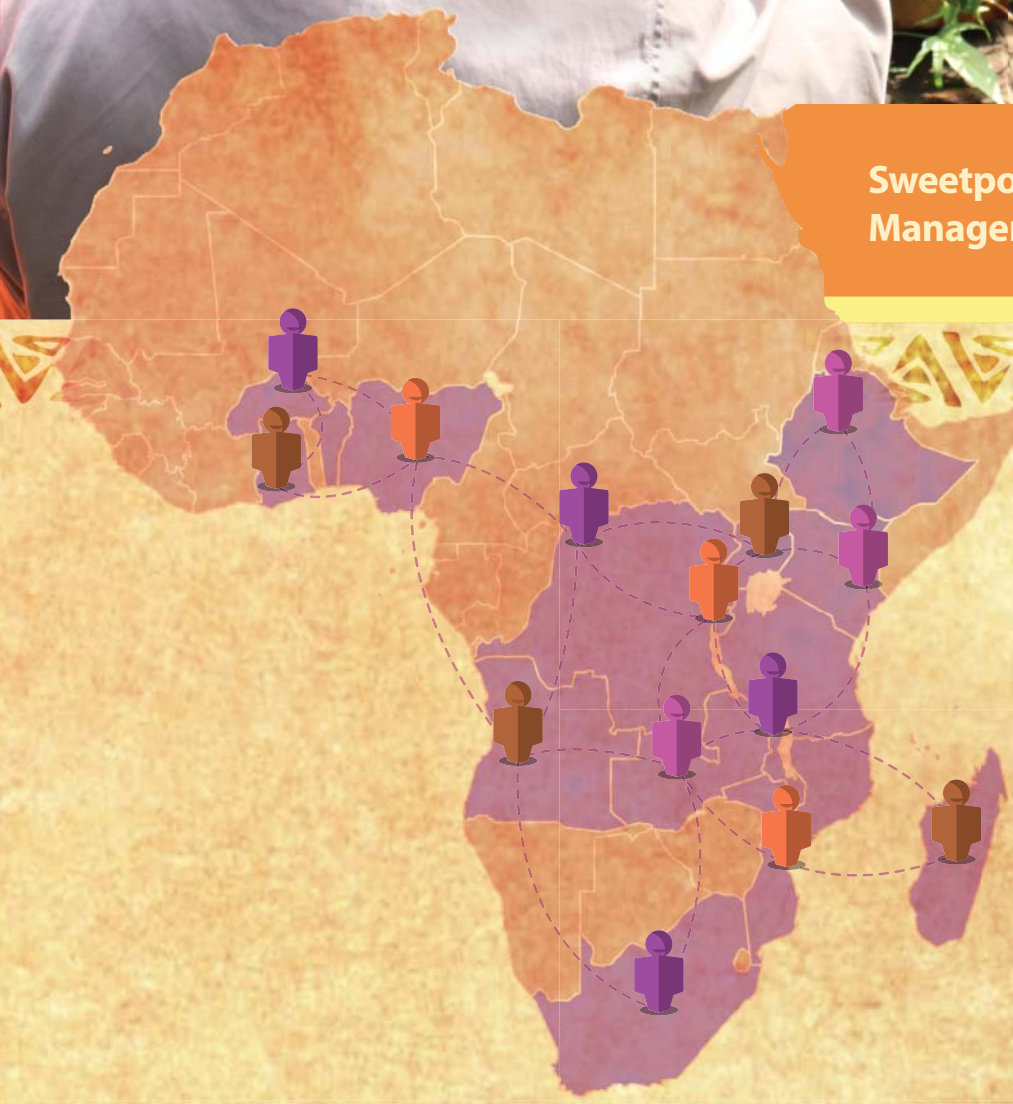
Sweetpotato Seed Systems and Crop Management Community of Practice



SPHI
Sweetpotato for Profit and Health Initiative

Regional Technical Support Platform for East, West, Central and Southern Africa

Third Consultation: The Business Case for Sweetpotato Seed Multiplication

Hotel Villa Portofino, Kigali Rwanda

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Acronyms

A4NH	CGIAR Research Program for Nutrition and Health
AGRA	Alliance for a Green Revolution in Africa
AGRA-SSTP	AGRA Scaling Seeds and Technologies Partnership
BCMV	Bean Common Mosaic Virus
BMGF	Bill and Melinda Gates Foundation
CBB	Common Bacterial Blight
CGIAR	Consultative Group for International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIP	International Potato Center
COP	Community of Practice
CRS	Catholic Relief Services
DARS	Department of Agricultural Services (Malawi)
DVM	Decentralized Vine Multiplier
FTC	Farmer Training Centre
iDE	International Development Enterprises
IFPRI	International Food Policy Research Institute
INERA	Institut de l'Environnement et de Recherches Agricoles (Burkina Faso)
KEPHIS	Kenya Plant Health Inspectorate Services
NaCRRI	National Crops Resources Research Institute (Uganda)
NARI	National Agricultural Research Institutes
NARS	National Agricultural Research Systems
NGO	Non-Governmental Organization
NRCRI	National Root Crops Research Institute (Nigeria)
N-ZARDI	Ngetta Zonal Agricultural Research and Development Institute (Uganda)
OFSP	Orange-fleshed Sweetpotato
QDPM	Quality Declared Planting Material
QDS	Quality Declared Seed
RAB	Rwanda Agricultural Bureau
RAC	Reaching Agents of Change
RTB	Roots, Tubers and Bananas
SARI	Southern Agricultural Research Institute (Ethiopia)
SARI	Savannah Agricultural Research Institute (Ghana)
SNNPR	Southern Nations, Nationalities and Peoples' Region

SPHI	Sweetpotato for Profit and Health Initiative
SPVD	Sweet Potato Virus Disease
SSA	Sub-Saharan Africa
TARI	Tigray Agricultural Research Institute (Ethiopia)
UN	United Nations
USAID-OFDA	United States Agency for International Development – Office of U.S. Foreign Disaster Assistance
VAD	Vitamin A Deficiency
WAAP	West Africa Agricultural Productivity Programme
YWCA	Young Women Christian Association

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Extended Executive Summary

Background

The Sweetpotato for Profit and Health Initiative is (SPHI) is a 10 year, multi donor initiative that seeks to reduce child malnutrition and improve smallholder incomes through the effective production and expanded use of sweetpotato. The SPHI is expected to improve the lives of 10 million households by 2020 in 17 target countries, through promoting production, consumption and utilization of sweetpotato. Without quality seed this goal cannot be met. We need to ensure that male and female farmers have timely access to adequate quantities of quality seed of the varieties which meet end user preferences. This requires: understanding farmer demand for seed; tackling seed borne pests and diseases; improving capacities to conserve and multiply seed in areas with a long dry season; increasing the multiplication rate for sweetpotato seed; implementing appropriate quality assurance mechanisms and identifying appropriate seed enterprise opportunities and distribution channels.

In 2012, the first Sweetpotato Seed Systems Consultation was held in Nairobi, Kenya. In April 2014, during the second Consultation in Entebbe, Uganda, the Sweetpotato Seed Systems Community of Practice (CoP) was established. The purpose of the CoP is to *facilitate networking, exchange of experiences and learning in order to generate new knowledge about how to tackle crucial constraints in sweetpotato seed systems across Sub Saharan Africa (SSA*).

Introduction and objectives

The Sweetpotato Seed Systems Community of Practice (CoP) third consultation meeting was held on April 28 – 29 2015 in Kigali, Rwanda. The meeting brought together more than 40 participants from 11 countries, namely: Burkina Faso, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Tanzania, Uganda, and Zambia. The theme of the meeting was *'The Business Case for Sweetpotato Seed.'*

The meeting was officially opened by **Dr. Jean Jacques Mbonigaba Muhinda**, the Director General of Rwanda Agricultural Bureau (RAB). In his remarks he noted that quality seed is the starting point for any successful agricultural venture and emphasized that a functioning sweetpotato seed system will contribute towards food security and income generation especially for female farmers who are the majority growers of the crop. The Director General highlighted quality assurance and the need for developing seed standards but cautioned against over-regulation and bureaucracy that could stifle emerging seed entrepreneurs.

Summary of presentations

Current sweetpotato seed system in Rwanda: **Jean Ndirigwe** highlighted the factors hampering sweetpotato production in Rwanda, and the progress made to establish a sustainable seed system. The Rwanda Agricultural Board (RAB) is responsible for in vitro multiplication and conservation of seed, and provides technical support and certification of secondary multipliers and Decentralized Vine Multipliers (DVMs). Rwanda has adopted the use of the low cost net tunnel at farmer level to protect the mother stock of clean planting materials from attack by insect vectors of sweetpotato virus diseases. To commercialize seed production, there is need to create demand through

awareness creation of the health benefits of orange-fleshed varieties and the importance of using clean planting material on the one hand; and improve supply by rolling out a multiplication plan that enables seed multipliers to take advantage of the increased demand at peak planting season.

The business case for sweetpotato seed multiplication – business plans: John Jagwe explained the benefits of developing business plans for sweetpotato seed enterprises. His presentation sought to spur discussion about the commercial perspective for seed systems. In addition to explaining the components of a business plan, he highlighted the strategic importance of a business plan for quality management, fundraising and collaboration. Two draft business plans were briefly presented for pre-basic seed production. These compared the business case for the public sector and private sector in Uganda. Financial analysis showed different net present value and internal rates of return, highlighting how the costs structure was different due to varying levels of subsidy.

The business case for existing local vine multipliers: Uganda and Tanzania experiences: **Yuventino Obong** provided an overview of the trade in vines in dry and wet seasons in Lira and Gulu in Uganda, and in Gairo and Lake Zone in Tanzania. Factors that influence this trade, such as price fluctuations, quality, quantity and varieties were also discussed. To improve the vine supply, a project on commercializing clean sweetpotato seed production in areas with a long dry season in Uganda and Tanzania, targeting informal vine multipliers, was initiated. Experience with this project shows that vine multiplication can be a viable business but first, farmers must be encouraged to invest in quality seed; and market linkages, including synchronizing the multiplication cycle with the planting season, should be developed.

Ethiopia: coordinating demand and managing supply: **Beyene Demstu** explained the progress made in establishing a seed system in Tigray, Ethiopia, where previously sweetpotato was not grown and where orange-fleshed sweetpotato (OFSP) is now being massively promoted as one of the strategic food and nutrition crops identified by the regional government to address malnutrition. Tigray Agricultural Research Institute (TARI) is producing pre-basic seed; however the presentation highlighted the lack of demand for quality declared seed (QDS) from root producers, because of lack of awareness, low willingness to pay, and lack of registered QDS producers. On the other hand there is a relatively big demand for QDS by local and international NGOs. Efforts to build a sustainable seed system are focusing on activities to raise the awareness of the benefits of clean planting material and subsequent demand and willingness to pay for it among small scale root producers.

Projecting Demand: **Temesgen Bocher's** presentation emphasized that understanding seed demand and providing seed at the right time are important aspects of a sweetpotato vine business. This involves understanding the kind of seed in demand and the factors most sought after by farmers i.e. is it quality, accessibility, amount, timing or cost. Currently, there is no single method that can be used in predicting demand for sweetpotato planting materials. A seed demand model developed by Monare, is being improved and tested by the sweetpotato seed system community, so that we can have a more systematic approach for projecting demand for sweetpotato seed.

Overview of sandponics technology and its application to rapid multiplication of sweetpotato planting material: **Bramwel Wanjala** explained that currently micro propagation is successfully used to produce quality planting material by multiplying clean plantlets *in vitro*, hardening, and then transferring into screen houses and the field for further multiplication. However

tissue culture based technology is expensive, requires a high level of expertise and delivers varied results depending on the sweetpotato variety. There is the need to identify technologies which can increase the multiplication rate for early generation sweetpotato seed, so that the unit cost can be reduced. CIP is working with partners to test the potential of one technology: sand hydroponics. Current research areas include: the effect of nutrient mix, temperature and irrigation management on variety specific performance; and a cost comparison between conventional and sand hydroponics multiplication.

SASHA Rwanda Super Foods: Roots Tubers Banana (RTB) seed system case study: Jean Claude Nshimiyimana presented the case study on the seed system of the Rwanda Super Foods project. The case study analysis was based on a seed system conceptual framework being tested across RTB crops. The objective of the Rwanda Super Foods project was to reposition white and orange-fleshed sweetpotato and their products in the Rwandan urban consumer market. The project also sought to understand whether commercially-oriented seed systems might emerge in Rwanda. From the case study, it has been established that vine commercialization is possible. However, demand for vines must be created among root producers especially for the main planting seasons. In addition, technologies that ensure supply of affordable clean planting materials by multipliers at the right time should be promoted further.

Status of sweetpotato seed system in Malawi: Achievements and lessons learned from first year of SASHA II and AGRA-SSTP: **Maggie Chiipanthenga** presented the three distinct levels of sweetpotato seed production in Malawi – primary, secondary and tertiary. One of the lessons learnt in Malawi is that farmers and NGOs prefer to work at the secondary and tertiary levels of seed production, because they find the primary level of pre-basic seed production too costly. Farmers also prefer to work in groups of between 10 and 15 people. Field days, and initiatives to train technical staff on tissue culture management, and development of a sweetpotato production manual are expected to help overcome some of these existing challenges.

High Iron Bean Seed Systems: An update on HarvestPlus Activities: **Lister Katsvairo** shared lessons from the seed system development for a biofortified crop – high iron beans in Rwanda. RAB works closely with HarvestPlus to identify train and provide technical support to bean seed multipliers. RAB carries out inspection and certification of bean seed. To address constraints to seed production, RAB is working with HarvestPlus to increase production of foundation seed, and improve agronomic practices, such as using string stakes and yields, through introduction of animal traction.

