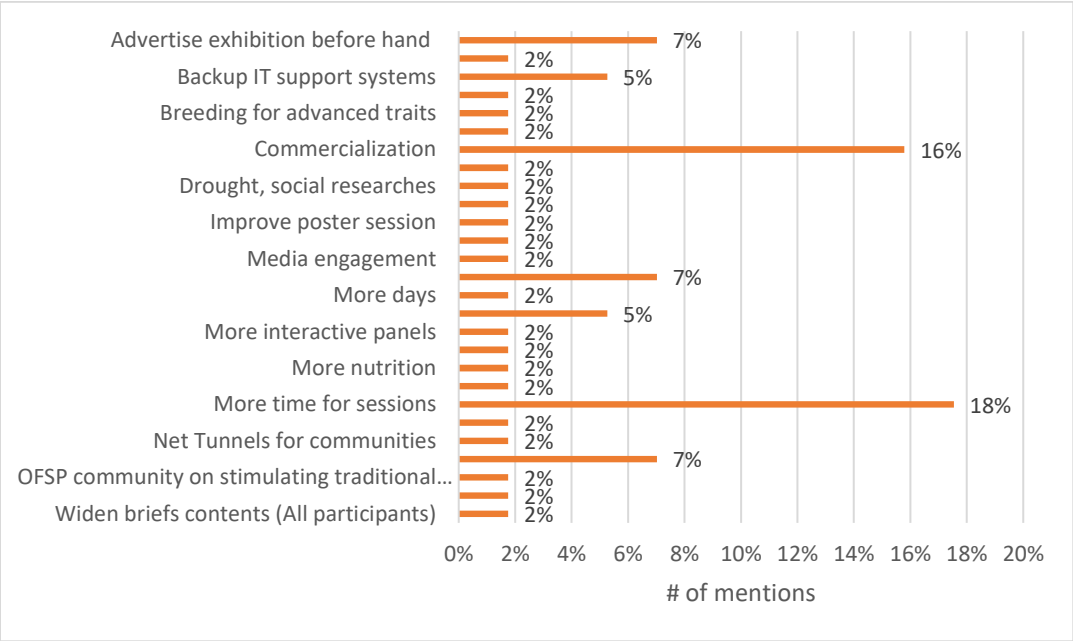
The majority of the participants rated the organization of the meeting as being at the very least good (Fig. 10.8). 7.89% of the participants thought the meeting organization was alright. Mixed reactions were received regarding the time management in the most useful parts, least useful parts and suggestions for improvement in the future. Some of the participants felt that the meeting was too short whereas others felt that the short meeting was good. Still on time management, one participant pointed out that the first day of the meeting was very long and packed whereas the second day was too short. Other participants called on presenters to stick to the allocated time in the future. The information technology support was noted by some of the participants as not being adequate and suggestions made on having a backup projector in place in the future.

Figure 10.8 Meeting organization rating



Suggestions for future improvements or topics for next meeting

Below is a summary on suggestions made by participants for future improvements:



Cocktail Party and Awarding of Communication and Best Photo Prizes

Tuesday evening, a cocktail party was held at the Ramada Resort. Graham Thiele, RTB Director, presented the Communication for Change Award of $500 to the team from HKI and Spring who produced a community video for OFSP promotion in French and English (Annex 4.2 for details). This award is also funded from the Excellence in Sweetpotato Endowment. In addition, the annual awards for the photo contest were awarded in 2 categories for distinct CIP and non-CIP participants (12 in all). The names of those receiving the photo contest cash prizes are provided in Annex 4.3 and the photos are posted on the Sweetpotato Knowledge Portal.

4 Annexes

4.1 Best Scientific Paper Award

Winner of the 2017 Best Sweetpotato Scientific Paper Award ($500), presented at the Annual Sweetpotato for Profit and Health Technical Meeting in Dar-es-Salaam, Tanzania.

Earnest Baafi, K. Ofori, E.T. Blay, V.E. Gracen, J. Manu-Adening, and E.E. Carey (2016). Exploitation of genetic potential of sweetpotato for end-user traits improvement. African Crop Science Journal, Vol. 24, No. 4, pp. 377 - 387 DOI: http://dx.doi.org/10.4314/acsj.v24i4.4.

Sweetpotato (Ipomoea batatas Lam) is a staple food globally, but it has remained underutilized resource in Ghana due to lack of consumer preferred cultivars. There is the need to develop staple-type sweetpotato cultivars which are preferred by consumers to increase sweetpotato use as a food security, health and industrial crop commodity in Ghana. This study was conducted to evaluate the breeding potential of sweetpotato germplasm for the development of farmer and consumer preferred varieties in Ghana. A total of 115 sweetpotato accessions were evaluated for genetic variability. Significant ($P<0.01$) differences were observed indicating genetic diversity. G x E was significant for all traits, except dry matter, sucrose, total sugar, and starch content. Phenotypic Coefficient of Variation (PCV) ranged from 4.78% for starch content to 63.40% for marketable root weight. Genotypic Coefficient of Variation (GCV) ranged from 4.07% for starch content to 55.35% for marketable root weight. Broad-sense heritability estimates varied from medium (0.61) to high (0.90) for all the traits, except for sucrose content. Predicted improvement over the means is 10 up to 105% for all traits, except starch (7.13%). This indicates sufficient useful genetic variation prospect which could be used to provide substantial improvement through selection of superior genotypes. The strong positive genetic association between dry matter and starch ($r = 0.71$), and strong negative relationship for sugar and dry matter ($r = -0.77$) and starch content ($r = -0.99$) indicates the possibility of developing non-sweet high dry matter sweetpotatoes, which are the preferred varieties in Ghana. Read it here.

4.2 Communication for Change Award

Tom van Mourik of Helen Keller International (HKI) regional office and Strengthening Partnerships, Results and Innovations in Nutrition Globally (SPRING) - Senegal, Albert Yéra Boubane – SBCC Advisor at SPRING-Senegal, Mariam Sy – Nutrition Advisor at SPRING-Senegal and Aliou Babou – Agriculture Advisor at SPRING-Senegal put together a video on the advantages of orange-fleshed sweetpotato (OFSP) that won this year's Communication for Change Award.

This is a community video conceived to encourage men and women farmers to try out and adopt orange-fleshed sweetpotato (OFSP) for improved nutrition and food security. As OFSP is new in this area, this is a video to get people curious and create demand for this crop. In Sibinokho village in the Kaffrine Region of Senegal, women have started growing and consuming a new kind of potato: the nutrient-rich orange-fleshed sweet potato (OFSP). This variety of potato is rich in vitamins A, B, and C, and is effective in reducing malnutrition. Using irrigation, the women in Sibinokho grow OFSP both in the dry season and rainy season. Plus, OFSP is a delicious addition to a variety of local dishes. Cheikh is a farmer, who gets introduced to OFSP by his aunt Mariam. She also shows him techniques for growing this special variety of sweetpotato and some delicious dishes that can be prepared with it. She also sensitizes Cheikh on the nutritional benefits of OFSP and how men can support women in securing a good harvest.

View at: English subtitles: https://www.youtube.com/watch?v=GZSJN_dgs04

4.3 Photo Contest

The photo contest had two themes:

Sweetpotato's Role in Food Systems: This category is aligned with the theme of this year's SPHI meeting: Building Resilient Food Systems with Sweetpotato. This category emphasized how sweetpotato fits with other crops in different production systems, how it is traded, and its diversified use in processed products and integration into traditional dishes.

Promoting OFSP for Health and Wealth: This category captured the myriad of events and innovative techniques being used to promote the consumption and diversified use of orange-fleshed sweetpotato.

There were two types of entrants in each theme:

1. International Potato Center (CIP) staff members
2. Partner organization members

View the winning photos at www.sweetpotatoknowledge.org
The top 3 photographs in each category won a cash prize:

- Winner: $120
- 2nd place: $70
- 3rd place: $45

Sweetpotato's Role in Food Systems:

CIP Winner: Mihiretu Cherinet
2nd place: Aime Ndayisenga
3rd Place: Gerald Kyalo

Partner organization winner: Dibi Konan
2nd place: Michelin Bruno
3rd place: Tanya Stathers

Promoting OFSP for Health and Wealth

CIP Winner: Tawanda Muzhingi

2nd Place: Benjamin Rakotoarisoa

3rd Place: Frezer Asfaw

Partner Organizations Winner: Laira Kyazike

2nd Place: Zena Mshana

3rd Place: Fortunata Mmari

People's choice award – Sam Namanda

4.4 Agenda

8th Annual SPHI - TECHNICAL AND STEERING COMMITTEE MEETING, RAMADA RESORT
DAR ES SALAAM, TANZANIA
Building Resilient Food Systems with Sweetpotato
TECHNICAL: 24-26 September 2017 Field trips: 27-29 SEPTEMBER 2017
STEERING COMMITTEE: 26 SEPTEMBER 2017 SASHA PAC: 27 SEPTEMBER 2017

Time	Subject	Responsible
24 SEPTEMBER 2017, SUNDAY		
	Participants arrive in Dar es Salaam. Transport from Airport to Hotel Arranged *if* we have your travel details.	Tassy Kariuki & Frank Ojwang
Noon-18 h	Sweetpotato Exhibition at the Mlimani City Mall: Highlights OFSP Utilization, Exhibitors are listed in Annex A	Lilies Gachanja & Frank Ojwang
	Transport from the hotel to the venue will be at 9 am for those involved in setting up booths and 11 am for those just attending the exhibition. Meet in the hotel lobby. There will be transport back and forth if needed during the exhibition.	
25 SEPTEMBER 2017, MONDAY		
8:00	Registration	Tassy Kariuki
Session 1	**Opening Session**	*Moderator: Aggrey Agumya (FARA)* *Rapporteur: Ted Carey*
8:15	Welcome to the meeting & overview	*Aggrey Agumya (FARA)*
8:30	Opening Address	Dr. Hussein Mansoor, Director of Research and Development Division, Ministry of Agriculture, Food Security, and Cooperatives
8:50	**Keynote:** Breeding and Seed Systems for Resilience for Different Food Systems in Tanzania & Implications for the East African region	Kiddo Mtunda (SRI)
9:20	Status of Sweetpotato in SSA Update	Julius Okello (CIP)
9:40	Improved Sweetpotato Knowledge Portal	Luka Wanjohi (CIP)
9:50	Questions on Session 1	
10:00	Health Break	
Session 2	**Post-harvest Advances**	*Moderator: Jan Low* *Rapporteur: Sarah Mayanja*
10:30	Storing fresh sweetpotato roots using evaporative cooking to reduce purée supply chain risks	Tanya Stathers
10:50	Achieving affordable shelf-storable OFSP purée without refrigeration	Tawanda Muzhingi
10:10	PANEL DISCUSSION: Getting sweetpotato processed products moving	*Moderator: Jan Low*
	Panel Discussants: Emmanuel Darkey (Ghana), Lucas Mujuju (Moz), Zena Mshana (BMC Products, TZ), Domana Metta (Perfect Foods), Antonio Magnaghi (EIL)	

Time	Subject	Responsible
11:45	Extending Access to Sweetpotato Roots using Stepped Pit Stores and Sand Boxes	Erna Abidin
12:00	Lessons learned from pilot market-led value chains in West Africa (Jumpstarting Project)	Souleimane Adekambi
12:30	Discussion	
13:00	Lunch	
Session 3	**The Challenge of Drought-Prone Areas**	*Moderator: Jude Njoku* *Rapporteur: Kwame Ogero*
14:00	Integrating vine survival and sprouting ability into breeding programs	Maria Andrade
14:15	Triple S: Why participatory testing & local adaptation is necessary	Mihiretu Cherinet & Tanya Stathers
14:35	Lessons learned from Scaling the Triple S technology in Uganda	Sam Namanda
14:55	Can understanding gender roles in different food systems help us to design better interventions in Ethiopia?	Birhanu Biazin
15:15	Discussion: What is still needed for Scaling up Triple S and Double S	Jude Njoku
15:30	Health Break	
Session 4	**Award and Listening to the Speedbreeders**	*Moderator: Hugo Campos* *Rapporteur: Godwill Makunde*
16:00	Awarding of the Best Sweetpotato Scientific Paper of 2016	Jan Low & Hugo Campos, chair of judging committee
16:10	Presentation of findings of Best Scientific Paper 2016	Dr. Ernest Baafi (CRI)
16:30	"World Cafe" Poster Session on Breeding Progress for Different Agro-ecologies & Food Systems	Breeders attending meeting & Vivian Atakos
17:00	Feedback session on breeding progress	
Session 5	**Learning from Experiences in Diverse Settings across Different Countries**	*Moderator: Anna-Marie Ball* *Rapporteur: Norman Kwikiriza*
17:15	Fostering CHANGE: Lessons from HKI's work in nutrition-sensitive agriculture across four diverse African settings	Mette Kinoti
17:30	Getting markets working for sweetpotato in different agro-ecological settings	Stanley Mwangi
17:45	Rapid market assessments in different settings in Tanzania: Can they help us target different food systems and value chain actors better?	Sarah Mayanja
18:00	Discussion	
18:15	Close of day 1	
26 SEPTEMBER 2017, TUESDAY		
Session 6	**The Challenge of Sustainable Seed Systems & Fighting Viruses in Bimodal Areas**	*Moderator: Margaret McEwan* *Rapporteur: Tom van Mourik*
8:15	Judging for the People's Choice for the Photo Contest	Lilies Gachanja