One Acre Fund Rwanda: TUBURA sweet potato field trial results and planned distribution approaches: **Kaitlyn Smoot** explained that One Acre Fund (OAF) provides input supply, credit, direct delivery, trainings and insurance services to farmers in 13 districts in Rwanda. However, even though 65% of their clients produce sweetpotato during the February to June growing season, OAF has no specific sweetpotato intervention. She presented OAF's recent work on sweetpotato field trials. TUBURA has initiated trials that are testing: variety, planting methods, and fertilizer. Some pending questions, such as the varieties to be tested, approaches to delivery (including how to store cuttings before delivery), distribution and maximizing adoption were highlighted.

Triple S: Potential and Challenges: **Sam Namanda** began his presentation by stating that to ensure functional seed systems, there is the need to start with clean seed stock; produce adequate quantities of clean vines at the right time; promote technologies that basic/primary vine multipliers can easily adopt; produce at affordable cost; and promote technologies that support maintenance of clean planting material. One such technology is the Triple S (Sand, Storage and Sprouting) which is an affordable technology that is easy for multipliers to adopt and maintain. Factors affecting efficiency of Triple S include - maturity and health status of roots; storage containers and medium; storage environment; and watering – were discussed.

Sweetpotato crop and seed management: new findings and future research areas: **Erna Abidin** presented on behalf of colleagues from West Africa, where OFSP is being promoted in Ghana, Burkina Faso and Nigeria through improved seed systems, addressing SPVD problems, training of trainers, nutrition and market intervention and advocacy. Different projects have been supporting action research on improved planting techniques, drip and centre pivot irrigation, intercropping for weevil management, and fertilizer application. They have also been working on the use of positive selection (i.e. whole plant evaluation), when SPVD infection is widespread and negative selection (i.e. rouging) when there is limited SPVD. It was also made clear that elements required for a functioning seed system for Ghana already exist; they only have to be harmonized.

Roundtable discussions

Two roundtable discussions were held: the first focused on questions around the nutrient mix, temperature regime and cutting management for sandponics; the second aimed at facilitating an exchange of experiences and lessons between countries that started implementing the sustainable pre-basic seed production in 2014 (Rwanda, Uganda, Ethiopia, Tanzania and Malawi) on one hand, and those that will start activities in July 2015 (Zambia, Burkina Faso, Kenya and Nigeria). Outcomes of these discussions were synthesized to form part of the issues which the CoP will continue to deliberate.

Learning journeys

A Learning Route is a planned journey with learning objectives that are designed based on i) the knowledge needs of development practitioners that are faced with problems associated with rural poverty and, ii) the identification of relevant experiences in which local stakeholders have tackled similar challenges in innovative ways, with successful results and accumulated knowledge which is potentially useful to others. www.africa.procasur.org.

On 29 April 2015, participants had the opportunity to go on one of three learning routes: (i) Net tunnels; (ii) Inspection of sweetpotato Quality Declared Seed; and (iii) Route 3: Rubona Research Station: tissue culture micro propagation and hardening. Before the site visits, participants were required to inform themselves about the site, review and select priority questions and agree on the protocol during the visit, including allocating specific tasks (leader, time-keeper and note-taker). After the visit, the groups held a reflection session to collate and document key learning points and actions arising from the visit, new or more in-depth research questions that could be pursued in light of the visit – which were presented to in plenary. Each group identified a topic and lead person for continued on-line discussion.

Reflections from the meeting and issues moving forward

The following points have been synthesized as the main issues identified throughout the meeting and the learning routes. These will form the basis of the issues which the CoP will continue to deliberate on through on-line discussion and individual country follow up before the next meeting.

Nomenclature & terminology: Create a common understanding about formal and informal seed systems and their complementary roles; and harmonize the terminology to use for different seed classes. There is also need to agree on the number of generations that seed can be multiplied as pre-basic seed.

Demand creation: Create awareness among farmers about the importance of clean planting material; synchronize seed production with peak planting seasons and promote sweetpotato as a priority crop for health, nutrition and food security.

Demand projection: Monare's method for projecting seed demand and improve on data collection to validate the tool should be tested and refined. Participants also require training on how to use the demand projection tool.

Revolving fund mechanisms: Create awareness among CoP members on revolving funds and how to take advantage of features that would increase the pace of financial transactions and procurement of supplies.

Cost Analysis: Compare cost structure and production costs for each segment of the seed value chain for different countries.

Partnerships: Test different approaches to strengthen linkages between the different segments of the seed chain through to root producers. Identify and obtain additional sources of funds to support CoP activities.

Tissue Culture Plantlet production: Adopt cost-cutting measures such as substituting sugar for sucrose and improving efficiency of tissue culture plantlet production.

Identify and test methods to increase multiplication rate for early generation seed: This includes factors such as greenhouse and screen house specifications; nutrient solution; integration of micro propagation with seed production system; testing field performance-effect of fertilizer on plant quality; optimization of conditions for sand hydroponics and economics of sand hydroponics under local conditions.

Net Tunnels: More work is required on alternative materials for net construction, (in particular the insect proof netting); management options to reduce/minimize weeding; and the response of different varieties to net tunnel technology.

Crop and Seed Management: Techniques and practices for farmers to get and maintain clean planting material even if their fields are completely infected by SPVD.

Appropriate quality assurance mechanisms: Pilot and adapt QDS inspection schemes with regulatory authorities at country level.

1.0. Opening session

1.1. Objectives and opening remarks – *Gorrettie Ssemakula, Margaret McEwan and Jean Jacques Mbonigaba (DG, RAB)*

The Sweetpotato Seed Systems Community of Practice (CoP) third consultation meeting was held on April 28 – 29 2015 in Kigali, Rwanda. The meeting brought together more than forty participants from 11 countries, namely: Burkina Faso, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Tanzania, Uganda, and Zambia. The objectives of the meeting, whose theme was *'The Business Case for Sweetpotato Seed'* were presented by Margaret McEwan and Gorrettie Ssemakula as follows:

- To understand the financial aspects of sweetpotato seed multiplication and development of business plans for the same
- To share updates on sustainable pre-basic seed production
- To share updates on seed system technologies including sandponics, "Triple S" (Sand, Storage and Sprouting), net tunnels, and crop and seed management issues
- To learn from other countries, partners and producers of seed for other crops
- To network with other seed systems experts and share ideas

The CoP members were reminded to utilize available online platforms in sharing experiences on a regular basis. The International Potato Center (CIP) has already developed a Google Group where members can conduct online discussions on different topics.

The meeting was officially opened by Dr. Jean Jacques Mbonigaba Muhinda, the Director General of Rwanda Agricultural Bureau (RAB). Dr. Muhinda welcomed participants to Kigali and reminded them why the meeting was so important *(Annex 1).* In his remarks he noted that quality seed is the starting point for any successful agricultural venture. However, the seed of any crop is more than its genetic material. Seed provides a channel whereby farmers can exchange and gain knowledge around: seed traits and characteristics; improved agronomic and management practices; and in turn strengthen institutional and social networks. Dr. Muhinda added that a functioning sweetpotato seed system will contribute towards food security and income generation especially for female farmers who are the majority growers of the crop. The Director General highlighted quality assurance as a key point, given that sweetpotato is propagated through vegetative cuttings and the practice of farmers to exchange planting materials. He commended Ethiopia and Tanzania for progress made so far in developing seed standards for the production of quality planting materials; but reminded participants of the need to be cautious and ensure that over-regulation and bureaucracy do not stifle emerging seed entrepreneurs. He urged participants to take full advantage of the opportunities for learning and developing further research questions in the CoP and to actively use virtual platforms for communication and sharing experiences on sweetpotato seed systems.

1.2. Third Sweetpotato Seed Systems CoP Third Consultation: Progress with our CoP – *Margaret McEwan (CIP – SSA)*

The Sweetpotato for Profit and Health Initiative (SPHI) is focused on promoting production, consumption and utilization of sweetpotato. It has a goal of reaching 10 million households in SSA by 2020 in 17 target countries. Without quality seed this goal cannot be met. Access to clean planting material is still a challenge. We need to ensure that male and female farmers have timely access to adequate quantities of quality seed of the varieties which meet end user preferences. This requires: understanding farmer demand for seed; tackling seed borne pests and diseases; improving capacities to conserve and multiply seed in areas with a long dry season; increasing the multiplication rate for sweetpotato seed; implementing appropriate quality assurance mechanisms and identifying appropriate seed enterprise opportunities and distribution channels.

The purpose of the CoP is to facilitate networking, exchange of experiences and learning in order to generate new knowledge about how to tackle crucial constraints in sweetpotato seed systems across Sub Saharan Africa (SSA). In addressing the bottlenecks along the sweetpotato seed value chain, members are committed to developing and being active members of a dynamic CoP on sweetpotato seed system research and development. The CoP members are genuinely interested in learning from each other's expertise and practice. The CoP is a good platform for knowledge-sharing since members can freely exchange ideas in an informal structure.

1.2.1. Envisioned outputs of the CoP

i. Increased visibility and spread of good sweetpotato seed system technologies and practices across the Eastern, Western and Southern African sub-regions (e.g. business models for sweetpotato vine multiplication and distribution; Triple S root based vine multiplication approach; low cost net tunnel protection of basic planting material).
ii. Increased information flow with respect to availability and management of sweetpotato germplasm.
iii. Improved information flow about different sweetpotato seed system initiatives.
iv. Harmonisation and where appropriate standardisation of relevant protocols, e.g. Quality Declared Seed (QDS)/Quality Declared Planting Material (QDPM); germplasm exchange protocols).

1.2.2. Updates from first year of the CoP

The first Sweetpotato Seed Systems Consultation was held in Nairobi, Kenya in June 2012. The CoP was established as an output of the second consultation in Entebbe, Uganda April, 2014. The CoP has run for one year now and has provided an opportunity for members to learn lessons from different vine commercialization and business models. Colleagues involved in various vines commercialization initiatives have shared their experiences. Under objective one, a concept note for scaling-up inclusion of orange-fleshed sweetpotato (OFSP) vine distribution through agro-dealers

ON-LINE DISCUSSION TOPICS

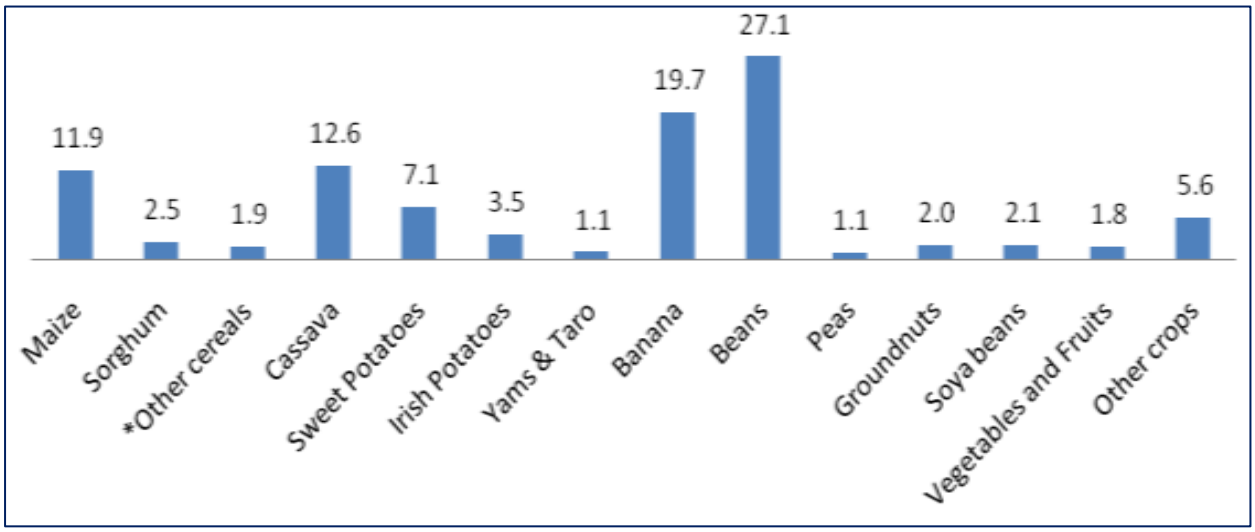
- The use of positive and negative selection in the production of clean planting material
- Seed degeneration through accumulation of virus diseases and the potential of reversion in some varieties
- Phytosanitation practices and seed system innovations

in Kenya was developed. This was based on experience from a pilot project. Additionally, an online discussion forum was started in March 2015 to enable the virtual exchange of ideas. The online discussion was initially email based but has since been moved to Google Groups. Further, an updated OFSP catalogue and list of clean germplasm available at Kenya Plant Health Inspectorate Service (KEPHIS) have been developed and distributed. The Sweetpotato Knowledge Portal is also being revamped to enable efficient sharing of information.

1.3. Current sweetpotato seed system in Rwanda – *Jean Ndirigwe (RAB, Rwanda)*

Sweetpotato is a staple food crop grown in all the agri-ecological zones of Rwanda. The crop is a source of income and employment. Production is mainly rain-fed and utilizes marshlands during the off-season. White-fleshed varieties are more dominant compared with yellow and orange-fleshed. This is despite OFSP varieties offering a sustainable strategy to combat Vitamin A deficiency (VAD). As indicated in the graph below sweetpotato is in the fifth position in terms of land allocation.

Figure 1: Share of agricultural land per crop in Rwanda



Source: NISR, 2013: National Institute of Statistics of Rwanda, p.61.Kigali, Rwanda

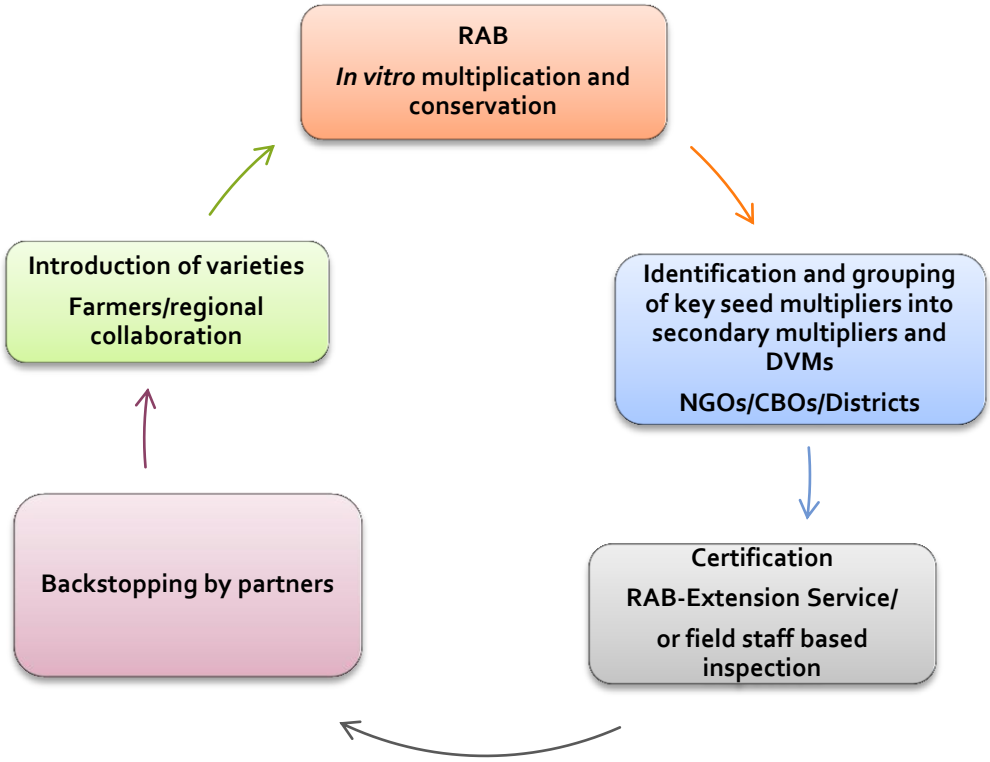
1.3.1. Challenges in sweetpotato production in Rwanda

In Rwanda, sweetpotato production is hampered by limited access to clean planting materials, climate change and climate variability, farmer to farmer exchange of virus-infected planting materials and restrictions on access to swamps or marshlands for off-season preservation and production of planting materials.

Although progress has been made to establish a sustainable seed system, the pricing of pre-basic seeds – especially laboratory, hardening and screen house costs – is still not standardized. The seed system is still mainly informal. Most sweetpotato growers do not seek the right seeds from seed multipliers.

In order to address the above challenges sweetpotato actors are working towards establishing an improved seed system taking into consideration the needs of all stakeholders.

Figure 2: Model for improved sweetpotato seed system in Rwanda



Key stakeholders include RAB, CIP, and Catholic Relief Services (CRS), Young Women Christian Association (YWCA), Imbaraga, One Acre Fund, other development agents, private sector and local authorities. Selection of varieties is based on consumer preferences.

1.3.2. Adoption of the net tunnel technology

Net tunnel technology in use at RAB

Rwanda has adopted the use of the low cost net tunnel at farmer-multiplier level to protect the mother stock of clean planting materials - such as those of Naspot 10 and Tacna varieties - from attack by insect vectors of sweetpotato virus diseases. Depending on weather conditions and agro-ecological zone, a tunnel can be ready for harvest after 38 days. The number of three-node cuttings varies from 816 (19.5 Kg) to 1,200. However, this technology has its own set of challenges. Firstly,

the use of binding wires increases likelihood of damage to the net and therefore entry points for whiteflies and aphids. The wires are also not easy to work with. Secondly, when poorly handled, tunnels easily get holes negating their purpose. Farmers need more training to maintain the tunnels particularly ensuring that there are no holes. Thirdly, although spraying with insecticide and applying fertilizers is recommended, it is sometimes too costly for the farmers. Lastly, depending on the location of the tunnels, security can be a problem, whereby children or passers-by damage the net out of curiosity to find out what is inside.

1.3.3. Why commercialization of sweetpotato seed system in Rwanda?

While the sweetpotato seed system in Rwanda is mainly informal, there are opportunities to make it commercial and a reliable source of income. First, there is always a shortage of clean planting materials at the beginning of the main planting seasons. With a well thought out multiplication plan, farmer multipliers can take advantage of the increased demand at this time. Second, there is increased awareness of the nutritional qualities and opportunities for processing of OFSP in Rwanda. Sweetpotato is no longer grown for its energy content but also as a source of vitamin A which has led to increased demand for orange-fleshed varieties. Third, is an increase in demand for the roots for the export market, which gives farmers an opportunity to increase their income. Lastly, farmers have become more aware of the need to use high quality planting materials for higher productivity.

At the moment seed multiplied conventionally costs 0.01 USD. Improved seed costs significantly higher as shown below (Table 1).

Table 1: Prices of different types of sweetpotato seed in Rwanda

Type of seed	Price/cutting (RWF)	Price/cutting (USD)
Hardened tissue culture	50	0.07
Screen house	60 - 70	0.08 – 0.1
Net tunnel	60 - 70	0.08 – 0.1
Nursery	30 - 40	0.04 – 0.06
Conventional	10	0.01

1 USD = 720 RWF[1]

Source: Rwanda Agricultural Bureau, 2014

[1] RAB is selling at 10 RWF at research level for the basic seeds and the Decentralized Vine Multipliers (DVM) at the farmer group level sell a bundle of 10 kg (which is made of 25-30 cuttings) at 3,000 RWF.

2.0. Sustainable pre-basic seed production: the financial and institutional issues

2.1. The business case for sweetpotato seed multiplication – *John Jagwe (Consultant, Uganda)*

Dr. Jagwe's presentation sought to answer the following two questions:

a) Is there a business case for pre-basic sweetpotato seed production?
b) How can we start thinking from a commercial perspective for seed systems?

Farming has become a business and to succeed, farmers need to transition from subsistence to commercial farming. To do this, a written business plan is essential. A business plan is a formal statement of business goals and the strategies or ways of attaining them with available resources. It is important in any commercial venture since it enables someone to manage their business in a quality manner (Total Quality Management), assists in strategic planning and helps in fund raising. Resources are always limited, but needs are unlimited; strategic planning helps to balance needs and available resources and ensure that one's business remains relevant.

A SIMPLE BUSINESS PLAN HAS THE FOLLOWING SECTIONS:

- Executive summary
- Description of the business
- Analysis of the business environment
- Industry background
- Market analysis
- Promotional Plan
- Operations plan
- Gender equality analysis
- Financial plan
- Milestones

There are two major parts of a business plan - namely narrative and financials. The narrative part explains what the business is all about while the financials captures income and expenditure. Developing a business plan is an iterative process that requires wide consultation with experts. Additionally, it should be noted that business plans can be for existing businesses or those yet to begin. They are also not cast on in stone and can be adjusted with time.

2.2. The business case for existing local vine multipliers: Uganda and Tanzania experiences – *Yuventino Obong,* Ngetta Zonal Agricultural Research and Development Institute *(N-ZARDI, Lira Uganda)*

In most of Africa, sweetpotato is grown mainly for family food. However, in recent years the crop has gained a commercial appeal especially for urban markets. Production is not sufficient due to limited supply of clean planting materials especially at the onset of rains. Most often, farmers lose their vines during the dry seasons, with only those with access to water sources being able to conserve. Sweetpotato irrigated or grown in wetlands for roots during the dry season provides planting materials at the onset of rains.

2.2.1. The project on commercializing clean sweetpotato seed production in areas with a long dry season in Uganda and Tanzania

Dry season conservation in Tanzania (left) and Uganda (right)

The goal of this project is to empower informal vine multipliers to provide their customers with sufficient quantities of clean planting materials of improved varieties. The multipliers are linked with research institutes where they can access healthier planting materials of improved varieties. The project provides information on how formal and informal systems can work together, especially to governments, development partners and non-governmental organizations. The project envisages building the strengths of the informal seed systems for sustainability, wide reach, flexibility and resilience.

2.2.2. Types of vines supply chains

There are four types of supply chains for vines:

- Vine multipliers selling on-farm direct to farmers
- Vine multipliers taking their vines to markets to sell
- Vine multipliers selling to traders who sell to more distant farmers
- Vine multipliers selling vines to intermediaries who pack and transport them to vine sellers in trading centers

The informal multipliers allow farmers to buy whatever quantities they desire, packaged either in small or in big bundles. Prices vary depending on the bundle size and the buyer, but they are relatively stable, as can be seen in the table 2 below.

Table 2: Price variations per buyer for sweetpotato vines in the informal seed system in Uganda

SELLER	BUYER	BUNDLE TYPE	PRICE (UGX)
Vine multiplier	Farmer	Small	300
Vine multiplier	Farmer	Big	5,000-10,000
Vine multiplier	Trader	Un-organized big bundles	3,000
Vine multiplier	Street seller	Small	300
Trader	Street seller	Small	300
Street seller	Customer/small holder farmer	Small	500

1 USD = 2950 UGX

Types of bundles in Uganda: left: Unsorted big bundle in Arua at Ombatini Junction; and right: sorted big bundles in Gulu

A big bundle consists of 20 small bundles each containing 50 vines. Multipliers in Uganda play multiple roles in the supply chain, e.g. often trading the vines they produce. Gulu town has 5 – 10 female sellers. The sale of vines is most profitable from April to September, when rains are good. The tables below show[2] sweetpotato production costs in select areas in Uganda and Lake Zone, Tanzania during dry and wet seasons.

[2] *NB: There are many variations and inconsistencies in data provided above but the averages still provide a reasonable picture.*

Table 3: Sweetpotato production costs per acre and sales in Arua and Gulu, Uganda

Region	Season	Production cost (UGX)	Vines yield (large bundles)	Roots yield (kg)	Vines sales (UGX)	Roots sales (UGX)	Gross margin
Gulu	Dry	571,200	32	2,400	176,000	600,000	204,800
	Wet	589,500	-	3,750	-	750,000	160,500
Arua	Dry	541,600	34	2,600	68,000	660,000	186,400
	Wet	440,000	-	3,000	-	625,000	185,000

Table 4: Sweetpotato production costs per acre and sales during the dry season in Lake Zone, Tanzania

DRY SEASON (0.5 acre)	Misungwi	Nyakasanga	Mwasonge	Samuye	Usanda	Semu, Meatu	Averages
Production cost (TZS)	152,250	161,083	224,500	111,083	161,833	161,500	162,000
Vines yield (kg)	125	675	900	712.5	675	525	600
Roots yield (kg)	425	250	400	650	350	400	400
Vines sales (TZS)	30,000	150,000	150,000	375,000	210,000	80,000	165,800
Roots sales (TZS)	60,000	45,000	160,000	90,000	120,000	120,000	99,150
Margin average	-62,250	33,917	85,500	353,917	330,000	38,500	129,931

Table 5: Sweetpotato production costs per acre and sales during the wet season in Lake Zone, Tanzania

WET SEASON (0.5 acre)	Misungwi	Shinyanga	Meatu	Averages
Production cost (TZS)	111,416	145,625	146,500	134,500
Roots yield (kg)	1000	1000	300	770
Roots sales (TZS)	150,000	240,000	-	195,000
Margin average	38,584	94,375	-	66,500

Source: Report of Survey commissioned by the 'Commercializing Sweetpotato Project', implemented by NARO and Lake Zone Agricultural Research Institute, 2014.

2.2.3. Sweetpotato business in Gairo, Lake Zone, Tanzania

In Gairo, vine buyers can travel up to 40 km to purchase vines and they often do the harvesting fom the multiplication plot themselves. Roots are sold to traders either at the farm or in town markets. There is high demand (and prices) for vines from November/December to mid-January which is usually the peak period. Planting finishes in February/March. The demand for vines decreases during the dry season (generally July to December) when few farmers have access to water for irrigation.

Vines are traded informally, with limited market information on quantity, quality and varieties. Market prices fluctuate depending on the point in the root production calendar and prices do not necessarily reflect the quality of vines. Commercial vine multiplication exists in spite of the limited entrepreneurship skills and low literacy levels of majority of the vines multipliers. The multipliers utilize low-lying marsh lands in producing and conserving vines during the dry season. The conserved crop is used to 'kick-start' the main season. Most farmers buy vines from on-farm multipliers who are in close proximity.

In conclusion, vine multiplication can be a viable business but the following factors need to be considered:

- Water availability especially during dry season
- Logistical efficiencies including proper planning of the multiplication cycle to be in synchronization with planting time
- Market linkages
- Willingness of farmers to invest in quality seed
- Strategies/technologies to increase shelf life (of vines)

2.3. Ethiopia: coordinating demand and managing supply - *Beyene Demtsu (TARI, Ethiopia)*

Training and demand creation activities are conducted in Tigray Region, Ethiopia.

Sweetpotato is produced and consumed mainly in the southern and eastern parts of Ethiopia. In northern Ethiopia, OFSP is being massively promoted as one of the strategic food and nutrition crops identified by the regional government to address malnutrition.

There is no established seed system for root and tuber crops, especially Quality Declared Seed (QDS) and pre-basic seed for sweetpotato. However, Ethiopia has a favorable policy environment for the development of sweetpotato seed production, as no planting material can be introduced into the Tigray region without the approval of the Bureau of Agriculture regulatory unit.

Under the SASHA II project, the aim is to establish a seed system for production of sustainable pre-basic seed, with Tigray and Southern Nations, Nationalities and Peoples' Region (SNNPR) as target

regions. At the moment, the preferred model focuses on public sector, with a possibility of the entry of private sector players.