Time	Subject	Responsible
8:30	Developing, implementing and institutionalizing a sustainable business plan for pre-basic seed at KEPHIS	Florence Munguti
8:55	Speeding up Virus Removal: ClonDiag vs Grafting	Jan Kreuze
9:10	Lessons learned from scaling the net tunnel technology & the launch of a revised brochure	Kwame Ogero
9:30	Discussion	
10:00	Health Break	
Session 7	**Making a Difference in the Tropical Highlands**	*Moderator: Srini Rajendron* *Rapporteur: Joyce Maru*
10:30	Going national in Rwanda in close collaboration with government extension	Kirimi Sindi
10:50	Strengthening seed & root entrepreneurs in the Southern Highlands of Tanzania	Fred Grant
11:10	Breeding for cold tolerance and dual purpose in the East African Highlands	Robert Mwanga
11:30	Commercialization of OFSP value chain in Tanzania	Jacqueline Mkindi
12:00	Discussion	
12:30	Lunch	
Session 8	**Capturing our Efforts**	*Moderator: Kirimi Sindi* *Rapporteur: Srini Rajendran*
13:30	HarvestPlus global model for measuring beneficiaries	Bho Mudyahoto (HarvestPlus)
13:50	Capturing core information for projects with sweetpotato interventions	Julius Okello & Temesgen Bocher
14:10	Discussion	
Session 9	**PANEL DISCUSSION: Building the Enabling Environment for Going-to-Scale**	*Moderator: Adiel Mbabu* *Rapporteur: Vivian Atakos*
14:30	**Panel members:**	
	Advocacy for Biofortification	Hilda Munyua
	Going for the long term: Integrating OFSP knowledge into the School System	Kiddo Mtunda
	Institutionalizing the Trainers of Trainers course in Ghana	Ibok Oduro
	Stronger seed regulations: a help or a hindrance for getting quality seed to farmers	Margaret McEwan
	Integrating OFSP into CRS led multi-crop interventions and nutrition programs	Valerie Rhoe Davis
	From the Perspective of the Roots, Tubers and Banana Consortium Research Program	Graham Thiele
15:30	Evaluation and Closing	Jan Low
15:45	End of Meeting	
16:15-18:00	**Closed Session Meeting for Members of the SPHI Steering Committee**	**Jan Low and Aggrey Agumya** **Ramada Resort**
19:00	Cocktail Party & Awards	Tassy Kariuki

Time	Subject	Responsible
	Awarding the Communicating Change Prize for 2016	Graham Thiele will announce the winner: HKI and Spring team
	Awarding the Winners of the 2017 Photo Contest	Vivian Atakos will announce the winners
27 SEPTEMBER 2017, WEDNESDAY		
8:30-noon	**SASHA Project Advisory Committee Meeting: Closed meeting for PAC members only**	Anna-Marie-Ball, Chairperson Ramada Resort- Room to be announced
7:00-Noon	Depart for Field Trip to Kibaha: Participants list shown in Annex B	Contact Tassy Kariuki (t.kariuki@cgiar.org) for info
14:30-18:30	Depart to Field Trip to Morogoro: Participants list shown in Annex C	Contact Tassy Kariuki
28 SEPTEMBER 2017, THURSDAY MOROGORO FIELD TRIP		
08.00	Travel to FCI in Kilosa DC	
09.30	View sweetpotato work at FCI village in Kilosa DC	Winston Mwombeki (FCI)
11.00	Travel to Gairo town	
11.30	Courtesy visit Gairo DC authorities (DAICO, DED, DC)	
12.30	Packed lunch (from Arc Hotel or Nashera Hotel)	
13.30	Travel to Madege village	Fred Grant and Haile Okuku (CIP)
14.15	View CIP sweetpotato activities	
16.30	Travel back to hotels in Morogoro	
29 SEPTEMBER 2017, FRIDAY MOROGORO FIELD TRIP		
08.30 – 12.00	Travel back to Dar es Salaam	Tassy Kariuki

4.5 SSC and PAC Members Attending Meeting

	First Name	Last Name	Gender	Title	Institution	Country	Telephone number	Mobile number	Email	Skype
1	Adiel	Mbabu	M	Regional Director	International Potato Center (CIP)	Kenya	+254 711860964	254 711860964	a.mbabu@cgiar.org	
2	Aggrey	Agumya	M	Director, Corporate Partnerships and Communications	Forum for Agricultural Research in Africa (FARA)	Ghana	+233 302 77 2823	+233 242 976 132	aagumya@faraafrica.org	aggrey.agumya
3	Andrew	Westby	M	Director	Natural Resources Institute	UK	+44 1634 883478		'A.Westby@greenwich.ac.uk'	andrew.westby
4	Anna-Marie	Ball	F	Director	HarvestPlus	Uganda		+254 774016909	A.Ball@cgiar.org	
5	Barbara	Wells	F	Director General	International Potato Center (CIP)	Lima			cip-dg@cgiar.org	
6	Christiane	Gebhardt	F		Max-Planck Institute of Plant Breeding Research	Germany	+ 49 (0) 2253 545413		gebhardt@mpipz.mpg.de	
7	Craig	Yencho	M	Lead PI	NC State University	USA	+ 1 919 513 7417	+1 919 218 0618	craig_yencho@ncsu.edu	
8	Graham	Thiele	M	Director	RTB	Lima	+51 (1) 3496017		g.thiele@cgiar.org	
9	Hugo	Campos	M	Director Research	International Potato Center (CIP)	Lima	+51 (1) 3496017		h.campos@cgiar.org	
10	Ibok	Oduro	F	Provost	Kwame Nkrumah University of Science and Technology	Ghana	+233 32060312	+233 244288315	ibok.oduro@gmail.com	
11	Jan	Low	F	Principal Scientist, SASHA Project manager	International Potato Center	Kenya	+254 20 422 3601	+ 254 705 813 707	J.LOW@CGIAR.ORG	janhigh2
12	Jim	Lorenzen	M	Senior Program Officer	Bill and Melinda Gates Foundation (BMGF)	USA	+ 206 770 2284	+1 206 661 3491	jim.lorenzen@gatesfoundation.org	
13	Louise	Horner	F	Livelihoods Adviser	DFID	UK			L-Horner@dfid.gov.uk	
14	Mairead	Petersen	F	Regional Nutrition Advisor	Irish Aid	Malawi		+265 997306855	Mairead.Petersen@dfa.ie	
15	Meghan	Anson	F	BFS Nutrition Advisor	USAID	USA			manson@usaid.gov	
16	Mette Kjaer	Kinoti	F	Vice President, Africa	Hellen Keller International	Senegal	+221 338691063	+221 771210144 /'+254	m.kinoti@hki.org	mkinoti1
17	Stanley	Mwangi	M	Associate Director	Farm Concern International	Kenya	+254 715 408650	+254 715 408650	stanley.mwangi@farmconcern.org	stanley.mwangi
18	Valerie	Rhoe Davis	F	Senior Technical Advisor, Agriculture - Gender and Nutrition	Catholic Relief Services	USA	+ 1 4443 955 7192	+ 1 703 568 1949	valerie.davis@crs.org	Valerie.Rhoe

4.6 List of General Participants in Meeting

	First Name	Last Name	Gender	Title	Institution	Country	Telephone number	Mobile number	Email	Skype
1	Abdul	Naico	M	Monitoring and Evaluation Specialist- OFDA Project	International Potato Cent	Mozambique	+258 21461620	+258 829849584	A.Naico@cgiar.org	
2	Aime	Ndayisenga	M	Communication Specialist	International Potato Center	Rwanda	+250 788500086	+250 788342131	A.Ndayisenga@cgiar.org	aimendayisenga
3	Alessandra	Furtado	F	Head of PMU	International Potato Cent	Kenya	+254 20 422 2656	+254 734074162	A.Furtado@cgiar.org	
4	Anafrida	Bwenge	F	Agricultural Development Officer	USAID	Zambia	+260-211-357000	+260 969 341 078	abwenge@usaid.gov	
5	Anania	Bansimbile	M	Regional Agronomist	Tanzania Horticultural Association	Tanzania	+255 27 254 4568	+255 784 588223	anania.bansimbile@taha.or.tz	
6	Antonio	Magnaghi	M	CEO & Application director	Euro Ingredients	Kenya	+254 722700665	+254 721 782767	antonio@euroingredients.net	gelatoking
7	Benard	Yada	M	Breeder-Genetist	National Crops Resources Research	Uganda		+256 772 889069	yadabenard21@gmail.com	
8	Benjamin	Rakotoarisoa	M	Project manager	International Potato Centre (CIP)	Mozambique	+258 862462416	+258 825464912	b.rakotoarisoa@cgiar.org	
9	Bho	Mudyahoto	M	Head-Monitoring and Evaluation (Global)	HarvestPlus	Uganda	+256 778395530	+256778395530	B.Mudyahoto@cgiar.org	bho.muyahoto46
10	Birhanu	Biazin	M	Value Chain Specialist	International Potato Centre (CIP)	Ethiopia		+251 916829891	B.Temesgen@cgiar.org	
11	David	Charles	M		USAID	Tanzania			dcharles@usaid.gov	
12	Dawit	Sahlu	M	Project manager	People in Need	Ethiopia	251 462 124024	+ 251 91686140	dawit.sahlu@peopleinneed.cz	dawitsahlu
13	Domana	Metta	F	Group Director	Perfect Farm Group	Tanzania	+255 2752964	+255 754 286 160	domanam@yahoo.com	
14	Dorothy	Magesse	F	Nutrition & Social Inclusion Director	Feed the Future Tanzania	Tanzania	+255 22 2773313	+255 628 092 808	dmagesse@fintrac.com	dorothy.magesse
15	Edward	Carey	M	Ghana Country Manager /Regional SP Breeder	International Potato Center	Ghana	+233 546938599	+233 546938599	E.Carey@cgiar.org	
16	Eliah	Munda	M	Sweetpotato Senior Agronomist	International Potato Center	Mozambique		+258 826650495	E.Munda@cgiar.org	eliah.munda
17	Emmanuel	Darkey	M	CEO	Emmanuel Darkey & Asso	Ghana	+233 242 627197		kwakudarkey@gmail.com	
18	Epson	Luhwago	M	The Guardian Limited	Chief Sub Editor	Tanzania		+255 786 777177	mdunde@gmail.com	
19	Erin	Smith	F		HKI-Tanzania	Tanzania			ESmith@hki.org	
20	Ernest	Baafi	M	Research Scientist	CSIR - Crops Research Institute	Ghana	+233 322060389	+233 244 155180	e.baafi@gmail.com	
21	Felistus	Chipungu	F	Project Leader - RTC - Action Malawi	International Potato Centre (CIP)	Malawi		+265 999933411	F.Chipungu@cgiar.org	felistus.chipungu
22	Florence	Munguti	F	Officer-In-Charge	Kenya Plant Health Inspectorate	Kenya	+254 720 805493	254 720 805493	fmunguti@kephis.org>	
23	Frank	Ojwang	M	Senior Procurement Officer	International Potato Center	Kenya	+254 020 422 3640	+254 722 470854	F.Ojwang@cgiar.org	
24	Frederick	Grant	M	Acting Country Manager/Project	International Potato Centre (CIP)	Tanzania		+255 699 88 44 88	F.Grant@cgiar.org	
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4.7 Speech of the Guest of Honor for Opening SPHI Meeting

SPEECH OF GUEST OF HONOUR DR HUSSEIN A. MANSOOR, DIRECTOR OF RESEARCH AND DEVELOPMENT. MALF, AT THE OPENING THE 8TH ANNUAL SWEETPOTATO FOR PROFIT AND HEALTH INITIATIVE MEETING HELD AT RAMADA HOTEL IN DAR-ES-SALAAM, TANZANIA ON SEPTEMBER 25TH, 2017

Chairperson,

Representatives of CIP, Development partners, distinguished public scientists from 13 African countries, National and International Organizations (NGOs and research) involved in sweetpotato activities, private sector processors, Meeting Organizers, Distinguished guests, Workshop Participants,

Ladies and Gentlemen: I am greatly honored to officially open this 8th annual sweet potato for profit and health initiative technical meeting. I take this opportunity to welcome you to Tanzania, a country famous for its game parks, attractive beaches and the tropical spices of Zanzibar. Fifty-two million people live in Tanzania, and our port city Dar-es-Salaam, with a population of 4.3 million, is the largest. Over 100 languages are spoken in Tanzania, but Swahili is our national language—Karibuni.

Ladies and Gentlemen: This is the 8th Annual Sweetpotato for Profit and Health Initiative Technical Meeting. I am informed that it is bringing together over 100 participants representing 16 Sub-Saharan African countries and scientists from Germany, Peru, the USA and the UK. The theme of this meeting is Building Resilient Food Systems with Sweetpotato. It is a timely theme as our world is growing in complexity and uncertainty. Most countries in SSA are seeing rapid urbanization, which changes the food mix and food demand outlook, and unexpected shocks like drought that are becoming at times expected shocks. Resilience is that ability to manage change, both expected and unexpected, understanding the biophysical, economic and social processes that are affected and reacting to changing situations. Sweetpotato's ability to fit into a range of different agro-ecologies and its ability to use water efficiently makes it a key ally in building resilient food systems.

Ladies and Gentlemen: Tanzania is an agricultural country. Agriculture accounts for almost 29% of GDP and employs two-thirds of our workforce. While maize, rice and cassava are the most important food crops, sweet potato is rising in its importance, with 3.5 million tons produced in 2014. According to FAO, Tanzania is now the second largest sweetpotato producing country in SSA after Nigeria. Sweetpotato is a critical crop for our food security. Increasingly, we have been recognizing how important it is for building a nutritious, resilient food supply. I am pleased to learn that there are several Tanzanian processing companies attending this meeting and the exhibition yesterday. Creating new products with a crop that all categories of farmer's can grow is an excellent way to reach our growing urban populations and generate income for them.

Ladies and Gentlemen: We particularly recognize the contribution that the pro-vitamin A rich orange-fleshed sweet potatoes can make in Tanzania. At a national summit on food fortification held just last month, in her opening remarks the Vice President of the United Republic of Tanzania - Her Excellency Samia Suluhu Hassan, noted that no country in the world can achieve sustainable development without having in place a vibrant nutrition programme. She emphasized that micronutrient malnutrition was a huge problem in Tanzania, despite the economic growth of 7 percent. She said "The fight against deficiencies in micronutrients and malnutrition needs multi-sectoral efforts." and remarked that "It is a pity that even in areas of the country where there are always bumper harvests, the magnitude of stunting and anaemia are still very high. This is so true: In 2016, we found the prevalence of stunting among our children under 5 years of age was 42%, which is an unacceptably high figure. Only 9% of our children 6-23 months of age have a minimum acceptable diet.

Ladies and Gentlemen: One-third (33%) of our children under five years of age and 42% of women of reproductive age are vitamin A deficient (TDHS, 2010). The WHO and FAO of UN define fortification as "the practice of deliberately increasing the content of an essential micronutrient. The goal is to improve the nutritional quality of the food supply and to provide a public health benefit with minimal risk to health". When most consumers think of fortification they think of the food industry adding vitamins and/or minerals to a processed food product. But her Excellency Vice President noted the challenge of access to industrial fortified foods by the rural population, and called upon Government officials and other actors to cooperate with fortification stakeholders to provide nutrition education to the population in a coordinated manner. She further emphasised the importance of making available varieties of crops of bio-fortified nutritious staples to rural communities to complement industrial fortification efforts.

Ladies and Gentlemen: Given the significant and complementary role of biofortification in addressing hidden hunger, the Tanzania Food and Nutrition Center considered it necessary to revise the terms of reference of the National Food Fortification Alliance, established in 2003 to oversee implementation of food fortification initiatives in Tanzania. With support from the CIP-led Building Nutritious Food Baskets project and other partners, the terms of reference of the National Food Fortification Alliance, were revised to include biofortification. Since 2012, six other major national policy and strategy documents on agriculture development and nutrition have included biofortification. These include

i. The National Agricultural Policy of 2013,
ii. Agriculture Sector Development Strategy II (ASDS-II) of 2014,
iii. Agriculture Sector Development Programme II (ASDP-II) of 2016,
iv. National Multisectoral Nutrition Action Plan (NMNAP) (July 2016-June 2021),
v. The Tanzania Food and Nutrition Policy (2015) and,
vi. The 5-year strategy for the Ministry of Agriculture, Livestock and Fisheries (2016-2020)

At the present time in Tanzania, we have orange-fleshed sweetpotato with high-iron beans and orange maize in the pipeline. OFSP are being promoted and produced in 48 out of 169 districts in Tanzania that is 28% of the total. They could be and should be expanded to almost all districts.

Ladies and Gentlemen: With 44% of Tanzania's population under 15 years of age, as we think about sweet potato's role in resilient food systems, we must think about the best strategies for engaging youth along the sweetpotato value chain.

With the potential for agro-processing as demonstrated at the Exhibition yesterday, there is tremendous scope for involving even youth with limited land access in production as well as in trade and processing ventures. Youth are often more willing to try new things and are conscious about their looks and health. This means investing in sweetpotato's image and especially in the image of orange-fleshed sweetpotato as a health food for all—young and old, rural and urban, and rich and poor consumers will have quick returns.

I congratulate CIP and all collaborating partners for effective implementation of this project. With this note, I have pleasure to declare that the 8th annual sweet potato for profit and health initiative technical meeting is officially opened. I wish you fruit full deliberations.

Thank You

Akhsanteni Sana

4.8 Field Visit Guides

Agenda for field visit to SRI Kibaha during 8th Sweetpotato for Profit and Health Initiative (SPHI) Meeting

Wednesday, 27th Sep 2017	
Time	Presentation / Visit
07.00-08.30	Travel to Kibaha research station
08.30-11.00	View primarily sweet potato work at SRI Kibaha – pre-basic seed production
11.00-13.00	Depart SRI Kibaha to Afco Investments / Airport
13.30-14.30	View processing of SP products at Afco Investments factory (Mbagala)
	Depart for Morogoro/ Airport

SUGARCANE RESEARCH INSTITUTE – KIBAHA (SRI-KIBAHA)
Sweetpotato pre-basic seed at SRI-KIBAHA

In 2014/15, the Sugarcane Research Institute (SRI) at Kibaha received project funds from International Potato Centre's SASHA II project to implement a three-year (2014/15 to 2016/17) project on sustainable production of pre-basic seeds in Tanzania. For the first two years, we implemented the project in two sites of Kibaha and Ukiriguru mainly to serve Eastern Agro-ecological Zones and Lake Zone, respectively. We started by undertaking maintenance and repair of infrastructure such as screen houses, water storage tanks and water networks.

Our main aim was to be a reliable source of pre-basic seeds for released sweetpotato varieties with special focus on orange-fleshed sweetpotato (OFSP) ensuring vine multipliers have access to clean planting materials, free from viruses and other diseases. The starter materials are sourced from a private tissue culture lab in Arusha and Kenya Plant Health Inspectorate Services (KEPHIS) in Kenya. Some of these varieties are Mataya, Kiegeya, Polista, Kakamega, Ejumula among others. Due to high demand, requests from multipliers in Central and Southern Highlands Agro-ecological zones forced SRI - Kibaha to also supply in these zones before we established another production center at Agricultural Research Institute (ARI) Uyole.

Production of Pre-Basic seeds in screenhouses at SRI-Kibaha

To make the supply system sustainable, we used the project to track production costs and incomes for developing a Business Model (BM) that will be used to run production and supply activities as businesses after the end of the project. To date, the project has accomplished the following:

- Sold 787,647 (79%) cuttings. Kibaha sold 250,843 of these
- Trained 96 multipliers (42 were trained at Kibaha) in good agronomic practices for seed multiplication.
- Developed two draft business models (one for Kibaha and one for Ukiriguru),
- Created awareness on importance of OFSP and seed availability through Radio, TV, banners, leaflets, farmer field days and agriculture shows.
- Lessons from this project has been presented at conferences within the country and at the international level. For example, the importance of using clean planting materials compared to those not clean were presented at the 13th International Symposium of the International Society for the Tropical Root Crops-Africa branch.

The work has been successfully undertaken with other partners namely, Tanzania Official Seed Certification Institute (TOSCI) and Mikocheni Agricultural Research Institute (MARI). The plan is to continue with multiplication of clean seeds in the form of businesses under full support from the Institute (SRI-Kibaha).

AFCO Investment Co. Ltd

This is a private food processor based in Temeke, Dar-es-Salaam. They process OFSP flour, pro-vitamin A (PVA) maize flour, and other composite flour for distribute to clinics to other network of distributors across the country and sold in supermarkets such as TSN Supermarket, Home Supermarket, Shop & Save, Price Right, Pick & Pay, J. Mall Samora, etc.

Agenda for field visit to Morogoro during 8th Sweetpotato for Profit and Health Initiative (SPHI) Meeting

	Wednesday, 27th Sep 2017
2.30 pm	Depart for Morogoro
18.30-19.30	Check into hotels in Morogoro
	Thursday, 28th Sep 2017
07.30 – 09.00	Drive to Sokoine University Graduate Entrepreneurs Cooperative (SUGECO) to view sweetpotato work by SUA and CIP
09.00 – 10.30	Travel to FCI village in Kilosa DC
10.30 -12.00	View sweetpotato work at FCI village (Mtumbatu): observe SP farm and observe SP market in Mtumbatu
12.00 – 12.30	Travel to Gairo town
12.30 – 13.30	Courtesy visit Gairo DC authorities (DAICO, DED, DC)
13.30 – 14.30	Packed lunch
14.30 – 15.15	Travel to Madege village
15.15 – 17.30	View CIP sweetpotato activities: adaptive storage structures, seed conservation and bulking site
17.30 – 19.00	Travel back to hotels in Morogoro
	Friday, 29th Sep 2017
08.30 – 12.00	Travel back to Dar es Salaam

Sokoine University Graduate Entrepreneurs Cooperative (SUGECO)

1.0 Introduction

SUGECO is a cooperative founded in July 2011 championed by a group of 40 founder members undergraduate & post-graduate students and academic members of staff from Department of Agricultural Economics and Agribusiness (DAEA) and registered under Tanzania Cooperative Act No. 20 of (2003). Currently SUGECO has over 500 members spread all over Tanzania and engaging in various agribusiness entrepreneurial activities. The main goal of SUGECO is to make a difference in the minds of youth, communities and graduates from higher learning institutions towards enterprise development for self-employment, agribusiness development, job creation, community development, and economic prosperity.

Organization's Goal

The main goal for the organization is to make a difference in the minds of community and graduates from higher learning institutions to develop private business for self-employment and job creation in the Agribusiness sector and support community development for economic prosperity. Innovation in minds, acts and actions are what SUGECO is to pursue.