2.3.1. Demand Coordination

Currently Tigray Agricultural Research Institute (TARI) and The Southern Agricultural Research Institute (SARI) are producing pre-basic seed. In Tigray, there is no demand for QDS from actual root producers.

The main reasons for this include:

- Lack of awareness of the need for clean planting material
- Low willingness to pay for planting material in both Tigray and SNNPR
- Lack of registered QDS producers
- Lack of approved regulatory manual for QDS and pre-basic seed in the country

However, there is a relatively big demand for QDS by local and international NGOs.

Table 6: Demand of pre-basic (cuttings) seed as projected from demand for QDS in Tigray, Ethiopia

Name of organization	Actual Demand (QDS)	Pre-basic seed needed to raise QDS
Relief Society of Tigray (REST)	50,000	3,300
The Tigray BoA	Not available	Not available
GIZ	70,000	4,600
World Vision Ethiopia	100,000	6,600
Amhara BoA	1,500,000	100,000
CIP	2,000,000	133,000
FOA	Not available	Not available
Total demand	> 3,720,000	> 247,500

Source: TARI – Mekelle Agricultural Research Centre, 2014

Managing supply

Pre-basic seed is produced without any request from QDS producers. The quantity produced is limited by the total space available in the mobile net tunnel production at Mekelle Agricultural Research Centre. Production started in July 2014.

Production plan

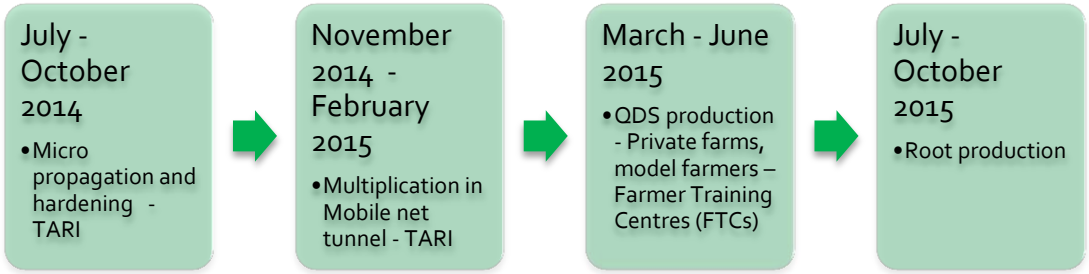


Table 7: Pre-basic seed (cuttings) distributed to QDS producers and estimated cost, Tigray Ethiopia

QDS producer receiving Pre-basic seed	Producer Type	Total Pre-basic seed received	Estimated cost in Birr
Hafteab	Investor (Private)	65,000	19,500
Safron Agri.	Investor (private)	65,000	19,500
Alganesh	Model Farmer	25,000	7,500
Kidanu	Model farmer	25,000	7,500
BoA	FTC	50,000	15,000
BoA	Nursery	50,000	15,000
Total		**280,000**	**83,500**

1 USD=21 Birr

Source: TARI – Mekelle Agricultural Research Centre, 2014

2.3.2. Challenges

Small scale root producers are unwilling to pay for planting material. In addition, there is a danger of dependence on the supply of planting material from NGOs. Production of quality seed is also hampered by the limited availability of tissue culture reagents and equipment.

2.4. Projecting Demand – *Temesgen Bocher (CIP – SSA)*

Demand is an economic principle that describes a consumer's desire and willingness to pay a price for a specific good or service. Understanding demand and providing seed at the right time is an important aspect of a sweetpotato vine business. It is important to develop a strategy that will strengthen the existing seed system so that it can be self-sustaining. For this to happen we need to understand the demand for both roots and planting materials since they are interdependent. Projecting demand also helps in understanding the kind of seed being demanded and the factors most sought by farmer i.e. is it quality, accessibility, amount, timing or cost.

Demand can be forecasted using qualitative or quantitative approaches. Qualitative methods are important when operating under uncertain contexts. Under such circumstances there is often no past data available either because it is a new technology or product. It is therefore crucial to involve institutions and individuals with experience. Additionally, a survey can be conducted to generate some data. On the other hand quantitative approaches are used when the existing system is stable and there is historic data available. This approach requires good computation skills.

Currently, there is no single method that can be used in predicting demand for sweetpotato planting materials. The Sweetpotato for Profit and Health Initiative (SPHI) is improving the seed demand model developed by Monare so that it can be used in projecting demand for sweetpotato seed. Monare's model is as follows:

$S_a = A * T_s * T_r * P_j$
S_a= Seed demand
A=Area under sweetpotato the previous year
T_s=Amount of seed used per hectare
$T_{R=}$Renewal rate (%)
P_j=Area planted to improved seed (%)

2.5. Plenary discussion for session 2: summary

Three main issues emerged during the plenary discussion. These are: ***Interaction between formal and informal seed systems; estimation of seed demand; and costs of production***. The following sections summarize the main questions and responses that arose from the discussion.

2.5.1. Interaction between formal and informal seed systems

What is the difference between informal and formal seed system? Can informal seed systems guarantee the quality of planting materials and how long will it take to formalize them?

Formal systems are regulated by statutory bodies while informal ones are regulated by farmers. An effective strategy should include strengthening of the informal seed system to make it more efficient, because even with grain crops, only a small proportion of farmers obtain seed through the formal system.

A seed system should be seen as a continuum with formal elements, such as breeding, as well as informal elements especially down the value chain, such as distribution. Quality assurance mechanisms should be identified and implemented at different levels of the seed system. Formal regulation can be emphasized up-stream in the chain (at tissue culture and screen house level); but downstream e.g. with Decentralized Vine Multipliers (DVM), we should be careful not to overregulate as it might shut down the system.

2.5.2. Estimation of demand

Farm Concern International is trying to build competitiveness of the seed system through the Seed, Farmer, Markets and Consumer (SeFaMaCo) Program. The organization would like to work with stakeholders to come up with a strategy that will guarantee sustainable commercialization. However, estimating demand is still a challenge. Are there lessons from the 'Commercialization of Informal Seed Systems Project' that can help us develop a methodology for estimating real annual demand for seed?

Seed demand is difficult to project. Efforts to project demand at different primary and secondary multiplication levels have not been successful. It has also been recognized that demand for seed is interrelated with market demand for roots. Additionally, demand estimation is made difficult by losses incurred during transportation of vines can make it very difficult to estimate. One thing to note is that when running an agriculture-based business, the risk of incurring losses is always present. Therefore, the DVMs should be informed upfront that there is always going to be booms and busts and they should be trained on how to stagger vine production so that they can maintain material and multiply during the dry period.

Participants hold plenary discussions at the end of the session

2.5.3. Costs of production

According to the data presented, there are no significant differences in the costs of production in Uganda during dry and wet seasons but in Tanzania the cost of production is much higher during the dry season. Why?

In Uganda, extensive irrigation is not required, even in the dry season since there is a reliable supply of water where multiplication is done. It is important also to note, that the figures presented are not very accurate because most multipliers do not keep records. Efforts are being made to refine data collection so as to advise farmers better.

At what scale of production will a decentralized vine multiplier break even in the vine business and at what price?

In business, revenue is generated by quantity and price. A good business should be able to produce at maximum capacity and at the lowest possible price. Breaking even is dependent on a DVM's ability to understand the market dynamics. This understanding helps the DVM to determine the quantities to produce and the selling price.

In the presentation from Rwanda, it was indicated that 816 to 1,200 three-node cuttings were harvested after 38 days. Was this from a single harvest and what is the frequency of harvesting? Lastly, how many times can you harvest from a net tunnel?

Eight hundred to one thousand three-node cuttings can be harvested from the tunnel (1.8 m x 3 m) after five weeks. One can have up to six rattoons. The plant population in the net tunnels is 360 and depending on the variety, one plant can give up to four three-node cuttings after 38 days. The number of times one harvests depends on management of the net tunnel, e.g. watering and fertilizer/manure application. The weather is also a factor, with faster growth being experienced in warm and humid areas. The business case should be: how many cuttings can you get within the shortest time possible within a unit?

When projecting demand using the seed demand tool, is the area projected from a specific zone or the whole country? The projections are for specific areas. Areas of production should be in close proximity to farmers in order to reduce losses during transportation. The more effective approach is to get information from the district level or project area. If this information is unavailable, regional data could be used. Currently, available sweetpotato data is very unreliable, and this CoP has an opportunity to develop a better method for projecting demand and improving on data collection.

As a starting point, we can get the area estimates and adoption trends to see what quantities are produced and triangulate that with expert opinions from the area e.g. researchers and extension officers. Additionally, we should implement this model, while at the same time supporting multipliers to keep records. In time, we will have reliable information.

How do we address the capacity gaps of some of the extension officers?

Without proper capacity, there is a danger that some extension officers may not be able to capture the exact acreage. There is need for further training on the use of the formulas (e.g. through online platforms).

To what extent can other factors such as pests and diseases be incorporated in the formula used?

It is possible to change the formula and extend it to include other factors such as pests and diseases by estimating the elasticity and how much area will be affected by pests, diseases and drought.

Why are you using kilograms instead of number of cuttings when referring to sweetpotato seed yet it can give a wrong picture on the amount of available seed? Weight varies with many factors including water content.

The decision was based on an assumption that 1 cutting is 20 grams but it can be revised. *NB: CoP members participating in the meeting agreed that number of cuttings is a more appropriate standard measure.*

3.0. Sustainable pre-basic seed production: the technical issues

3.1. Overview of the sandponics technology and its application to rapid multiplication of sweetpotato planting material: *Bramwel Wanjala (CIP-Nairobi); Mihiretu Cherinet (CIP-Ethiopia)*

The production of sweetpotato in Kenya rose by 22% from 2004 to 2009. The main constraints for sweetpotato production in the country are pests, diseases and access to quality planting material at the right time and in the right quantities. To build a functional seed system, there is need for clean seed stock, production of adequate quantities of clean vines at the right time, adaptable technologies by basic seed multipliers and high quality first and second generation pre-basic seed at affordable cost.

Micro propagation is used to produce quality planting material. This involves multiplying clean plantlets *in vitro*, in screen houses or greenhouses and in the field. However, micro propagation also has its limitations. These include high costs of facilities, high level of technical know-how required and contamination. Furthermore, response to micro propagation varies among different varieties and the hardening of *in vitro* plants is quite challenging. Use of hydroponics and aeroponics has been adopted as an alternative in other crops but these technologies may not be appropriate for lower value crops.

Therefore, CIP is working with partners to explore the use of sandponics for the production of vines. This is a simple, easily adoptable and low-cost technique that uses sand as a media. Sand is easily and cheaply available. It can be sterilized chemically (using bleach) at a lower cost and it can be recycled.

In Zambia, sandponics is already being implemented. Uganda is undertaking research on sandponics, while Kenya, Malawi and Ethiopia have initiated research activities.

Sandponics system for cucumber production at National Agrarian University - La Molina, Lima, Peru

The research questions with regard to sandponics are related to the following issues:

- Greenhouse and screen house specifications
- Nutrient solution- Economical optimum N rates
- Optimum conditions for sand hydroponics
- Plant husbandry
- Variety differences
- Field performance-effect of fertilizer on plant quality
- Integration of micro propagation with seed production system
- Economical adoptability under local conditions

3.2. Roundtable discussion on the research questions - *Mihiretu Cherinet (CIP-Ethiopia); Maggie Chiipanthenga (DARS, Malawi)*

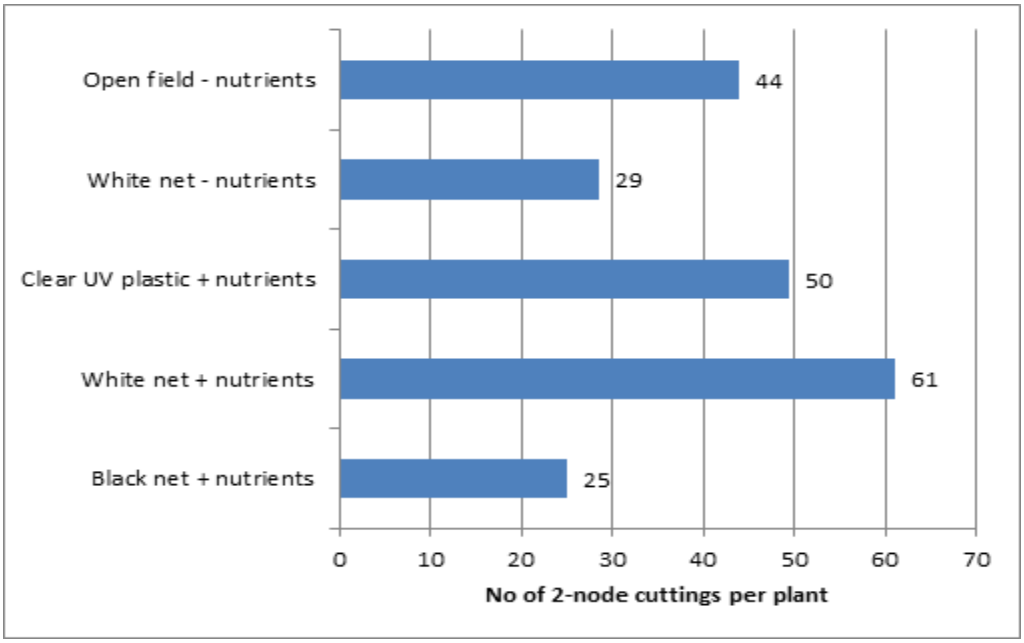
The roundtable discussion focused on questions around the nutrient mix, temperature regime and cutting management for sandponics production.