2.0 PLANNED ACTIVITIES TO VISIT

Presentation – SUGECO and its Product Development Lab	Short presentation about SUGECO and its product development Lab
OFSP Seed Multiplication Site and other demo farms	Demo farms for OFSP seed multiplication and the site developed by VISTA showing different OFSP seed varieties
Drying Technology for OFSP and food products	Solar dryer at SUGECO incubation center used for drying OFSP produce
SUGECO Processing Centre	Visit processing facilities and see equipment used to make different products from OFSP
OFSP Product packaging Centre & Packed products	See packaging areas and packaged products e.g. OFSP Nutritious formulation flours, Biscuits, juice made of OFSP, etc.
OSFP Storage Sample	Developed sample technologies for OFSP and other root crops used to improve shelf life of the produce

FARM CONCERN INTERNATIONAL

Kilosa & Gairo Commercial Zones (SeFaMaCo Programme)

Farm Concern International (FCI) is implementing the Integrated Value Chain Development and Smallholder Farmer (SHF) Commercialization of Banana & Sweetpotato in 19 districts of Tanzania. The Seed-Farmer-Market and Consumer (SeFaMaCo) programme, funded by the Bill & Melinda Gates Foundation, intends to optimize profitability and productivity by catalyzing market oriented value chain-wide competitiveness and investments in sweetpotato for increased household incomes. In Kilosa and Gairo Commercial Zones (COZO), the programme has established 51 Commercial Villages. Smallholder farmers have commercialized 4,953.5 ha of Sweetpotato producing a total of 39,780 metric tons annually and sales worth USD 7,232,738.4 facilitated through the Commercial Villages.

FCI staff during commercialization campaign in Morogoro

Mtumbatu Village is one of the 51 villages within Mtumbatu Ward in Kilosa district with 1,270 households. The main market in the region is Mtumbatu Market where a Sweetpotato Aggregation Centre has been established and operates throughout the week. The Mtumbatu

Market has over 60 Sweetpotato wholesale buyers and 23 women (Mama Lishe) who sell food to the market. During peak season, which is from April to October, over 34MT of sweetpotatoes are sold per day. During off season, which is from November to March, the average sale is 5MT per week. FCI has created partnerships with wholesale buyers and mobilized them to form a buyers' association which is enabling them to source commodities as well as access other services from the government and private sector partnerships.

The Mtumbatu Village has one primary school with a population of 1,328 pupils where FCI, through SeFaMaCo programme, has provided support in various areas such as capacity building on the nutritional value of sweetpotato, cooking demonstration, and diverse products of sweetpotato. Additionally, FCI has conducted several trainings on market linkages, leadership and capacity building sessions on Good Agronomic Practice (GAP).

During this visit, the team will observe a sweetpotato farm by a model farmer and also visit the Mtumbatu Market to observe sweetpotato trading and interact with sweetpotato traders.

Bulking of commodities enables farmers to reduce logistical costs making Commercial Villages attractive business partners.

INTERNATIONAL POTATO CENTER

Viable Sweetpotato Technologies in Africa - Tanzania Project

The International Potato Center (CIP) is implementing "Viable Sweetpotato Technologies in Africa – Tanzania Project" (VISTA-Tanzania) in Morogoro (Gairo and Ulanga districts), Iringa (Iringa and Mufindi districts) and, Mbeya (Wanging'ombe, Mbozi and Chunya districts) regions of Tanzania. The seven districts are within the USAID/Tanzania Feed the Future's Zones of Influence (ZoI). The project is implemented in 170 villages across the seven districts with Mufindi district having the least (21) and Mbozi the highest (27) number of project intervention villages. The project has already directly benefited slightly more than 21,000 households as planned and has met more than 95% of the critical targets in all the four project objectives. In Gairo district, the project is implemented in 25 villages.

Gairo district was chosen for this visit because of its proximity to Morogoro town and hence, Dar-es-Salaam. Sweetpotato is very important in this district and has high priority for food and nutrition security. Further, the district management team has been very supportive and active in this project in output delivery. However, considering the time and distances to be travelled and the geographical distribution of the villages, Madege, one of the project intervention villages, has been selected for this visitation. Madege village is about 30 km from Gairo town. In Madege village, all the 150 households received the target number of pro-vitamin A, orange fleshed sweetpotato (OFSP) vine cuttings (45,000) between 2016 and 2017 which they further multiplied for production of roots for consumption and sale. The village also had a trained Community Health Worker (CHW) who formed and holds monthly mother-support group meetings using Swahili, well-illustrated information, education and communication (IEC) materials on infant and young child feeding during the first 1,000 days. These meetings aimed at improving nutrition knowledge, child health care and enhance behavioral change among primary caregivers of young children.

Madege has been chosen for this learning tour because it is one of the model villages for this project. Unlike other sites, it has no permanent running water. Therefore, Madege has advanced dry season sweetpotato planting material conservation and multiplication sites. In 2017, Madege provided the second highest quantity of vine cuttings. Juhida Farmers' Group, a model of the decentralized vine multipliers (DVMs) managing this site, sold 379,400 cuttings of OFSP planting material worth TShs. 7,588,000/ (US$3,800). These vines were distributed to farmers in Madege and neighboring villages while more were taken to another project district where there were shortfalls in vine cutting production. Members of Juhida Farmer's Group and other beneficiary farmers in Madege village have some of the largest fields of OFSP since 2016 cropping season to date.

As part of income generation, farmers from Madege village sell sweetpotato roots along the Morogoro-Dodoma highway throughout the year meaning they have mastered the art of food and income security. The village also hosts sweetpotato storage adaptive trials as part of participatory technology development for extending the shelf-life of fresh sweetpotato roots. This village thus, provides a good learning site for farmers from other villages who are not aware of such technologies for safe and extended storage of fresh sweetpotato roots.

Whom is the visiting delegation likely to meet in Gairo district local government authority?

We expect to meet and have a brief discussion at the district headquarters and our host will be the District Executive Director and members of the district senior management team who may include, but not limited to:

1. The District Commissioner
2. The District Executive Director
3. The DAICO and his team that have been implementing activities at district level

What is the visiting delegation expected to see in Madege village?

1. Sweetpotato dry season vine conservation and multiplication
2. Possible sweetpotato crops for root production (harvesting started in June)
3. Preservation products from sweetpotato roots
4. Mothers and young child caregivers' clubs with CHW in session
5. Farmers that have benefited from the project
6. Fresh sweetpotato roots storage technology adaptive trial

4.9 Media Articles

- The Guardian/ IPP Media website – Gerald Kitabu: Tanzania can reduce Vitamin A deficiency by promoting production, consumption of orange-fleshed sweetpotatoes: http://ippmedia.com/en/features/tanzania-can-reduce-vitamin-deficiencies-promoting

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06 NOV 2017

FEATURES
The Guardian

Tanzania can reduce vitamin A deficiencies by promoting

- *production and consumption of orange-fleshed sweet potatoes*

MALNUTRITION is one of the most serious health problems affecting infants, children, and women of reproductive age in Tanzania. Despite progress made, millions of children and women in Tanzania continue to suffer from one or more forms of under-nutrition,

40
Shares

including low birth weight, stunting, being underweight, wasting, vitamin A deficiency (VAD), iodine deficiency disorders, and anemia. Addressing malnutrition problems results in significant economic and social benefits as it reduces morbidity and mortality leading to resource savings in healthcare, improved education outcomes, enhanced productivity and increased incomes.

Tanzania has a comparative advantage in the production of sweet

http://ippmedia.com/en/features/tanzania-can-reduce-vitamin-deficiencies-promoting

- Nipashe – Jumamosi, October 28, 2017 by Epson Luhago: Viazi lishe and siri ya fursa tele kiuchumi

24 Nipashe Jumamosi Oktoba 28, 2017

MAKALA

Viazi lishe na siri ya fursa tele kiuchumi

Mjasiriamali akionyesha bidhaa za viazi lishe.

Lucas Mujuju akionyesha juisi na biskuti za viazi lishe.

Mkulima wa viazi lishe ana nafasi ya kuupiga teke umaskini wa kipato na hali, vyatumika katika usindikaji wa bidhaa mbalimbali kama chapati, maandazi, keki, mikate na unga wa lishe. Juisi yake yaleta gumzo kwa watumiaji.

Na Epson Luhwago

SERIKALI ya awamu ya tano chini ya Rais John Magufuli imeweka mpango mkakati wa kujitegeka (Tanzania ka-

ya kilimo, kwa namna nyingine unaendana na mkakati wa taifa wa kukuza uchumi na kupunguza umaskini (Mkukuta) ambao kwa sasa unatekelezwa kwa awamu ya

vya aina hiyo ya viazi huwawezesha wazalishaji mbegu kujipatia fedha nzuri kwa kuwa kipando kimoja huuza kati ya Sh. 60 na 80 huku ekari moja mahitaji yake yakiwa vipando 16,000 hadi 16,666.

"Hii inamaanisha kwamba kwa bei ya chini, mzalishaji mbegu anaweza kujipatia Sh. 960,000 kwa kuuza mbegu za ekari moja. Kwa hiyo akiwa na vipando (mbegu) za ekari 10 tu ana karibu sh. milioni 10. Hii ni ishara kwamba mtu anayejishu-

nakuwa na usindikaji wa bihaa mbalimbali kutokana na viazi lishe. Pia majani yake ambayo ni mboga yanakaushwa ili kutumiwa wakati wa kiangazi," alifafanua.

Domana Metta mmoja wa wasindikaji wa bidhaa zitokanazo na viazi lishe, kwa upande wake alibainisha katika kampuni yake ya Perfect Farm Group, wameikuwa wakisindika chapati, maandazi, 'crisps', keki, tambi na unga wa lishe.

Alisema kutokana na

- Guardian, October 9,2017 Pg 4 and on IPP Media: Tanzanians challenged to invest in orange fleshed sweetpotatoes

http://ippmedia.com/en/news/tanzanians-challenged-invest-orange-fleshed-sweet-potatoes

09 OCT 2017

GERALD KITABU

NEWS

The Guardian

Tanzanians challenged to invest in orange fleshed sweet potatoes

AGRO-PROCESSORS, private sector, business companies and farmers have been challenged to invest in orange fleshed sweet potatoes (OFSP) because of its nutritional values.

DIRECTOR GENERAL FOR THE COMMISSION FOR SCIENCE AND TECHNOLOGY (COSTECH) DR HASSAN MSHINDA.

Scientists and researchers made the call when speaking at the just-concluded 8th Annual Sweet Potato for Profit and Health Initiative (SPHI) exhibition held in Dar es Salaam.

Director general for the Commission for Science and Technology (Costech) Dr Hassan Mshinda said such potatoes can be used as an ingredient in baking to replace 20-60 per cent of wheat flour in baked products.

He said the new revelation is a breakthrough for creating markets for the

- I TV – 27/9/2017 – Viazi Lishe - https://youtu.be/orQjLREqZeM

- ITV – 28/9/2017 – SRI Kibaha Field Visit https://youtu.be/xAI30lpbWbQ

4.10 World Café Breeding Posters

Sweetpotato Speedbreeders

From release to uptake: Emerging Stars among the Mozambican Releases

INTRODUCTION

Poverty and food insecurity are widespread and major causes of chronic undernutrition in Mozambique. Almost 70 % of the population live in abject poverty and ¾ of these people reside in rural areas. Agriculture is the predominant economic activity in rural Mozambique. Sweetpotato, particularly orange-fleshed (OFSP) types has the potential to reduce malnutrition in the form of vitamin A deficiency and food insecurity. Currently, about 23% of the sweetpotato produced in Mozambique is OFSP. Nineteen drought tolerant OFSP varieties were released since 2011. Ten OFSP varieties are winning the race of wide acceptance, production and utilization among smallholder farmers. Dominant varieties from 2011 releases include Irene, Sumaia, Delvia, Namanga, Bela and Gloria, while Alisha, Victoria and Ivone lead the race from the 2016 releases. An emerging group of purple-fleshed is coming up, with Bita and Caelan providing the sweetness one can get from sweetpotato. The general attribute among all the varieties is their ability to give high storage root yields under both drought and good rainfall seasons. They are also 'dry' OFSP due to their high dry matter content, a trait driving adoption in Mozambique.

METHODS

Projects within the International Potato Center working in different projects across Mozambique working on seed dissemination together with their partners have taken all the released varieties to the farmers door steps. The Irish Aid project working on 7 districts in Naissa Province for 4 years and 3 districts in Inhambane from 2017; SUSTAIN project worked for 3 years in the provinces of Manica (7 districts), Sofala (3 districts) and Maputo (5 districts); VISTA project in Nampula and Zambezia Provinces for 3 years and the OFDA emergency project in Maputo, Gaza and Inhambane Provinces for 2 years have provided an insight on high ranking varieties across Mozambique. Their initial work involved variety evaluation in all districts to assess the yield, culinary tests for leaves and storage roots as well as easiness of vine production. Additionally, in Niassa and Maputo Provinces the use of OFSP puree combined with wheat floor was used to make bread and other bakery products. Meanwhile, in Manica Province, OFSP juice was extracted and packaged. All the OFSP processing work is done in conjunction with partners.

RESULTS

- Irene, Delvia, Sumaia and Gloria (2011 releases) most accepted and dominate production in Niassa, Manica, Sofala, Zambezia, Maputo and Gaza provinces
- Alisha, Victoria and Ivone (2016 releases) are breaking new ground in Maputo, Gaza and Inhambane Provinces
- Farmers have increased OFSP production, domestic consumption and trade
- Sumaia, Irene, Gloria and Tio Joe are suitable for processing – juice and bakery products
- Women consider cookability and palatability of leaves (Delvia and Irene most preferred by women).
- We have never imagined acceptance of OFSP by men, women and children at equal proportions. Generally, age does not matter.

KEY TABLE OF RESULTS

Variety	Attracting attributes
Irene	High yielding, good leaf and root taste, easy to process, wider adaptation
Sumaia	High yielding, good root taste, easy to market due to good uniform roots, easy to process, wider adaptation
Delvia	High yielding, good leaf taste, wider adaptation
Gloria	Good yield, good root taste
Bela	High yielding, very good root taste
Namanga	High yielding, good root taste
Tio Joe	Good yield, deep orange variety – the king of beta-carotene
Alisha	High yielding, good root taste, early bulking, wider adaptation
Victoria	High yielding, good root taste, early bulking, wider adaptation
Ivone	High yielding, good root taste, early bulking, wider adaptation
Bita	High yielding, very good root taste, purple fleshed, good vine survival
Caelan	High yielding, very good root taste, good vine survival

RELEVANCE FOR DIFFERENT FOOD SYSTEMS

- Early bulking in these varieties provide (i) piece-meal harvest (ii) escape from late season drought
- Provide leaf vegetable and storage roots for cooking
- Storage roots are amenable to processing – resulting in various delicious spreading, baking and cooking products and juice.
- Income generation: storage roots and vines are sold on open and closed markets

Fig 1: Puree from Sumaia, a key ingredient for processing OFSP products. Credit: Maria Andrade

CONCLUSIONS

The 22 released varieties had unequal opportunity to reach the farmers. The initial large multiplication site, Lozano Farm in Maputo was able to distributed seven varieties to different projects on a large scale. All the top ranking varieties are early bulking confirmed by research trials at Umbeluzi and Gurue Research Stations. This makes these varieties a perfect match for shortened growing seasons due to climate change. Yield stability is essential in improving livelihoods of resource poor smallholder farmers. More efforts should be directed to value addition and market creation of OFSP.

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Sweetpotato Speedbreeders

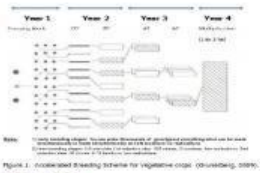
Progress in breeding in Rwanda: Incorporating Feedback from Farmers

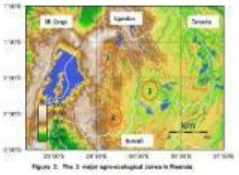
INTRODUCTION

Sweetpotato [*Ipomoea batatas* (L.) Lam.] is an important food crop in many parts of Africa, especially in Sub Saharan countries. In Rwanda, it is cultivated throughout the country and is especially important in densely populated areas of the plateau central (mid altitude), and Bugesera (low altitude) (Ndirigwe, 2006; Njeru *et al.* 2008). Although it is considered as a "flexible crop" due to its ability to produce under adverse weather and soil conditions, most of cultivated sweetpotato varieties are white fleshed cultivars characterized by low yield and low tolerant to sweetpotato virus diseases. Usually breeding and selecting genotypes for the important production zones can take up to 8 years for a varieties to go for release. However, using innovative Accelerating Breeding Scheme (ABS) proposed by Grüneberg et al; 2009, new sweetpotato varieties have been released in three years and promoted across all agro-ecological zones in Rwanda.

METHODS

- Surveying, collecting, evaluating, and selecting from local germplasm good parents to be incorporated in the crossing blocks.
- Use ABS with more parents, more controlled crosses and coupled with a rapid selection through farmer participation (FP) across 3 locations and 6 environments during the first clonal evaluation. This allows early identification of stable genotypes.
- Select drought and virus tolerant, and dual purpose sweetpotato varieties through FP
- Through farmer participatory approach and innovation platforms, released OFSP varieties and male them available to the public, private, developmental organizations, and farmer group's for planting.





RESULTS

- Drought tolerant and high yielding orange, white and purple fleshed sweetpotato varieties high and medium dry matter content, rich in beta carotene, or anthocyanins, and or other polyphenolic components have been also identified .
- Eight new varieties for human consumption and animal feed were released to farmers in three years.
- There is evidence these new varieties have a higher yields on average of 12 t/ha compared to farmers variety of 5 t/ha under farmers conditions.
- Some are very good dual purpose for roots and animal fodder.
- Around 80 Decentralized Vines Multipliers are using the released varieties for large scale dissemination.

Table 1: Yield performance of selected genotypes under ABS

No	Clone code	Root yield (T/ha)	Dry matter content (%)	Flesh color
1	Rw- 2560	29.13	21.00	Deep Orange
2	Rw- 3736	27.50	23.47	Light Orange
3	Rw-2910	25.29	31.13	Deep orange
4	Rw-1860	22.92	37.78	Cream
5	Rw-2285	22.78	30.00	Cream
6	Rw-17	22.35	30.80	White
7	Rw-5091	20.69	28.83	Light orange
8	Rw-5135	20.28	28.47	White
9	Rw-2419	18.87	24.90	White
10	Rw-3074	15.58	33.43	White

RELEVANCE FOR DIFFERENT FOOD SYSTEMS

Good selection sites (Low - medium altitude zones) and partners have been identified in Rwanda, where sweetpotato is important, and which varying agro-ecologies. Farmer' participating in selecting genotypes in important production zones strengthens breeding linkages. It also enables a client-oriented breeding effort for varieties with different desirable traits increasing variety acceptances, adoption and diffusion.

CONCLUSIONS:

1. New released varieties namely, Cacearpedo, Gihingamukungu, Terimbere, Ndamirabana, and Maryoha possess preferred traits by farmers compared to the local varieties
2. Some of the varieties have dual purpose qualities and most have high drought and disease tolerance traits
3. Farmers are important partners in the breeding and selection process for ease adoption of varieties
4. Breeding process need to include processors, food scientists, and other value chain players to speed up the breeding process for adoption for different markets
5. Breeding and selection efficiency are increased by evaluating at more than one location from the initial clonal selection stage
6. Assessment of farmer-preferred traits and their implications to sweetpotato breeding showed that most farmers (>76%) preferred marketable root size and expressed their preference to red color skinned varieties in Rwanda

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Sweetpotato Speedbreeders

Breeding and disseminating early maturing, vitamin A rich sweetpotato in Burkina Faso

INTRODUCTION

In the Sudano-Sahelian zone like Burkina Faso, the rainy season is shorter with periods of drought of varying lengths, while the prevalence of acute malnutrition is over emergency thresholds. To contribute to building resilient food and nutrition systems suitable sweetpotato varieties are expected to be orange-fleshed and better fit in the agro-ecosystem with yield performance close or higher than this the farmers' varieties as well marketable traits. However, reliable access to elite varieties must based on well organized seed systems with trained actors.

IMAGE & CAPTION

Fig 1. Seed dissemination scheme

METHODS

- Eight sweetpotato varieties evaluated in 4 agro-ecological zones along with local checks with active participation sweetpotato growers.
- All trials harvested between 90 and 105 days after planting
- Field visits organized in each community
- Sweetpotato seed classes defined and validated with seed inspectors
- Pre-basic seed produced in screenhouses on two INERA stations
- Basic seed produced in open-field on-station under irrigation
- DVMs trained and provided with pre-basic and basic material
- One seed company involved in quality seed production (basic and certified seed)
- Meeting organized with Seed inspectors to discuss and validate the seed inspection protocols
- Training of stakeholders

RESULTS

- Five sweetpotato varieties (4 OFSP and 1 Purple-fleshed) early maturing and adapted to the Sudano-sahelian zone (90 – 105 days) submitted for release,
- Seed value chain functioning actively
- OFSP growers have access to quality seed
- OFSP root and product now reaching markets and consumers
- Around 12000 households and almost 1.5 million of people reached with OFSP vines in three years.

Table 1. Varieties submitted for release

N°	Pedigree	Yield (t/ha)	Colour	DM Cont. (%)	B-carotene (mg/100g of fresh root)	Reaction to SPVD
1	BF59X CIP-4	20-25	Flesh: Deep Orange Skin: Yellow	29	8.32	Good resistance to potato virus disease (SPVD)
2	BF59X CIP-1	15-20	Flesh: Orange Skin: Pink	27	4.00	Moderate resistance to SPVD
3	BF13XCIP-3	15-20	Flesh: Light Orange Skin: Light Pink	26	1.76	Moderate resistance to SPVD
4	TU-Or	15-20	Flesh: Light Orange Skin: Light Pink Good shape	26	7.12	Susceptible
5	TU-Pourpre	25-30	Flesh: Purple Skin: Purple	31	Rich in antioxidant	Moderate resistance

Table 2. Beneficiaries of OFSP varieties dissemination under the Jumpstarting project

Indicator Variables	Year: ____1____				Year: ____2____				Year: ____3____				
	Direct		Indirect		Direct		Indirect		Direct		Indirect		
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total
Households reached with OFSP vines	750	20	150	10	2400	75	2660	1250	4250	150	300	20	12035
Number of people reached	2250	130	200000	100000	12000	375	400000	150000	21250	750	500000	20000	1406755
DVMs	72	13	19	1	72	1	45	0	16	0	4	0	243

RELEVANCE FOR DIFFERENT FOOD SYSTEMS

- Adapted OFSP varieties available to address recurrent malnutrition in the Sudano-sahelian while also contributing in food security and in poverty alleviation.
- Processing units on OFSP base starting-up and new products and dishes promoted
- OFSP food value chain reinforced

Fig. 2. Screenhouse multiplication of pre-basic seed and farmers OFSP field

CONCLUSIONS

Demand-led varieties when available can constitute a good stimulation of a whole value chain.
However, getting the stakeholder informed and involved can help in reaching targets

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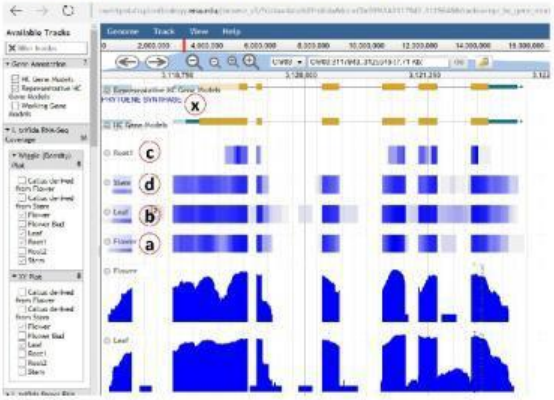
Sweetpotato Speedbreeders

Building resilient food systems for Sub-Sahara Africa through genomics assisted breeding

INTRODUCTION

Conventional breeding, is still dependent to a considerable extent on subjective evaluation and empirical selection. The process can be difficult, slow, influenced by the environment, and costly for the economy, as farmers suffer crop losses. Molecular marker assisted breeding (MAS) offers great challenges, opportunities and prospects for conventional scientific breeding, needs less subjectiveness and more science, i.e. practical and accurate evaluation and effective and efficient selection. MAS allows selection for all kinds of traits to be carried out at seedling stage and thus reduce the time required before the phenotype of an individual plant is known.