Sandponics is used for production of pre-basic seed, because the main interest is to reduce the costs of tissue culture production for pre-basic seed. Plants grow very fast within the first 45 days, but at 90 days one may not see any further growth. Questions arose as to when harvesting should be done to maximize on re-growth. Participants highlighted that slow growth could be as a result of different factors e.g. the type of nets, temperature, fertilizers and growth media.

Type of nets *for sandponics units*: In Uganda, three types of roofing materials (black net, white net and a UV clear plastic cover) were tested and compared with growth in an open environment. The black cover was used in the initial experiment.

Vine production data from the first growth cycle of the second round of trials clearly showed that choice of the type of cover had significant impact on sweetpotato vine growth (Figure 4). When the plants were directly grown in the soil (under the same nutrient regime used with the hydroponics system), with white net as the cover, 2.4 times more vine cuttings were obtained than with a black net cover under the same nutrient application regime (Figure 4). A possible explanation for this observation was that the conditions under the white net were warmer and had more light compared to the black net. The UV clear plastic cover, which was the hottest of the three covers, produced two times the number of stem cuttings than the black net but was slightly less productive compared to the white net, possibly as a result of higher internal temperature build up relative to the white net.

Figure 3: Effect of type of screenhouse cover on sweetpotato vine production when grown with nutrients added and without nutrients added



Watering in hot, dry countries: In countries like Burkina Faso, the temperature can go up to 47^{O}C, raising concerns about the quantity of water required. Initial use of water during washing of sand is high. The difference between conventional and sandponics methods have not yet been compared.

Sterilization: Sterilizing soil does not kill viruses and soil borne pathogens. A study conducted at CIP headquarters in Lima showed no difference between sterilized sand and sand washed in ordinary water.

Nutrient mix: Some presenters explained that they had tried to use nutrients from manure to produce the cuttings but this was unsuccessful and the plants died. Researchers also tried to correct discoloration using fertilizer to replace Compound D, but they realized that they were overdosing the plants; they are making the necessary adjustments. However, it was noted by participants that there is no clear information on the type and quantity of fertilizers required.

Availability of sandponics supplies: This depends on the context. In Zambia, the sandponics system is functioning well, but there have been problems getting chemicals to run sandponics research. The supplies are currently sourced from Nairobi.

4.0. Updates from sweetpotato seed systems, technologies and other seed systems

4.1. Roots Tubers Banana (RTB) seed system case study: Rwanda Super Foods - *Jean Claude Nshimiyimana (CIP-Rwanda)*

Sweetpotato is very important in densely populated areas of Rwanda, and it is grown throughout the year. Planting material (vines) is often obtained from existing mature crops. This practice leads to the build-up of sweetpotato viruses in the seed system.

The Rwanda Super Foods project wanted to reposition white and orange-fleshed sweetpotato and their products in the Rwandan urban consumer market. The main question was to determine how the poor and women would benefit from increased commercialization of sweetpotato. The aim of the project was to understand whether commercially-oriented seed systems might emerge in Rwanda.

4.1.1. Seed acquisition and accessibility

A baseline survey carried out in 2011 established that the informal system was the most dominant method of vine diffusion in the area. Farmers' main source of vines was from their own farm, followed by the neighbours, especially female ones. The most widely practiced method of conservation is to leave a portion of the sweetpotato plot un-harvested (48% and 58% in the north and south respectively); the second most widely used method of preserving the vines is planting them in the lowlands or swampy areas (26% and 27% in the north and south respectively). Other methods used are keeping vines under the shade, planting sweetpotato near the bathroom and burying them underground. Sometimes, farmers receive relief supplies from the Government, NGOs or International agencies. The sale of sweetpotato vines was very minimal: 5.4%.

4.1.2. Consequence of the intervention

The formal seed system channel has been developed and strengthened. RAB undertakes the production of pre-basic seed using *in vitro* plantlets and hardening in screen houses. Primary multiplication of basic seed is undertaken in open fields. Women's groups and DVMs have been trained to carry out secondary and tertiary multiplication of QDS using net tunnels and open field multiplication. This multi-stakeholder initiative involves among others, RAB, Imbaraga, YWCA, DVMs, farmer groups and individual multipliers.

Farmers were taught how to keep clean planting materials through negative selection, an action that has improved the ability of farmers keeping vines from season to season. The linkage with RAB's seed production facilities enabled farmers to get planting material and flush out diseased material. 45 net tunnels were constructed and are still being maintained by farmer groups.

The table below illustrates the production of different varieties which is a result of the efforts to improve the seed system in Rwanda:

Table 8: Yield of different varieties in Rwanda

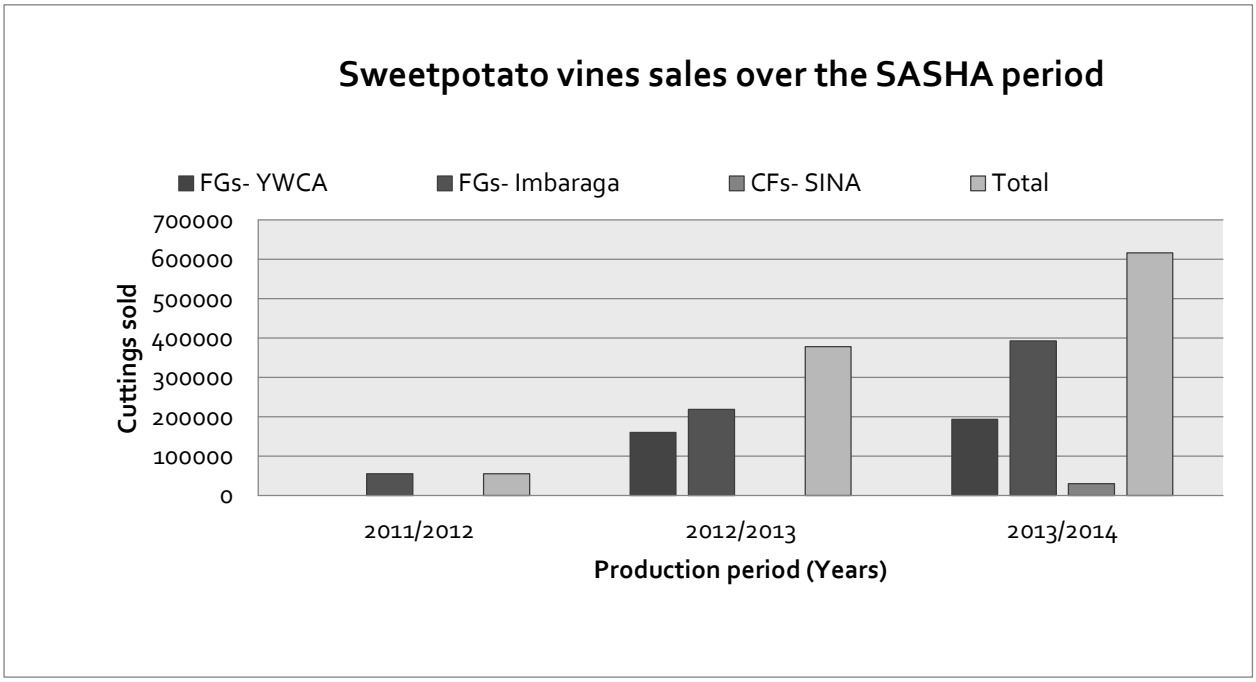
	Highest production t/ha	Average yields in 3 crop cut sites average t/ha
Cacearpedo	19.3	12.5
Naspot 9 (Vita)	18.6	13.3
Naspot 10 (Kabode)	19.6	15.4
Gihingamukungu	16.5	12.6
Local variety	15.8	10.3

Source: CIP-Rwanda data base 2014

Weighing roots to estimate yields at a farmer's plot

Commercialization of vines increased between the years 2011 to 2014, with DVMs supported by the YWCA and Imbaraga accounting for the most sales; compared to individual farmers contracted to SINA Urwibutso Enterprise, as illustrated in the figure below.

Figure 4: Sweetpotato vines sales over the SASHA period



Source: CIP-Rwanda database, 2014

4.1.3. Lessons learnt

It has been established that vine commercialization is possible. However, certain conditions are necessary for seed system market development. These are:

- Demand of vines among root producers especially for the main planting seasons
- Availability of new and improved varieties (high yielding, nutritional benefits, quality planting material, etc.)
- Affordability for small farmers (RWF/cutting)
- Packaging in small bundles
- Availability of high quality planting materials
- Adoption of technologies that enable maintenance of clean planting materials by multipliers e.g. the net tunnels
- Awareness creation through demonstration plots and community mobilization
- Development of viable market for sweetpotato roots

A damaged net tunnel

Net tunnels should be established near homes to allow easy supervision and management and to prevent vandalism. Vandalism and poor management damages the nets which might lead to entry of insect pests. It has also been observed that individual DVMs are better placed to manage the net tunnels compared to groups.

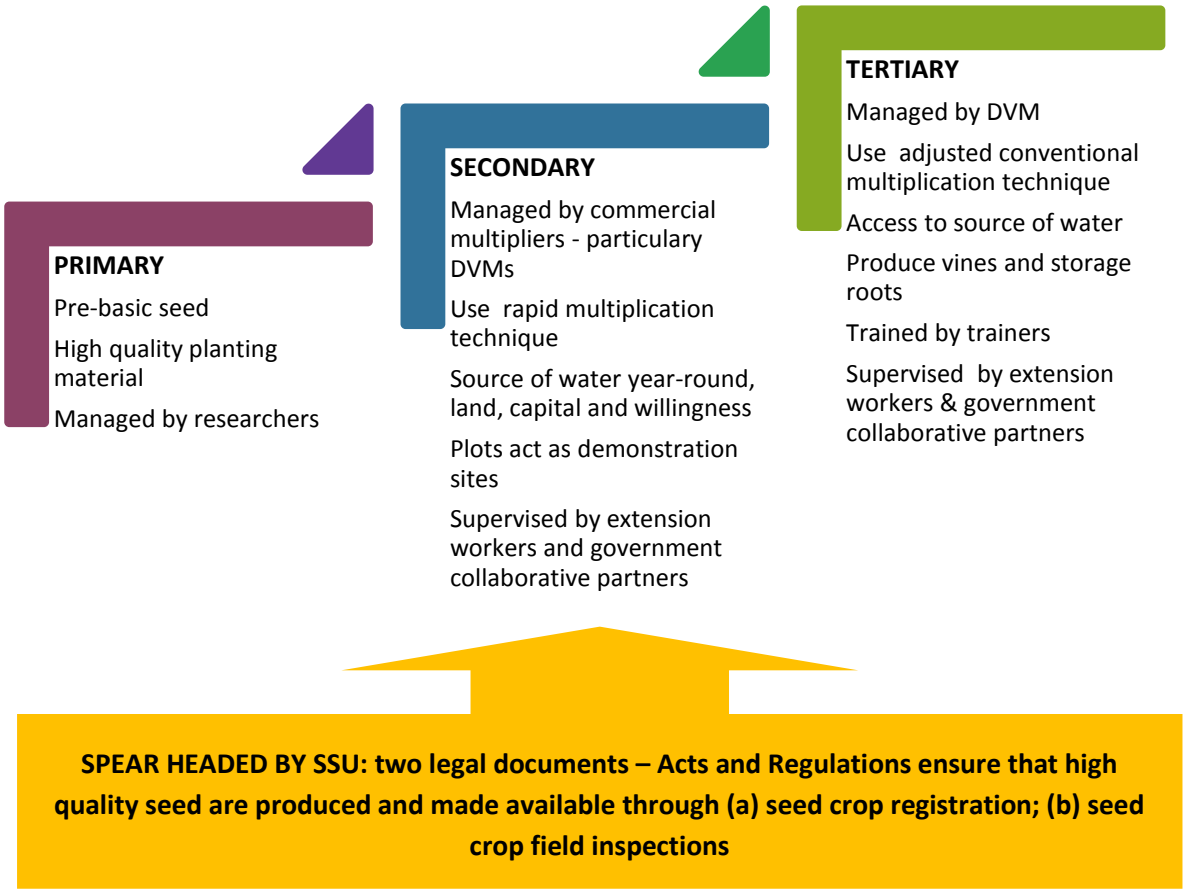
4.2. Status of sweetpotato seed system in Malawi: Achievements and lessons learned from first year of SASHA II - *M. Chiipanthenga (DARS-Malawi); G. Kananji (AGRA-Malawi); K. Masamba (DARS-Malawi)*

Malawi faces challenges such as effects of climate change and climate variability, flooding and drought. Like in other participants' countries, there is a shortage of clean planting materials and farmers tend to either preserve planting materials from the previous season or source from other farmers. As a result, there is a prevalence of diseases and pests. Declining soil fertility reduces root yields, a situation that is further worsened by post-harvest losses and limited value addition.

In Malawi, food diversification is at the core of the agricultural policy. The Cassava and Sweetpotato Flood Response Programme was launched in April 2015. There is strong collaboration among stakeholders, such as CIP, Department of Agricultural Services (DARS), Alliance for a Green Revolution in Africa (AGRA), CRS and others.

4.2.1. The structure and function of the seed system in Malawi

Figure 5: 1-2-3 (primary, secondary, tertiary) Sweetpotato Seed System in Malawi



4.2.2. Achievements and lessons learnt

The SASHA II project has made the following achievements: availability of pre-basic sweetpotato vines of improved varieties has increased, two screen houses were renovated and 34,159 vine cuttings of six varieties were produced. Distribution of pre-basic seed to stakeholders was coordinated through meetings, identification of three private multipliers, follow-ups and supervisions. A multi-purpose revolving fund was established through the Bvumbwe Research Fund Order.