High gene expression of the beta carotene gene on sweetpotato Jbrowse, Phytoene synthase (x), in flower (a), leaf (b) and stem (c) and not roots (d)



METHODS

- Clone identification
- Cultivar and variety identification, genetic relatedness and phylogeny
  - Simple sequence repeats and Genotyping by sequencing
- Analysis of population diversity and structure
- QTL and trait mapping population
- Genomics selection
- Gene expression
- High quality phenotyping

RESULTS

- ✓ Reduced breeders time and cost for variety improvement
- ✓ Enhanced breeding of farmer and end user preferred varieties through gene pyramiding
- ✓ Increased availability and utilization of sweetpotato
- ✓ Food, nutrition and income security leading to improved livelihoods and economic stability

KEY TABLE OF RESULTS

New genetic resources for sweetpotato many of which are first

- ✓ Sweetpotato reference genomes, *I. trifida and I. triloba* http://sweetpotato.plantbiology.msu.edu/
- ✓ High confidence working gene models
- ✓ Genotyping by sequencing protocol and Bioinformatics
- ✓ Sweetpotato database and ontology (SPBase)
- ✓ Trait dissection using high-quality genetic and phenotypic

RELEVANCE FOR DIFFERENT FOOD SYSTEMS

- Assessment of traits expressed at later developmental stages
- Improvement of traits expressed only when favorable environmental conditions present, e.g. disease/pest resistance and stress tolerance.
- Effective selection of minor (recessive) alleles of traits saving time and accelerating breeding progress
- Simultaneous selection for traits controlled by individual or multiple genes (QTLs)
- Discovering new genes and regulatory sequences, their positions, and markers available

Building capacity of the breeders to apply molecular breeding and accelerate improvement

CONCLUSIONS

With genomic tools, sweetpotato has great potential in the light of imminent challenges associated with its genetic complexity, emergence of new diseases and pests and climate change

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HIDAP: A unified platform for clonal crops breeders

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Background

Breeding programs involve large investments of time and money, but can pay very large returns on investment in the form of improved varieties which benefit farmers, societies and the environment. International breeding efforts involving multiple partners and targeting regionally important constraints have great potential for efficiently and rapidly achieving impact. Standardized information on the performance of progenies and selected clones across environments is necessary in order to assist breeders to efficiently make decisions about selection and variety release. Standardized methods also facilitate sharing and reporting of breeding program results with colleagues and the agencies that support us. A number of tools already exist to help with standardised breeding information management. For clonal crop breeders, the challenge has been how to improve the usability and power of existing tools, leveraging on advancements in various open source software technologies in the breeding space. The Highly Interactive Data Analysis Platform (HIDAP) has been developed to address the above challenge

Figure 1. HIDAP software screenshot.

HIDAP has been developed by the International Potato Center (CIP). It is part of on-going in-house efforts to unify best practices. These practices include data collection, data quality and data analysis in clonal crop breeding. HIDAP builds on the former in-house tools DataCollector (DC) and CloneSelector (CS). These tools supported potato and sweetpotato breeding, respectively. HIDAP now provides a single platform for use by potato and sweetpotato breeders, as well as improved usability and data quality checks. It also has new features built to support compliance with Open Access, open standards such as the potato and sweetpotato crop ontologies.

HIDAP is also linked with relevant corporate and community databases for example CIP's Corporate Database (https://research.cip.cgiar.org/gtdms/biomart) and the SweetPotatoBase (www.sweetpotatobase.org). The latter will be implemented via the Breeding API (BrAPI). BrAPI specifies a standard interface for plant phenotype/genotype databases to serve their data to crop breeding applications like HIDAP.

Key features

HIDAP builds on the statistical platform R. This includes the R shiny tools, the knitr package, the agricolae package, and more than 100 other R packages. HIDAP re-uses the R code that we used in both DC and CS. The R shiny package enables implementation of interactive web pages that are usable online and offline. The knitr package enables the creation of reproducible reports. The statistical analysis is performed using R and R functions developed at CIP. The software is available for download at https://research.cip.cgiar.org/gtdms/hidap/.

Key features of HIDAP include:

1. Easy to install. End users can download a stable release of the software from https://research.cip.cgiar.org/gtdms/hidap/ and follow a friendly graphical interface to complete the set up. CloneSelector in particular had an ineluctably complex installation process.
2. Provides a unified platform for clonal crops breeders.
3. Supports offline usage. Online usage has been successfully tested and will be ready in 2018.
4. Can read information (pedigree and passport genotypes) from CIP's Corporate Database (https://research.cip.cgiar.org/gtdms/biomart/). The experimental data can also be uploaded to the database via the Field Book Registry Tool (https://research.cip.cgiar.org/gtdms/fieldbook) and can be published in Open Access through CIP's Dataverse (https://data.cipotato.org).
5. Entirely Open Source.
6. Has an improved web based user interface, making it easy to present users with a more refined look and feel compared to the Excel based interfaces from both CS and DC.
7. Has improved usability and data quality checks.
8. Supports design of field experiments under several different experimental designs.
9. Supports creation of FieldBooks, which can be manipulated using Excel.
10. Supports analysis of single and multi-environment experiments.
11. Custom analysis with results output in the form of reproducible reports, available in both MS Word and HTML formats.

Key achievements so far

1. First major stable release done early 2017,with two major updates mid2017.
2. A series of webinars accompanied release first release.
3. Reference manuals and training materials from the introductory webinars available for download to the public on the HIDAP website.
4. HIDAP introduced to several sweetpotato breeders from across SSA during the 2017 annual sweetpotato breeders meeting in Kigali, Rwanda.
5. Two follow up in-country trainings held in July and August 2017 for Sweetpotato breeders based at Ethiopia's Southern Agricultural Research Institute (SARI) and Tigray Agricultural Research Institute (TARI) and Tanzania's Ukiriguru Agriculture Research Institute (LZARDI).

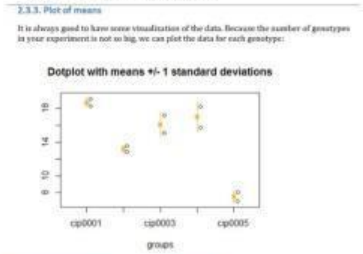

Figure 2. Sample dot plot from HIDAP.

Future plans

The development of HIDAP is led by the Research Informatics Unit (RIU), based at CIP headquarters in Lima, Peru. End user feedback from both within CIP and external partners informs a lot of the development work. Some of the major focus areas will include the integration of mobile data collection and management of data exchange with external databases.

HIDAP has been developed with the support of Genomic Tools 4 Sweetpotato Improvement project (GT4SP), The United States Agency for International Development (USAID), The CGIAR Research Program on Roots, Tubers & Bananas (RTB) and The Sweetpotato Action for Security and Health in Africa (SASHA) project.

Sweetpotato Speedbreeders

Progress in developing a low sweet sweetpotato for West Africa

INTRODUCTION

The signature focus of the Sweetpotato Support Platform for West Africa, in Ghana, is on quality, specifically developing low sweet varieties for staple, processing, and other uses.

- Ghanaian breeding program active since 1990s
- Sweetpotato is less important here than many parts of E. and S. Africa, but it is increasing in importance
- Must have lowland tropical adaptation (virus resistance in southern zones; earliness in northern zones). Drought tolerance is desirable.
- Sweetpotato quality (including sweetness) is affected by genotype, cooking method, and postharvest treatment
- Previous work has shown that consumers like most of our advanced selections, but we are still refining our understanding of quality attributes required, and the most efficient method for phenotyping
- We routinely use NIRS on raw, freeze dried samples, and cooked taste tests
- We used NIRS and taste tests on raw and cooked samples from an advanced trial to characterize selections, and tested use of refractometer as a faster throughput method

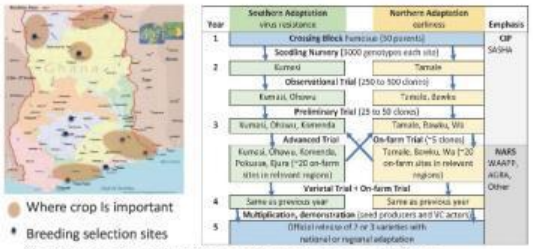

Fig 1. Sweetpotato breeding location and scheme in Ghana

METHODS

- Evaluated freshly harvested roots (7 entries and 3 checks) from advanced trial from Tamale (northern Ghana)
- Determined sugars, starch and dry matter content of raw and boiled roots using NIRS and previously-developed calibrations
- Sucrose equivalent (SE) calculated: non-sweet ≤12, low 12-20, moderate 21-28, high 29-37, very high ≥38% on dry or fresh basis
- Used sensory panel to evaluate sweetness, cooked taste (liking), and aroma
- Used refractometer to determine soluble solids in liquid expressed from grated raw and cooked samples

RESULTS

- Cooking effects accounted for much of the variance in SE (Table 1)

Table 1. Analysis of variance of sweetness of cooked and raw genotypes (treatment) from 2017 advanced trial in Tamale

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Genotype	9	914	101.6	25.28	< 0.001
Treatment	1	1583	1582.8	393.80	< 0.001
Genotype x Treatment	9	321	35.6	8.86	< 0.001
Residuals	31	125	4.0		

- On dry weight basis, SE values of cooked samples ranged from high to low, while values of raw samples ranged from moderate to non-sweet. Changes in SE between cooked and raw samples varied significantly among genotypes (Table 2, tier 1)
- On fresh weight basis, SE values of all raw and cooked samples were non-sweet, with changes in SE between cooked and raw samples ranging from 0 to 5% (Table 2, tier 2)
- The checks (Apomuden, Bohye and Ligri) were ranked as sweetest by taste panelists, Ligri and Bohye had the best taste, while Apomuden had highest Aroma. PGA14351-4, with lowest sweetness and aroma scores, was not ranked high on taste (Table 2, tier 3)

Table 2. Sucrose equivalent (SE) of raw and cooked sweetpotato clones on dry weight (tier 1) and fresh weight (tier 2) basis, and sensory assessment of sweetness, liking and aroma (tier 3)

Raw samples			Cooked samples			Difference (cooked-raw)		
Genotype	SE		Genotype	SE		Genotype	SE	
Apomuden	27.05	a	PGA14442-1	35.64	a	Ligri	18.11	a
PGA14010-5	20.18	b	Apomuden	35.39	a	PGA14442-1	16.82	a
PGA14011-43	19.85	b	PGA14610-5	32.65	ab	PGA14398-4	14.16	ab
PGA14442-1	18.81	b	PGA14011-43	31.69	ab	PGA14372-3	14.00	abc
PGA14351-4	17.12	b	Ligri	28.77	b	PGA14010-5	12.47	abcd
PGA14008-9	16.46	bc	PGA14398-4	28.16	bc	PGA14011-43	11.84	bcd
Bohye	16.34	bc	PGA14372-3	27.00	bcd	PGA14008-9	9.17	cd
PGA14398-4	14.00	cd	PGA14008-9	24.21	cd	Apomuden	8.34	d
PGA14372-3	13.00	de	Bohye	23.12	d	Bohye	6.77	d
Ligri	10.65	e	PGA14351-4	16.70	e	PGA14351-4	-6.42	e

Raw samples			Cooked samples			Difference (cooked-raw)		
Genotype	SE		Genotype	SE		Genotype	SE	
Apomuden	6.77	a	Ligri	8.76	a	Ligri	5.17	a
PGA14010-5	6.00	ab	PGA14010-5	8.46	ab	PGA14372-3	3.95	ab
PGA14011-43	5.75	b	PGA14372-3	8.31	ab	PGA14398-4	3.25	bc
PGA14008-9	5.26	bc	PGA14442-1	7.91	ab	PGA14442-1	3.23	bc
PGA14351-4	5.26	bc	PGA14011-43	7.87	ab	PGA14010-5	2.45	bcd
Bohye	4.86	cd	PGA14398-4	7.72	ab	PGA14011-43	2.12	cd
PGA14442-1	4.69	cd	Apomuden	7.26	bc	Bohye	1.70	cd
PGA14398-4	4.47	d	Bohye	6.57	bc	PGA14008-9	0.80	de
PGA14372-3	4.36	d	PGA14008-9	5.96	cd	Apomuden	0.48	de
Ligri	3.59	e	PGA14351-4	4.93	d	PGA14351-4	-0.33	e

Sweetness score			Cooked taste score			Aroma score		
Genotype	(1 low to 9)		Genotype	(1 best to 9)		Genotype	(1 low to 9)	
Apomuden	6.67	a	PGA14010-5	6.00	a	Apomuden	7.00	a
Bohye	6.00	ab	PGA14442-1	5.50	a	PGA14008-9	6.00	ab
Ligri	6.00	ab	PGA14351-4	4.50	ab	Bohye	5.33	bc
PGA14008-9	5.67	abc	Apomuden	4.00	bc	PGA14010-5	5.00	bcd
PGA14372-3	5.67	abc	PGA14008-9	4.00	bc	PGA14398-4	5.00	bcd
PGA14010-5	5.00	abcd	PGA14372-3	3.33	cd	PGA14442-1	5.00	bcd
PGA14442-1	5.00	bcd	PGA14398-4	3.33	cd	Ligri	4.67	bcd
PGA14398-4	4.33	cd	PGA14011-43	2.67	de	PGA14372-3	4.00	cd
PGA14011-43	3.67	d	Bohye	1.67	ef	PGA14011-43	3.33	de
PGA14351-4	3.00	d	Ligri	1.00	f	PGA14351-4	2.00	e

- Total sugars determined by refractometer correlated with SE in raw, but not in cooked samples.