The AGRA Scaling Seeds and Technologies Partnership (AGRA-SSTP) project has made the following achievements: pre-basic vine cuttings from four varieties were produced in the screen house and two hectares of open field multiplication was undertaken. 7,200 cuttings of 30 cm were distributed to secondary multipliers and 9,000 to tertiary multipliers. In addition, one screen house was renovated. Stakeholder meetings, radio messages and on-farm demonstrations were implemented to raise awareness and demand for vines. In an effort to develop a sustainable production and dissemination system of quality seed, 12 commercial sweetpotato seed multipliers were identified and 3.66 tons of basic seeds harvested and distributed to commercial farmers.

Screen house rehabilitation and open multiplication fields in Bvumbwe, Malawi

One of the insights gained from the work in Malawi, is that farmers are much more willing to work at secondary and tertiary levels, because they find the primary level of pre-basic seed production too costly. Farmers prefer to work in groups of between 10 and 15 people. NGOs too, prefer not to establish net tunnels – they feel it is too expensive and time consuming. Challenges that still exist include: difficulties in estimating demand; introducing planting material from the screen house into tissue culture; and extensive heavy rains.

Field days, and initiatives to train technical staff on tissue culture management, and development of a sweetpotato production manual are expected to help overcome some of these existing challenges.

4.3. High Iron Bean Seed Systems: An update on HarvestPlus Activities - *Lister Katsvairo (HarvestPlus – Rwanda)*

HarvestPlus leads a global effort to improve nutrition by developing and deploying food crops that are rich in vitamins and minerals. It is an interdisciplinary, global alliance of more than 200 scientific and implementation partners in over 40 countries. HarvestPlus is a joint venture between two Consultative Group for International Agricultural Research (CGIAR) Centers, the International Center for Tropical Agriculture (CIAT) based in Cali, Colombia and the International Food Policy Research Institute (IFPRI) based in Washington, D.C. HarvestPlus is part of the CGIAR Research Program for Nutrition and Health (A4NH).

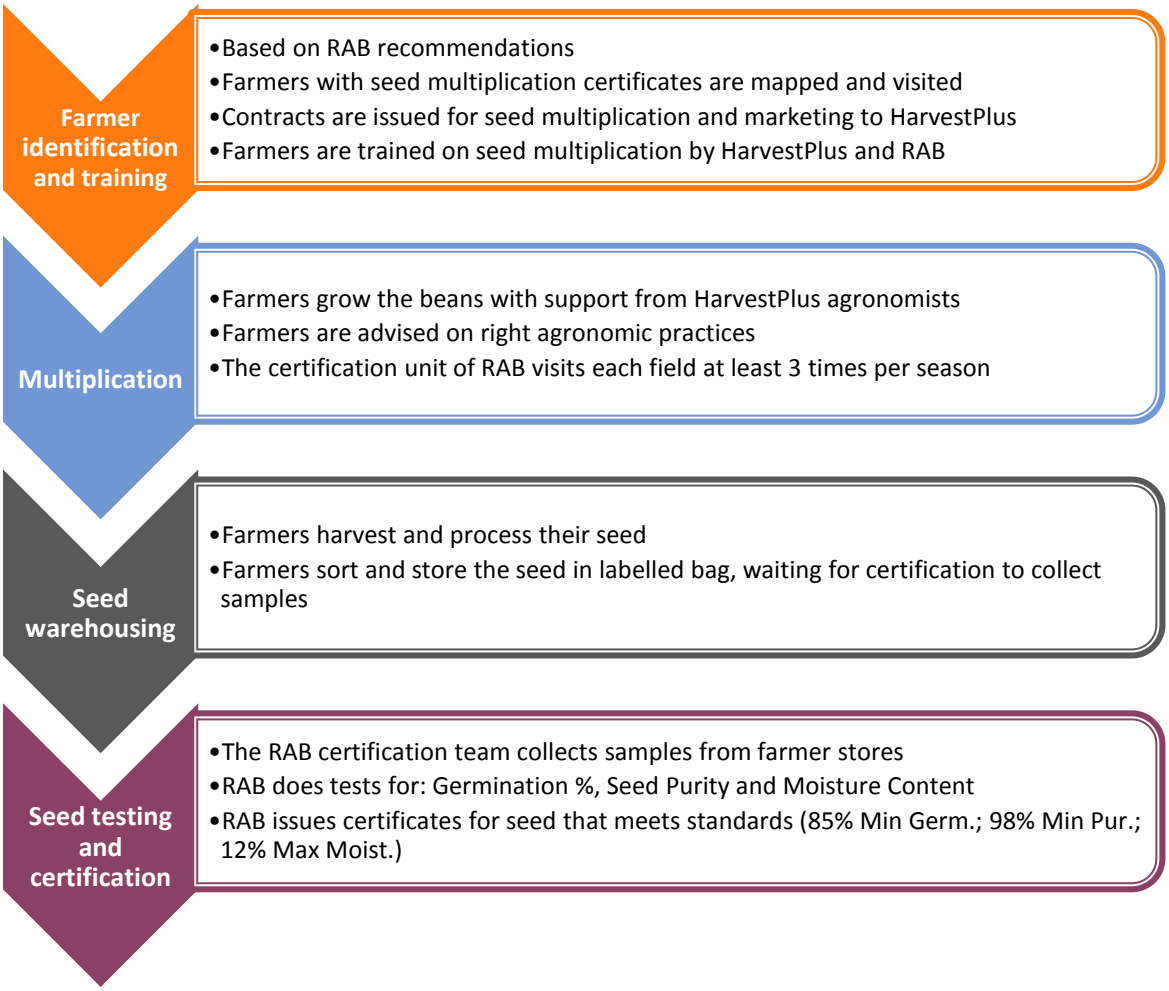
There are several ways to address nutritional issues in SSA. They include: diversification of the diet, food fortification e.g. with iron and iodine, and provision of supplements, e.g. vitamin A, iron and zinc. Because of its cost, dietary diversification is too expensive and out of reach for many people. For them to get fortified foods, they must have access to the market, where they would purchase processed foods, and food supplements are only accessible through the health care system, which makes the delivery costs high.

4.3.1. Biofortification

With biofortification, it is possible to develop wheat, rice, maize, cassava, beans and other staples packed with additional vitamins or minerals. This way nutritional benefits are derived from the crops, harvest after harvest, with no additional costs. The effect is that many people, who are not reached by other nutrition interventions, can benefit from biofortification. In Rwanda, RAB is

responsible for production of breeder and foundation seed; certified seed, which is multiplied from foundation seed and whose quality has been approved by inspectors is done by seed multipliers; and QDS seed, which is declared by producers as being in conformity with technical and quality standards, is done by seed multipliers.

Figure 6: Seed production and certification process for High Iron Beans in Rwanda



4.3.2. Major bean production constraints in Rwanda and potential solutions

- Low levels of foundation seed production
- Lack of stakes for climbing beans
- Low yield due to poor agronomic practices by farmers
- Price changes for beans, which causes farmers to sell to other parties
- Abiotic problems like drought
- Biotic problems: root rot, anthracnose, bean common mosaic virus (BCMV), angular leaf spot, Common Bacterial Blight (CBB) and stem maggot

To address these constraints, the following interventions have been undertaken:

String stakes: This approach is economic, because fewer stakes are used (from 50,000 stakes to 10,000 per ha); there are higher yields and they are more environmental-friendly.

Multiplication of foundation seed: Working hand in hand with RAB, production of foundation seed is being done on land hired by HarvestPlus.

Improving yield levels: This is being done through animal-drawn implements to encourage timely planting, reduce labor cost, increase weeding efficiency; Supply of fertilizer to increase yields and profitability; and practical training in agronomic practices.

Seed multiplication status: Generally, the number of seed multipliers has increased over time. Seed certification and farmer registration have been strengthened. HarvestPlus is now working with a total of 281 seed multipliers who grow beans in rotation with maize. This has resulted in production of 1,200MT of seed per year since 2014.

4.4. One Acre Fund Rwanda: TUBURA sweet potato field trial results and planned distribution approaches – *Kaitlyn Smoot (One Acre Fund – Rwanda)*

One Acre Fund has been working in Rwanda since 2007. Its operations which started in Nayamsheke, have expanded to 13 districts. TUBURA has a network of 550 Field Officers based in individual cells. In 2015, TUBURA reached 85,000 direct clients and worked with 200 agro-dealers. Their services include supply of inputs to small farmers on credit, provision of direct delivery, extension trainings, field visits, and weather-indexed insurance.

4.4.1. Method for reaching farmers

The marketing period runs between May and July, and between November and December. During this time, two officers per cell run enrolment meetings, and distribute product samples and catalogues. Farmers place orders by July. Fertilizer and seed distribution are carried out in August and January. Products are distributed at one location per cell, and planting and product trainings are carried out. Live plant distribution of banana plantlets, grevellia tree seedlings and trainings are carried out in September. During the rest of the year, repayment and service delivery takes place. Service delivery includes activities such as bi-weekly meetings with agronomic training, demonstration parcels and field trials, field and home visits, repayment, and insurance payouts in case of drought.

There are 25 trials per season in Rwanda, involving over 2,000 farmers, in 45 cells across 7 agro-ecological zones. The trials involve over 10 crops in side-by-side plots.

4.4.2. Sweetpotato field trials by TUBURA

Sweetpotato is the top crop for TUBURA clients (grown by 65%), in B season (February to June) yet One Acre Fund has no sweetpotato intervention. Therefore TUBURA has initiated trials looking at variety planting method, and fertilizer.

Table 9: Tubura field trials for sweetpotato in Rwanda

<table>
<tr>
<td>Field Trials: Spacing and Fertilizer 2014B
Variations
• Local variety, Farmers' current practice, without fertilizer
• Local variety, planting on lines, 2.5kg/are of NPK17, Spacing of 20cm
• Local variety, planting on lines, 2.5kg/are of NPK17, Spacing of 30cm
• Local variety, planting on lines, Spacing of 20cm, without fertilizer
Methodology
• No fertilizer used in the two plots
• The planting practice was the farmers' current one
• Each plot has 100 m^2
• All plots are managed in the same way for weeding, and other farming practices
• At the harvest time, our Innovation Officers harvested 25 m^2 in each plot as the representative part of the variation. Planting without lines</td>
<td>Field Trial: Variety 2014B
Variations
• Local variety
• Orange variety (Cacearpedo)
Methodology
• No fertilizer used in the two plots
• The planting practice was the farmers' current one
• Each plot has 100 m^2
• All plots are managed in the same way for weeding, and other farming practice
• At the harvest time, our Innovation Officers harvested 25 m^2 in each plot as the representative part of the variation. Planting without lines</td>
</tr>
<tr>
<td>Variety trial 2015A
• Local, Cacaerpedo, Ndamirabana and Ukerewe
• Harvests on-going, so far all new varieties preferred to local, Cacaerpedo is most preferred
• Fast to harvest, good taste
• Problem: attracts rats</td>
<td>Fertilizer and Spacing trial 2015B
• Farmer planting method, no fertilizer
• TUBURA spacing (in raised beds, 2 lines per bed with 20 cm spacing), no fertilizer
• Local: Cacaerpedo, Ndamirabana and Ukerewe
• TUBURA spacing, with NPK 17 (3 kg/are)
• TUBURA spacing, with DAP + KCl + Urea (2.5 kg/are)
• Just finished planting
• All local variety</td>
</tr>
<tr>
<td>Trial on Karongi Station
• 6 different spacing arrangements tested
• With each spacing, fertilizer vs. no fertilizer tested
• Naspot 9 variety used (orange fleshed) for all
• Naspot 9 also planted in multiplication plots
• Planted some cutting immediately upon delivery, others 3 weeks later after storage in the shade.
>> Those stored for 3 weeks are doing well.</td>
<td>Naspot 9 (SPK/004/6 or Vita)
• Our multiplier in Kamonyi (Serge Ganza) says very popular
• RAB confirmed it's a good variety
• Doing very well on station so far
• Scored highly in taste tests
• Given as gifts to Field Officers in Nyaruguru to test
•</td>
</tr>
<tr>
<td colspan="2">2016A Planned Trials and Projects
• Continue testing varieties (Naspot 9, Cacearpedo, Local) in side-by-side field trials, with TUBURA spacing but no fertilizer
• Continue testing most promising spacing and fertilizer variations from 15B
• Develop, begin testing, TUBURA planting guide page with sweet potato recommendations
• Sell Naspot 9 in several sectors in Nyaruguru and Karongi in 16A to test adoption potential and delivery systems.
• Put Naspot 9 into demonstration parcels (3-5 per cell) in Nyaruguru and Karongi</td>
</tr>
</table>

4.4.3. Pending questions

At One Acre Fund, there are still some questions and concerns that need to be addressed:

- Is Naspot 9 (Vita) the best? What other varieties should be tested?
- Should the sales be done through the normal method– individual sales on contract, delivery over 3 weeks– or through another way of distributing cuttings?
- What will maximize adoption?
- What will maximize adoption?
- What is most sustainable - cell-based multiplication plots, local sales or giving cuttings as gifts to field officers and group leaders?
- How should the cuttings be distributed: Store plants at central hub for 3 weeks, under soil/shade then deliver to individual cells day by day; or in August with fertilizer or September with bananas?

4.5. Triple S: Potential and Challenges - *Sam Namanda (CIP-Uganda); Mihiretu Cherinet (CIP-Ethiopia)*

The presenter introduced the presentation by quoting from previous presenters, who had highlighted the challenges faced in ensuring that the technology, planning, agronomic practices and financial investment was sufficient to ensure functional and sustainable sweetpotato seed systems.

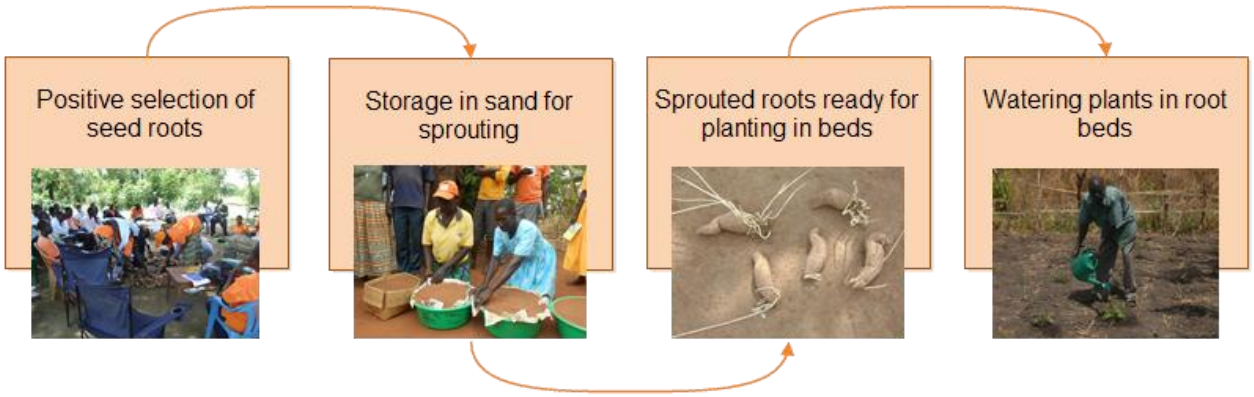
4.5.1. Functional seed systems

To ensure functional seed systems, there is need to start with clean seed stock; produce adequate quantities of clean vines at right time; promote technologies that basic/primary vine multipliers can easily adopt; produce at affordable cost; and promote technologies that support maintenance of clean planting material.

4.5.2. Key Triple S technology protocols

The diagram below depicts the key Triple S technology protocols.

Figure 7: Key Triple S technology protocols, Uganda



The table below shows the potential of Triple S in improving seed production.

Table 10: Triple S: Number of cuttings harvested from 100 roots of Ejumula, Kabode and Kakamega varieties in Uganda

Variety	# of cuttings Harvested		Total # cuttings	Market value Ug Sh.	Total area planted (ha)
	60 DAP	90 DAP	60 DAP		
Ejumula	3,500	4,700	8,200	63,000	0.3
Kabode	2,000	2,700	4,700	36,200	0.2
Kakamega	4,300	1,900	6,200	47,700	0.2

Source: Biofort annual report 2014 on Developing and Delivering Biofortified Crops in Uganda project submitted to HarvestPlus by CIP, 2014.

4.5.3. Areas for improvement of Triple S method

Factors affecting efficiency of Triple S include: maturity and health status of roots; storage containers and medium; storage environment; and watering.

Roots: Seed root maturity is important; only mature roots should be used. The pre-storage and post-planting selection of roots is critical. Prior to storage, the health status should be checked, stalks are removed or detached and the roots cured. Roots with higher dry matter content are better than those with lower dry matter.

Storage containers and medium: Containers that can be used include paper boxes, plastic basins, papers or bags. The sand medium should be dry with a relatively course texture.

Storage environment: Thatched storage conditions are better than iron-sheet houses due to the buildup of heat.

Watering and watering frequency: Ten planted seed roots are irrigated twice in a week using 10 liters of water (per irrigation) for the first two weeks. After this they are irrigated once a week for the six weeks preceding harvesting. Farmers are improving the Triple S method by reducing evaporation and watering frequency using soil clods.

In Ethiopia, research is being undertaken to validate Triple S, especially in areas which have long dry spells and high sweetpotato virus disease (SPVD). They are also looking at how long they can keep the roots before they plant them. The research is comparing Triple S with farmers' practices.

4.6. Plenary discussion for session 4: summary

How is the revolving fund in Malawi structured and how does it function?

In Malawi, any revenue generated by government institutions used to go straight to government, and those institutions could not determine how the revenue was used. In 2013/2014 the government initiated the revolving fund, which allows the research stations and institutions to retain 80 percent of the revenue they make from sales and other activities.

Participants discussed how revolving funds work, and the challenges involved in setting up a revolving fund within a government institution. They agreed that a revolving fund was effective if it was set up to finance specific activities within an institution, and if the initiators and project managers had a say in how these funds were allocated.

How do you promote bio-fortified crops with no visible traits?

A participant from Malawi described the challenge in promoting iron-rich beans, explaining that there were two types of red-specked bean which were similar in appearance, but only one was biofortified with iron. The result was that some people, who could not differentiate between the tastes of the two, were often sold the non-biofortified variety.

Another question was related to the promotion of biofortified crops among farmers. Participants suggested that increased capacity building about the importance of diversification and the nutritional value of various crops could be used to encourage farmers to plant iron-rich and other biofortified crops.

What is the standard size for a net tunnel and what area can the harvested material cover?

Around 6,000 cuttings harvested from the net tunnel can be used to plant between 0.12 – 0.15 ha for further multiplication. Depending on demand, farmers may prefer to sell vines after 6 months, immediately after rapid multiplication i.e. second generation.

What are the differences between vine multiplication in net tunnels and in the field?

Martin Chiona (Zambia) follows discussions attentively

The main difference between planting materials produced by DVMs using tunnels, and those that are produced without the net tunnels is in the quality of stock. Crop management also plays a very important role. For example, if not well managed after they come out of the net, planting materials could get infected by virus just after one or two planting generations. Thus, if farmers in a zone with low virus pressure implement good crop management while undertaking field multiplication of vines, they may get cleaner planting materials than farmers using net tunnels to multiply vines in a zone with high virus pressure.

For how long can roots be stored in the Triple S system?

In Malawi, when stored in a granary in pure dry sand, roots can be stored for up to 7 months and still retain good quality. Time to sprout depends on the variety, maturity and temperature.

How do you manage storage in hot and humid temperatures?

Experience has shown that it is possible to store roots in hot and humid areas. Sometimes, vents can be installed to improve air circulation. In Ghana, which is hot, roots are stored in thatch houses for up to seven months. It is possible to use the same techniques in areas that are hot and dry, such as Burkina Faso.

5.0. Sweetpotato crop and seed management

5.1 Sweetpotato crop & seed management: new findings and future research areas - *Erna Abidin, Ted Carey, Kwabena Asare (CIP), Issah Abukari, Kwabena Acheremu (SARI-Ghana), Jude Njoku (NRCRI-Nigeria), and Some Koussao (INERA, Burkina Faso)*

The West African environment is harsh and is characterized by a very different agro-ecology compared to Eastern, Central and Southern Africa. It has high temperatures, an unreliable rainy season, long dry season, low soil fertility, high virus pressure in the humid areas and high sweetpotato weevil (*Cylas* spp) population in the dry area.

5.1.1 Ongoing interventions

OFSP is being promoted in Ghana, Burkina Faso and Nigeria through the following projects:

1. Jumpstarting OFSP in West Africa through diversified markets (Ghana, Burkina Faso and Nigeria)
2. SASHA 2 (Breeding for West Africa)
3. Genomic Tools for Sweetpotato Improvement (Ghana)
4. Rainbow Project (Nigeria)
5. West Africa Agricultural Productivity Programme (WAAPP); National Agricultural Research Systems (NARS), etc.

The Bill and Melinda Gates Foundation (BMGF) is funding SASHA II, Jumpstarting OFSP, and Genomic Tools; the United States Agency for International Development – Office of U.S. Foreign Disaster Assistance (USAID-OFDA) is funding the Breaking Postharvest Bottlenecks: Long-term sweetpotato storage in adverse climates; and the Nigerian government is funding the one-year Rainbow project.

Improving seed systems: In Burkina Faso, the traditional system involves planting the whole vine stem on ridges: 60 cm between plants and 1 m between ridges for vine production; and 2-3 cuttings of 30 cm placed in one planting station for root production. The Jumpstarting project has collaborated with an NGO partner, iDE, to promote an improved method of planting vine and roots. In Bawku, Ghana, traditional multiplication of vines is usually done in a sunken bed in the swampy area. As in Burkina Faso, the Jumpstarting project has partnered with iDE to introduce an improved technique for production of vines and roots by using drip irrigation.

Addressing SPVD problems: In Burkina Faso, positive and negative selection is used to control SPVD. Negative selection is used where infected plants are surrounded by the clean plants. The infected

plants are removed. Where most of the plants are infected, positive selection is done, in which case the good plants are uprooted and planted elsewhere.

Training of trainers: Training has been undertaken in Bawku on OFSP production management and processing and utilization.

Nutrition and market intervention: In Nigeria, a school feeding program is being implemented. Through a willingness to pay initiative, Ghana is distributing vine cuttings and fresh roots through Community Health Services, while market assessments have been carried out in Nigeria, Burkina Faso and Ghana.

Advocacy: High level advocacy is carried out to push for increased investment in sweetpotato activities. For example, a meeting was held with the Vice President of Ghana; and the Former United Nations (UN) Secretary General Kofi Annan and his wife Nane Annan participated in an exposure visit, training and display. Advocacy activities have also been undertaken at state and village levels in Nigeria and Ghana.

Chief for Dimabi Community, Ghana and OFSP products

Action research and local knowledge: In Nigeria, action research has determined that intercropping maize and sweetpotato instead of monocropping is more effective in controlling weevil population and increases income. In Ghana, a dry-land area mother and baby advanced trial is being undertaken to compare fertilized plots versus non-fertilized plots.

5.1.2. Lessons learnt from successful seed systems - Malawi

Lessons Learnt from Malawi: ***Rooting out Hunger Project Phase 1 - A multi-pronged strategy***

The schematic 1-2-3 vine multiplication system in Malawi was presented above **(see figure 5).** The figure below is an illustration of the strategy for scaling up the seed system. It outlines the various stakeholders involved and their functions.