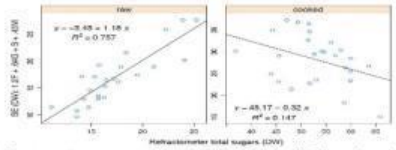

Fig 2. Refractometer vs sucrose equivalent in raw (left) and cooked (right)

Table 3. Quality characteristics of recently released varieties in Ghana

	AP3A	442162
dry matter (%)	35.90	32.92
sucrose (%DM)	6.20	8.66
fructose (%DM)	1.74	1.92
glucose (%DM)	2.85	3.14
starch (%DM)	66.96	65.28
sweetness equivalent (%DM)	10.11	12.97
sweetness equivalent (%FW)	3.63	4.24
cooked taste (1 best to 9)	4.50	3.50

CONCLUSIONS

- Adapted non- and low-sweet clones developed in Ghana
- NIRS and taste are currently necessary to identify amylase variants
- Assessment following curing and storage is needed
- Understanding of user preferences and requirements is needed

CGIAR RESEARCH PROGRAM ON Roots, Tubers and Bananas

CIP INTERNATIONAL POTATO CENTER

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Sweetpotato Speedbreeders

Varietal selection in Madagascar & the use of OFSP for disaster response

INTRODUCTION

Every year, many regions in Madagascar are affected by floods, droughts, frost and locusts. They destroy many crops and increase food and nutrition insecurity. As part of climate-smart agriculture, several projects, NGOs and ministries choose sweetpotato to enhance resilience. Promoting high yielding and nutrient rich crops such as orange-fleshed sweetpotatoes (OFSP) could contribute to the improvement of the health and livelihoods of vulnerable people.

METHODS

Varietal selection

- Importing planting material
- Multiplication by a micro propagation system
- Multiplication in greenhouses
- Setting up a material planting nursery
- Conducting different trials:
  - Observation trial
  - Preliminary yield trial
  - Advanced yield trial
  - On-farm trial

Extension of the released varieties

- Production of pre-basic, basic and certified vines
- Distribution of vines with the support of different projects, GNO, ministries, donors
- Participation in different events: fairs, etc.
- Many activities within the innovation platform, including women

RESULTS

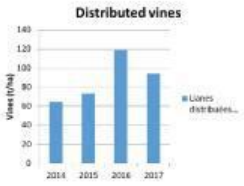
- The end users are the vulnerable people including the Children, pregnant and breastfeeding women.
- OFSP varieties become more accessible. They help them to achieve the food and nutrition security. They support them as a source of income.
- Through activities in the innovation platform, people from poor household, people with disabilities, marginalised ethnic or religious groups, men and women will have the opportunity to grow OFSP, to increase the production, to improve their health and livelihoods

KEY TABLE OF RESULTS

❑ 8 released OFSP varieties and dissemination

Variety	CIP No	Yield (t/ha)	Dry matter (%)	Maturity period	Year of release
Riba	CIP 420 027	18	22,6	Early	2002
Mendrika	CIP199004.2	24	28,1	Early	2006
Mevakely	CIP 199 026,10	20	28	Early	2009
Bora	CIP199062.1	25	29	Early	2007
Zambezi		24.5	36,6	Early	2011
Ejumila		24.7	32,7	Early	2011
Kaly		25,2	28,4	Early	2015
Donga		24,9	29,5	Early	2015

❑ 5 new released varieties: Delvia, Jane, Irene, Erica and Lourdes
❑ 1 OFSP innovation platform in progress with 335 members of association of women



RELEVANCE FOR DIFFERENT FOOD SYSTEMS

- OFSP could substitute or complement rice during the shortage period
- Possibility of processing - Various cooking methods

CONCLUSIONS

OFSP varieties play an important role in food and nutrition security in Madagascar. They have a great future as climate-smart crops.

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Sweetpotato Speedbreeders

Screening South African sweet potato cultivars for resistance to root-knot nematodes

INTRODUCTION

Plant parasitic nematodes, especially *Meloidogyne* species are considered to be the most important nematodes affecting sweet potato production worldwide. In South Africa a 6% loss, South America 15% and West Africa 24% loss is attributed to *Meloidogyne* spp. (Sasser 1979; Kleynhans, 1991).

South Africa does not have adequate empirically-based data on damage caused by root-knot nematodes on most popular South African sweet potato cultivars, except for Blesbok, which was found to be highly susceptible to *M. incognita* (Kleynhans, 1991).

Therefore, the objective of this project was to screen the most important South African sweet potato cultivars for host-status of three *Meloidogyne* species prevalent in South Africa.

RESULTS

Fifty-six days after inoculation, cultivars had highly significant effects on the reproductive potential of the test nematodes. 'Bosbok' (commercial use) and 'Mvuvhelo' (small-holder use), South African cream-fleshed cultivars, were non-hosts to all *Meloidogyne* species and races. 'Blesbok' (most popular commercial cultivar) showed low host-status to *M. javanica* and *M. incognita* race 4. Local orange-fleshed cultivar 'Bophelo' showed significantly lower reproductive potential than other orange-fleshed cultivars for *M. incognita* race 4 and *M. javanica*.

Table 1. Fresh root mass (FRM), eggs, second-stage juveniles (J2) and reproductive potential (RP) of *Meloidogyne javanica* and *Meloidogyne incognita* races 2 and 4 on sweet potato cultivars (n = 72).

Cultivar	Origin	Flesh Colour	Market	*Meloidogyne javanica*			*Meloidogyne incognita* race 2			*Meloidogyne incognita* race 4		
				Eggs	J2	RP[z]	Eggs	J2	RP[z]	Eggs	J2	RP[z]
Beauregard	USA	Orange	Commercial	1270	138	20.55[y]±8.14[x]	310	162	5.93[w]±0.41	3835	1013	258.93[v]±38.53
W-119	USA	Orange	Informal	260	92	6.59[fg]±3.47	188	55	3.23[wx]±0.57	0	0	0.00[i]±0.00
199062.1	CIP	Yellow orange	Informal	238	25	3.18[g]±2.52	248	58	2.44[xy]±0.32	7	22	1.12[i]±0.17
Impilo	ARC	Orange	Informal	218	28	3.71[fg]±2.44	183	70	3.82[h]±0.93	13	13	25.77[g]±2.48
Ndou	ARC	Cream orange	Informal	192	23	2.16[g]±0.70	165	60	2.00[i]±0.18	43	21	1.28[i]±0.19
Bophelo	ARC	Orange	Informal	87	12	1.35[g]±0.43	198	60	1.68[i]±0.32	65	28	2.18[i]±0.47
Lethlabula	ARC	Cream	Informal	172	27	1.91b[g]±0.40	177	58	2.03[i]±0.11	237	38	9.61[h]±1.17
Ribbok	ARC	Cream	Commercial	18	17	0.46[g]±0.35	180	47	2.00[i]±0.25	2	13	1.02[i]±0.31
Monate	ARC	Cream	Informal	307	22	3.38[fg]±5.77	147	38	1.68[i]±0.27	38	20	1.37[i]±0.32
Blesbok	ARC	Cream	Commercial	15	17	0.35[g]±0.01	130	28	1.78[i]±0.32	50	12	2.45[i]±0.55
Bosbok	ARC	Cream	Commercial	0	0	0.00[g]±0.00	0	0	0.00[i]±0.00	0	0	0.00[i]±0.00
Mvuvhelo	ARC	Cream	Informal	0	0	0.00[g]±0.00	0	0	0.00[i]±0.00	0	0	0.00[i]±0.00

[z]Reproductive potential (RP) = (Eggs + J2s)/Fresh root mass. [y]Column means followed by the same means were not different according to Waller-Duncan multiple range test at 5% level of probability

METHODS

Three parallel greenhouse trials were conducted at the University of Limpopo, South Africa. Sweet potato cuttings were established in 20-cm-diameter plastic pots containing 4:1 (v/v) steam-pasteurised river sand and Hygromix-T growing mixture. Each cutting was inoculated with 6000 eggs and second-stage juveniles in parallel trials of the three *Meloidogyne* species and races. Pots were spaced 0.25 by 0.30 m, with cultivars arranged in RCBD, with 6 replicates. At 56 days after inoculation, eggs and juveniles were extracted from 10 g roots. Reproductive potential (RP = eggs + J2/g roots) values were computed and data subjected to ANOVA with SAS software (SAS Institute, 2008).

Fig. 1 Nematode screening trials: a) Shortly after planting of trial against *M. incognita*; b) Trial against *M. javanica* race 4 during growing season; c) & d) roots showing infection.

RELEVANCE/POTENTIAL IMPACT

The Sweet Potato Programme (SPP) of the ARC aims at high β-carotene content, with selections primarily focused on high yield, storability, sweetness and/or dry taste (Laurie et al., 2015). The identification of tolerant/resistant sweet potato cultivars to the three *Meloidogyne* species prevalent in South Africa can increase profitability to both commercial and small-holder farmers. The estimated annual sweet potato loss due to damage caused by root-knot nematodes, together with Reniform nematodes, amounts to 2.6 billion U.S. dollars.

CONCLUSIONS

Cultivars 'Mvuvhelo' and 'Bosbok' were non-hosts to all *Meloidogyne* species and races.

These preliminary findings revealed the existence of resistant cream-fleshed sweet potato cultivars, however, additional work is necessary to confirm whether the nematode resistance allows for introgression through hybridization.

Identified sources of resistance are being targeted for biofortification intended to ameliorate malnutrition in Southern Africa.

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Sweetpotato Speedbreeders

Progress towards the holy grain of a virus resistant sweetpotato

INTRODUCTION

Sweetpotato is grown for food and feed and is increasingly becoming an important cash crop for many farmers in sub-Saharan Africa. Sweetpotato virus disease (SPVD) is, however, one of the major bottlenecks in the expanded use of sweetpotato because it is devastating and can cause 50 to 90% yield loss in susceptible cultivars. Available methods do not adequately control SPVD. There is a need for farmers to have cultivars with desirable traits and durable resistance to SPVD. Development of SPVD resistance is under way in Uganda, led by CIP.

Fig 1. Sweetpotato virus disease (SPVD) - middle, *Sweet potato chlorotic stunt virus* (SPCSV) and *Sweet potato feathery mottle virus* (SPFMV) - infected plants; whiteflies (left) and aphids (right) are the vectors.

METHODS

Several steps have been involved in developing resistance to SPVD: 1) Developed reliable methods to detect the different known viruses (symptomatology, serology, indicator plants, real time polymerase chain reaction) 2) Developed a reliable method to discriminating between SPVD tolerant and resistant genotypes. 3) Prioritized the most important viruses to breed for. 4) Identified different sources of SPVD resistance 5) Developing an efficient breeding scheme to increase the SPVD resistance is underway.

Fig 2. Two sweetpotato crossing blocks (population Uganda A, population Uganda B) at Namulonge, Uganda

RESULTS

Reliable methods have been developed to detect SPVD in breeding populations: symptoms (scale 1 to 9; 1 = no symptoms; 9 = most severe symptoms), serology for confirmation where needed and real (quantitative) time PCR for discriminating between clones tolerant and resistant to SPVD (Table 1, Fig. 2). Emphasis is placed on developing resistance to SPFMV and SPCSV, the combination of which leads to SPVD. Breeding populations from two crossing blocks (population Uganda A, and population Uganda B, Fig. 2) generated at Namulonge, and introduced populations exhibited a wide range resistance, but skewed towards the susceptible category (SPVD score above 3.5) with very few genotypes in the highly resistant category (SPVD score 3.0 and below).

KEY TABLES OF RESULTS

Table 1. Identification of high yielding resistant sweetpotato clones at Namulonge, Uganda (SPVD = sweetpotato virus disease; SPFMV = Sweet potato feathery mottle virus; SPCSV = Sweet potato chlorotic stunt virus; ΔCt = difference in real time real time PCR threshold cycle/relates to virus titer); LSD = least significant difference; CV =coefficient of variation).

Access. code	Root yield (t/ha)	[1]SPVD (3 seasons)	Mean scores (3 reps, 1 season) SPVD	Alternaria		SPFMV [2](1/ΔCt)	SPCSV (1/ΔCt)
4.3	5.1	5.3	2.3	3.0		0.556	1.011
12.22	6.6	6.0	3.7	3.0		0.19	0.11
17.3	6.1	3.0	2.0	2.7	Resistant	0.053	0.067
20.8	14.3	4.0	2.3	5.3		0.053	0.053
21.4	16.2	3.3	2.0	2.7	Tolerant	0.144	0.463
23.11	19.9	2.3	2.7	3.7		0.273	0.162
24.7	5.4	2.7	1.0	1.3	Resistant	0.053	0.053
29.3	7.0	5.3	4.0	2.7		0.052	0.349
34.6	9.8	5.0	3.0	2.0		0.178	0.077
NSP11	17.4	2.7	2.3	2.0		0.113	0.064
Mean	10.7	4.1	3.1	2.9	Negative control	0.052	0.062
$LSD_{0.05}$	4.9	2.0	1.8	1.9			
CV (%)	27.3	29.8	35.1	39.6			

NEXT STEPS

Evaluation of introduced SPVD resistant clones and breeding populations generated in Uganda will continue under the high SPVD pressure environment at Namulonge to identify resistant genotypes. Molecular markers (DaRT) evaluated on populations in Peru will be validated on populations in Uganda. Bad parents will be eliminated from the crossing blocks to increase the frequency of genotypes with SPVD in the progeny.

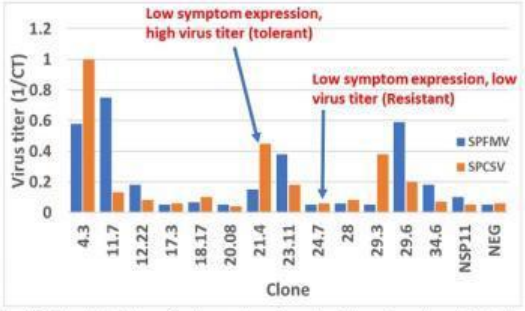

Fig 3. Discrimination of clones (genotypes) tolerant and resistant to viruses (CT = real time PCR threshold cycle; SPFMV (Sweet potato feathery mottle virus); SPCSV = Sweet potato chlorotic stunt virus; NSP11 = NASPOT 11 (virus resistant check clone); NEG = negative control

CONCLUSIONS

Good progress has been made in developing resistance to SPCSV and SPFMV (SPVD). However, developing molecular markers linked to SPVD resistance has been slow because of the complex nature of hexaploid sweetpotato. Routine SPVD screening protocals are working. Eliminating bad parents from crossing blocks is expected to increase the frequency of genotypes among populations generated in crossing schemes in sweetpotato population improvement.

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Sweetpotato Speedbreeders

Validating Heterosis in Sweetpotato Breeding

INTRODUCTION

Why developing hybrid breeding populations? Sweetpotato is a highly heterozygous clone hybrid crop and with hybrid breeding populations we achieve (i) yield increase, (ii) ease to stack simple inherited traits such as quality and disease resistance, and (iii) elevated yield stability. Achieving these goals is much more effective by offspring-parent analysis and heterosis exploitation than increasing current breeding efforts. Can current polycross breeding be the best for sweetpotato breeding? Hybrid breeding is different to polycross breeding with respect to the development of heterotic groups, controlled crosses, data managment, and intensive offspring – parent analysis.

Fig 1. Hybrid breeding populations (A) harvest of hybrid breeding population H0 in Peru (genepools PJ and PZ) and (B) field trials for hybrid breeding population AxB in Mozambique (genepools A and B developed in Uganda).

METHODS

Study 1: In total 231 families (210 cross combinations) comprising 6898 H0 hybrid genotypes were evaluated together with 49 PJ parents and 31 PZ parents at two locations (Huaral, San Ramon in Peru). Variance components due to families, genotypes within families, etc.; parent - offspring heterosis increments; variance components due to GCA_{PJ}, GCA_{PZ}, SCA, etc.; and GCA of parents were determined.

Study 2: In total 98 cross combinations (1010 genotypes) were evaluated under two treatments (irrigated, not irrigated) across two years (Umbeluzi / Mozambique). The parents were representing two genepools separated on basis of SSR markers designated Uganda A and Uganda B. The cross combinations were AxB (51 families, 609 genotypes), AxA (32 families, 264 genotypes), and BxB (15 families, 137 genotypes). Variance components due to families, genotypes within families, etc.; AxB versus AxA and BxB differences, variance components due to GCA_A, GCA_B, SCA, etc.; and GCA of parents were determined.

Study 3: In total 336 families comprising 3742 H1 NSSP clones were evaluated together with parents and the baseline (49 PJ parents and 31 PZ parents see study 1) at two locations (Canete, Satipo in Peru). Preliminary results from Canete for genetic gains for none-sweet after cooking are presented.

RESULTS

Study 1: Yield increases by 18 to 20% in H0 OFSP early and widely adapted and selection of appropriate parents for H1 OFSP. **Study 2:** Storage root yield and biomass increases of about 10% and 20%, respectively, under drought stress and selection of appropriate parents for next breeding populations (e.g. Naspot 5 and African Resisto identified as parents with high GCA. **Study 3:** Variety ability in H1 NSSP was maintained despite extreme high selection intensities within genepools (5 PJ and 5 PZ out of 48 PJ and 31 PZ) and large genetic gains were obtained for low sugar (even no sweetness) after cooking.

Breeders will benefit by emphasizing parents that develop better offspring for various variety types. End users comprising farmers and consumers of various differentiation (household type, gender, age) will benefit by income generation due to extending sweetpotato in farming systems, more healthy food, new processing and market options.

KEY TABLES OF RESULTS

Table 1. Average heterosis increments in OFSP PJ x OFSP PZ cross combinations (N=210) in H0 for observed traits evaluated at 2 locations in Peru.

Variable	Heterosis increments PJ x PZ in H0 as % Mean	P-Value	CL 95% limit of heterosis increments
Root yield	18.5	<0.001	15.0 – 22.0
Com. Roots	19.8	<0.001	15.8 – 23.8
Fol. Yield	-1.5	0.409	-5.1 – 2.1

Table 2. Inter- and intra-pool cross means and differences for observed traits evaluated under 2 treatments (irrigation and no irrigation) across 2 years in Mozambique [families from Uganda, AxB (N = 51), AxA and BxB (N = 47)].

Variable	Treat-ment	Interpool crosses AxB Mean	Intrapool crosses AxA & BxB Mean	Cross type difference in %	P-Value
Root yield	IRRI	12.3	12.0	2.9	0.555
t/ha	NOTIRRI	7.3	6.6	11.2	0.103
Fol. Yield	IRRI	21.1	19.6	7.4	<0.001
t/ha	NOTIRRI	21.0	17.3	21.2	<0.001
Biomass	IRRI	33.4	31.5	5.8	0.006
t/ha	NOTIRRI	28.3	23.9	18.4	<0.001

RELEVANCE FOR DIFFERENT FOOD SYSTEMS

Diversification of food systems with sweetpotato, especially OFSP, via higher efficiency of breeding for OFSP under short growing seasons (90 days), for OFSP under drought prone areas, for none-sweet

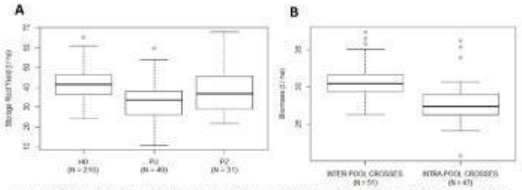

Fig 2. (A) Storage root yields for H0 cross combinations, PJ and PZ parents evaluated in Peru; (B) Biomass production for interpool crosses (AxB) and intrapool crosses (AxA and BxB) evaluated in Mozambique.

CONCLUSIONS

The genepools PJ and PZ are mutually heterotic. There are strong indications that Uganda A and Uganda B are also mutually heterotic genepools (15 parents out of 150 parents tested). Superiority of hybrid breeding populations are more pronounced under stress conditions. Parents with high general combining ability (GCA) have been identified, which allows to choose appropriate testers for genepools. With testers the best parents can be chosen on basis of offspring information among a very large number of parents. Offspring information and GCA of parents is much more informative for the value of a parent than the performance of the parent *per se*. Through investments into genepool separation, controlled crossings and data management sweetpotato can be rapidly developed (short to medium terms, 5 years) into breeding populations with high variety ability for various needs and purposes.

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Breeding for sweetpotato weevil resistance in Uganda

INTRODUCTION

Sweetpotato weevils (SPW) cause 67-98% yield losses in SSA. Management of this pest has not been successful. Breeding for sweetpotato weevil resistant varieties is viewed as the most viable option. This effort is being undertaken at NaCRRI through the following objectives:

1. Broadening sources of weevil resistance
2. Understanding the inheritance of field and chemical basis of SPW resistance
3. Understanding the stability of hydroxycinnamic acid ester (HCA) production across environments and its correlation with other traits in sweetpotato
4. Conducting long term population improvement for weevil resistance

C. puncticollis | *C. brunneus* | Sweetpotato weevil damage

METHODS

- **Broadening of sources of weevil resistance**

Total of 208 landrace accessions were assembled, evaluated at 4 sites for two seasons (2015A & B) for field and laboratory based resistance. Elite sweetpotato weevil resistance polycross population Ruddy introduced from NCSU, is being evaluated for field weevil resistance. To improve the SPW resistance data, no-choice bioassays and profiling of storage root HCA concentration are being conducted

- **Inheritance of SPW resistance**

An 8x8 half diallel population of 280 progeny is being evaluated

- **Stability of weevil resistance**

A total of 30 genotypes of varying SPW resistance is being evaluated at four sites for stability analysis

- **Long term population improvement for weevil resistance**

A crossing block for population improvement of SPW resistance and other traits has been established. Seedlings generated from the parents is evaluated routinely to select superior genotypes for the next cycle of crossing to increase level of resistance. Selected genotypes are subjected to yield trials for release.

RESULTS

The end users of the project are subsistence oriented sweetpotato farmers and regional breeders. In eastern Uganda for instance, 99% of the women farmers reported that they grow sweetpotato for both food and incomes, while most of the male farmers grow it exclusively for income. Production of weevil resistant, high yielding and nutrient rich sweetpotato by the small to medium holders will guarantee the availability and consumption of healthy sweetpotatoes by the both the rural and urban populations. This will reduce the burden of VAD related diseases in the country

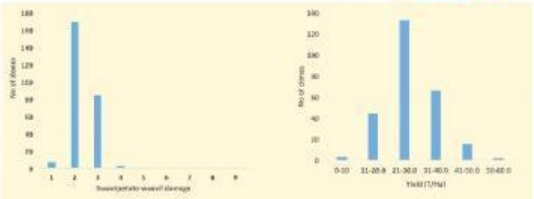

Table 1. Sweetpotato weevil resistance population seed generated in two years

YEAR	Type of cross	No of seed
2017	Paired Crosses	6,450
2017	OPs (Poly cross)	43,810
2016	Paired Crosses	6,222
2016	Ops (Poly cross)	31,208
TOTAL		**87,690**

Total of 10 genotypes selected for on-farm trials

RELEVANCE FOR DIFFERENT FOOD SYSTEMS

Sweetpotato is an excellent food security crop in Uganda. It is widely grown throughout the country on a small scale mainly in subsistence farming and has been gaining popularity along with other indigenous foods. It complements other food crops and serves to bridge "hunger periods" of food shortage before the next harvest of maize or other staple crop. Sweetpotato is being promoted in Uganda as a major food security crop due to its short maturity and resilience to prevalent adverse weather condition compared to other staple crops

Sweetpotato crossing at NaCRRI

Sweetpotato weevil bioassay laboratory at NaCRRI

CONCLUSIONS

Development of high yielding, nutrient rich and sweetpotato weevil resistant varieties provides the most reliable option to enhance food and nutrition security, especially for subsistence and small scale farmers in Uganda and SSA

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