Figure 8: Strategy for scaling up in Malawi

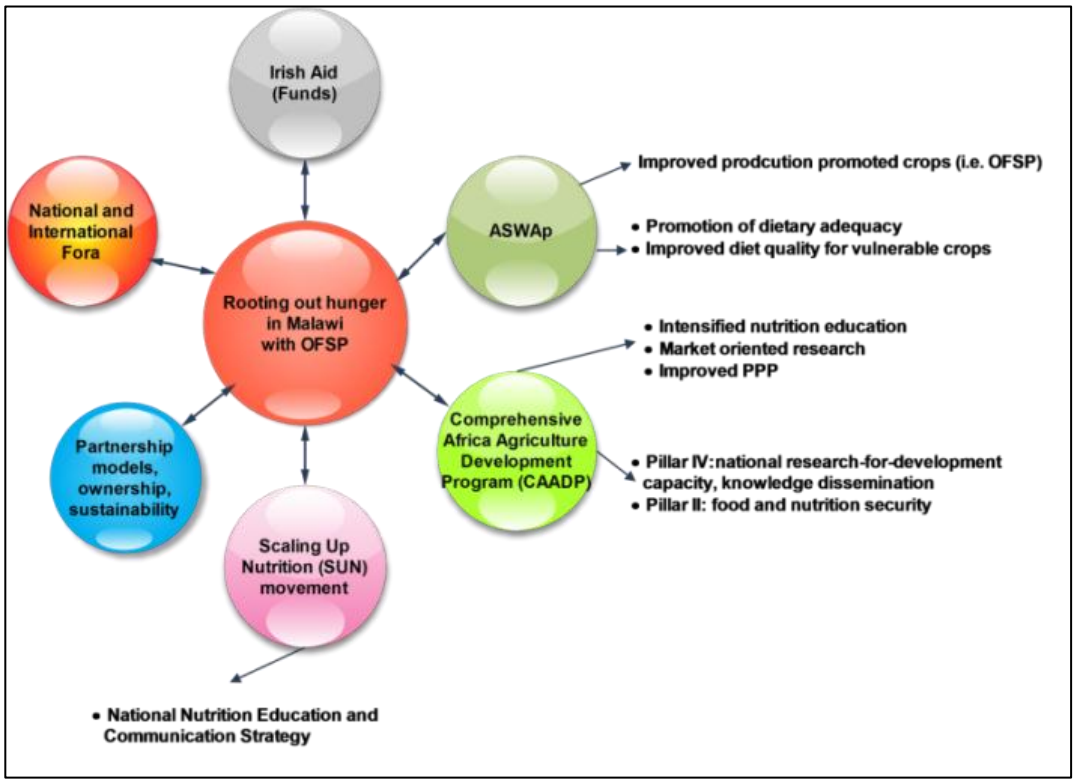


Table 11: Vine multiplication managed by farmer multipliers (DVMs) in Malawi

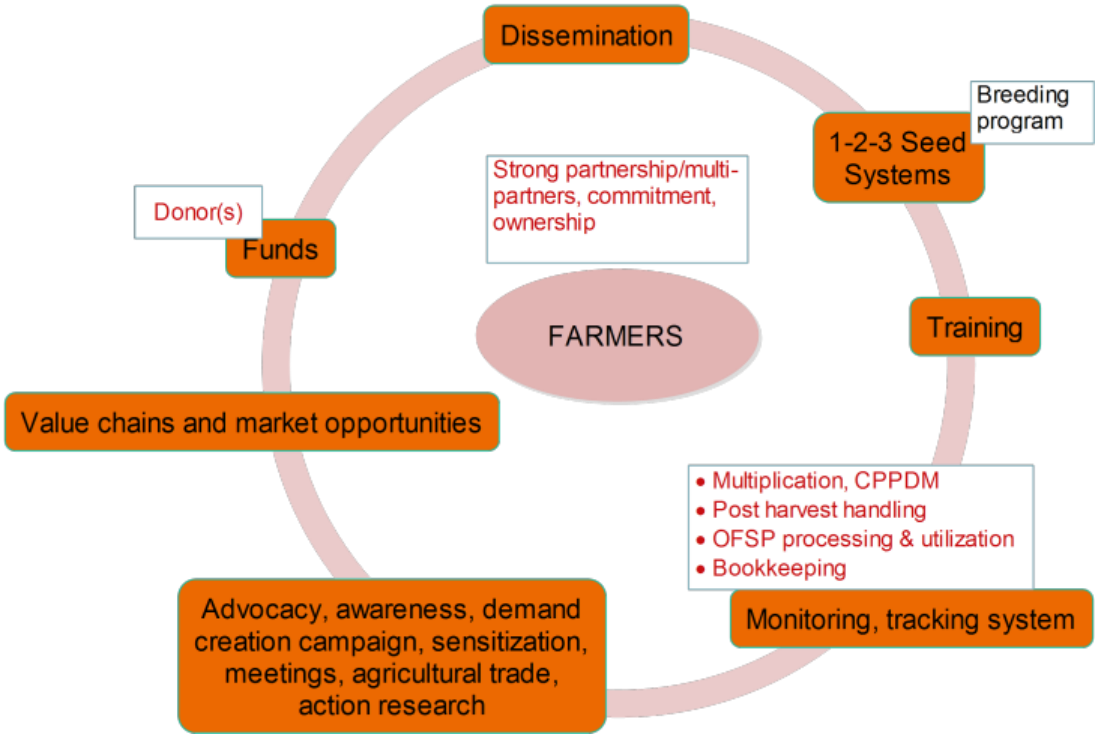
Clarification	Secondary Vine Multiplier Principal Goal: Vine Production	Tertiary Vine Multiplier Principal Goal: Dual Purpose (roots +vines)
Planting period	Shortly after the main harvest for storage root production. This could be in the last month of the rainy season.	Two months after the secondary multiplication as multipliers enter the months of dry spell.
Irrigation	Irrigation is needed	Irrigation is needed
Planting method	Rapid multiplication	Adjusted conventional multiplication
Technique of multiplication	Two or three nodes are needed, and then plant them in a manageable sized plot (i.e., 1 x 20 m with a planting distance of 10 x 20 cm). A plot size of 1 x 20 m contains 1000 plants. The multiplication rate depends on the varieties. For instance, the length of a stem of Zondeni can reach 90 cm, in this case, the multiplication rate is 1: 5 or 1:6	Vine cuttings of 30 cm long are planted in ridges. Planting distance within plants is 15 cm and between ridges 75 or 90 cm, depending on the locality. The size of the plot is not necessarily standardized because the tertiary multiplication will sustain the secondary multiplication to reach the area targeted. The multiplication rate for Zondeni is 1:3
Main objective	Producing vine cuttings	Producing vine cuttings as well as storage roots for food security during the dry season.

Impact: After four rainy seasons, there was an increase of partners and activities. 195,788 households were reached across 15 districts. There was an indication of adoption of Zondeni, which was illustrated by the expansion of areas and more implementing partners.

5.1.3. Using theory of change to develop seed systems for West Africa

Elements required for a functioning seed system for Ghana already exist; they only have to be harmonized as illustrated in the figure below:

Figure 9: Elements required for a functioning and sustainable seed system in Ghana



a) Establishing the '1' (Primary), '2' (Secondary), '3' (Tertiary) multiplication seed system

Primary: Managed and supervised by researchers, the primary level is aimed at breeding and producing improved varieties at research stations and producing clean planting material, by contracted private sector players. Irrigation facilities are used to undertake all-year-round production.

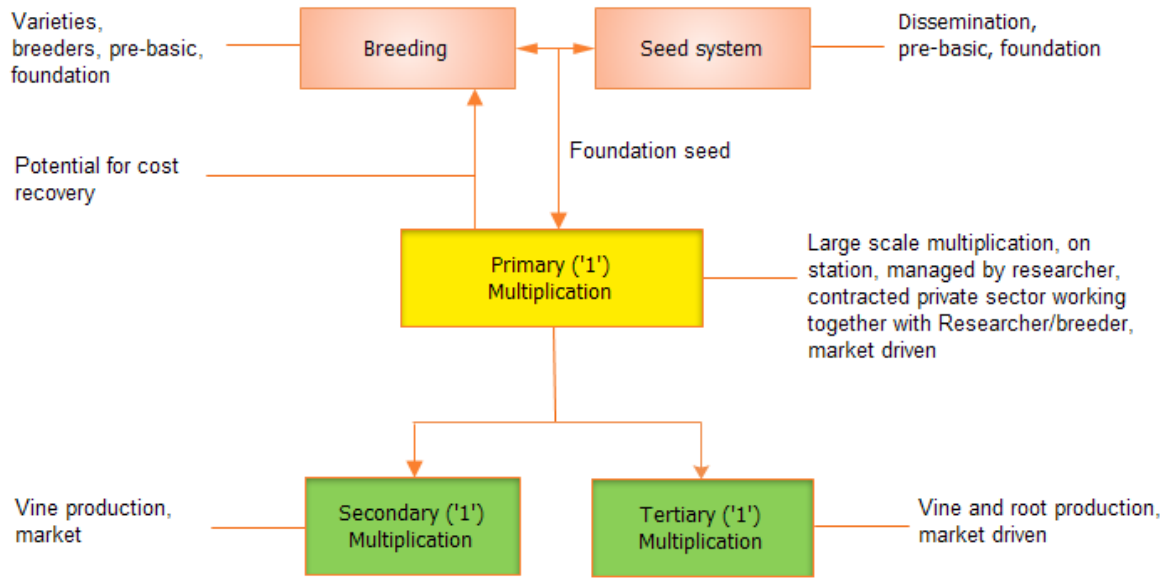
Secondary: Managed by individual farmer or groups of farmers at various localities, production is supervised by extension agencies, such as government, NGOs and implementing partners. Focused on vine production only, secondary production is undertaken shortly after harvest to provide clean planting material through rapid multiplication technique.

Tertiary: managed by individuals or groups of farmers, tertiary multiplication is dual purpose - for vine and storage root production for food security. Undertaken a few months before the rainy season, it utilizes adjusted traditional multiplication techniques, including irrigation.

b) Functional overview of seed flow

As illustrated in the figure below, the system responds to demand for pathogen tested seed and new varieties.

Figure 10: Functional overview of seed flow in Ghana



5.1.4. New findings and future research areas

As shown by the case presented below, new findings will be used to drive future action research.

Case Study: Mrs. Okalawon in Nigeria

Mrs. Okalawon is the future vine and root producer for Mother's Delight OFSP variety (1 ha). Previously, she was a vegetable grower. SPVD is affecting the entire field. She **does not want to destroy** her field because this variety produces good yields. **For us, the most important questions are:**

Mrs. Okalawon (extreme right) examines her field

- What action are we going to do for her?
- How can she benefit from clean planting material?
- What kind of action research do we need to determine degeneration of varieties as a result of issues such as high viral load?
- How do we monitor the performance of varieties over time?
- What kind of trial do we conduct? And where?
- How do we get farmers/growers to adopt the use of pathogen tested seed?
- Proper labeling of varieties could ensure the varietal purity, is it true?
- Cost analysis of vine production analysis
- What crops will be appropriate to intercrop with?
- Can intercropping maize/onion with sweetpotato be important in crop risk management?
- **Fertilizer trial** including use of **manure and compost**. Can we include this in our seed system action research?
- What are the suitable methods for seed systems in the dry areas?

5.2. Plenary discussion for session 5: summary

At which point do you decide not to use positive selection even if there is some clean material in a diseased field?

In West Africa, where efforts are being made to produce QDS, positive and negative selection is used to avoid destroying entire fields. This is especially the case when working with people who are doing seed multiplication for the first time. Usually, large scale QDS multipliers with irrigation facilities produce up to 200 ha of material.

In Nigeria, a farmer whose material was partially infected was given a net tunnel to produce clean planting material, but she still did not want to destroy the crop. The solution in this case was to do positive selection, so that the next planting material would be clean.

In Burkina Faso, it is not a common practice to keep a field that is not doing well. However, when clean material is spotted, it is uprooted and planted elsewhere for monitoring. If it is indeed free of viruses, it can be used as planting material.

Is drainage not faster on raised than on sunken bed?

If you use a sunken bed, you will not get planting material during rainy season because the beds will flood. Sometimes where you are multiplying it is far from the water, so they have to use the pumps, in which case they have to use ridges as it is more effective.

6. 0. Roundtable discussion: Sustainable pre-basic sweetpotato seed production: What are we trying to achieve?

This roundtable discussion aimed at facilitating an exchange of experiences and lessons between countries that started implementing the sustainable pre-basic seed production in 2014 (Rwanda, Uganda, Ethiopia, Tanzania and Malawi) on one hand, and those that will start activities in July 2015 (Zambia, Burkina Faso, Kenya and Nigeria).

Background: Responsibility for breeding mainly lies with National Agricultural Research Institutes (NARI). Both NARIs and the private sector carry out: mass *in vitro* micro propagation;a hardening of the plantlets and multiplication in screen houses to produce pre-basic cuttings. Certification is undertaken by regulatory bodies.

For SASHA II, our definition of the scope of pre-basic seed production is "stop at the screen house level and then coordinate demand". Coordination is essential to link producers to buyers at each segment of the seed value chain.

Some technical issues have to be addressed. First, sustainable supply of pathogen tested pre-basic cuttings, which was previously project based, must be established. Secondly, tissue culture laboratory and screen house procedures should be strengthened.

At the institutional level, there is need to improve demand projection, coordinate demand from basic and QDS multipliers, strengthen capacity and improve regulatory frameworks. A calendar showing when the farmers need planting material can facilitate the planning and coordination of timely seed production.

On the financial aspects, a business case must be made for the public and private sector involvement in pre-basic seed production. Business plans should include cost structure for pre-basic seed production cash flows, profitability and price determination. There is also the need to determine the optimal level of tissue culture plantlet and screen-house production by comparing the cost of production at each step. The possibility of reinvesting proceeds from sale of planting material back into seed production should be explored further through the use of revolving fund mechanisms.

Partnerships are very important; in Kenya, KEPHIS is trying to work with devolved government units to deal directly with the farmers. Tissue culture banana production is doing well, because the county governments' demand is so high that it cannot be met.

b) Lessons learnt in Uganda (Benard Yada, NaCRRI)

From the experience of the National Crops Resources Research Institute (NaCRRI), after the signing of the project sub-grant agreement in December, there was the need to authorize the opening of bank accounts and funds were only transferred at the end of January. Stringent government procurement procedures hamper timely acquisition of the necessary supplies, and there were further delays in getting approvals; therefore, researchers could only access the money in mid-February. The countries who are about to start implementation need to develop a strategy to access affordable laboratory reagents for timely execution of work. Alternatively, they need to start up some less cost demanding activities using their own institute funds to help keep pace in the achievement of project milestones.

The growth cycle of sweetpotato in the screen house to the stage of graft inoculation is so slow and tends to be prohibitive for fast tracking the virus indexing and downstream virus cleaning *and in vitro* multiplication processes. This will certainly affect the rate of production of clean plantlets of pre-basic seed to meet the growing demand.

For Uganda, we have experienced difficulties in accessing quality laboratory reagents for virus testing and cleaning as some of the consumables procured by our system turn out to be ineffective. We also experienced the difficulty in procurement of ELISA kits and Real Time PCR primers and consumables. We propose that the Seed Systems CoP creates a central procurement unit preferably through CIP to help fast track the acquisition of lab consumables for our work.

c) Lessons learnt in Malawi (Maggie Chiipanthenga, DARS)

The Malawi case provides many lessons in establishing functioning seed systems *(see 4.7.2.)* One of the highlighted lessons during the roundtable discussion is that farmers are less willing to engage at the pre-basic seed production level, but ready to engage at secondary and tertiary levels. They also prefer to work in groups of 10 to 15 people. Mobilization of farmers is difficult, as they tend to resist new technology because they fear that they will not have access to markets; it would be more effective if extensionists were involved.

Roundtable participants from countries that will start activities in July 2015 – Malawi, Kenya, Nigeria and Burkina Faso

d) Lessons from Tanzania (Nessie Luambano, SRI-Kibaha)

Although there is interest in continuing work after the project, there is an over-reliance on private laboratories. To sustain activities, material has to be sold at high prices. Therefore secondary multipliers are reluctant to buy pre-basic seed because of the cost, and because they are not sure of a customer base.

The revolving fund system in Tanzania has clear mechanisms and it is monitored by the ministry. However, it is multi-purpose and money earned from sweetpotato sales can be channeled to other activities.

During the Reaching Agents of Change (RAC) project, a screen house and clean materials were acquired and secondary multipliers identified. The SASHA II activities have been able to build on what RAC accomplished.

e) Lessons learnt in Rwanda (Jean Ndirigwe, RAB)

Currently, there is still no agreement on how to cost plantlets/vines at the pre-basic stage to make it both financially sustainable for the research station and affordable for secondary multipliers and DVMs to purchase. Pre-basic and basic seed is being supplied by Rubona Research Station at the same price.

There is need to create demand for pre-basic material. This is partly determined by timing of the production of planting material. While production at the laboratory and screen house is continuous, at nursery and multiplication sites, it should be increased and synchronized with the major planting seasons.

Right now, low cost technology, such as net tunnels, is being used to increase the supply at the DVM level. There is need for more capacity building on the management of these net tunnels by DVMs.

Roundtable participants from countries that started implementing the sustainable pre-basic seed production in 2014 (Ethiopia, Rwanda, Uganda, Tanzania and Malawi)

In Rwanda, farmers attend agricultural shows to exhibit their produce and connect with private sector players. This has increased partnerships for increased sweetpotato production.

f) Lessons learnt in Ethiopia (Beyene Demstu, TARI)

Sweetpotato is a versatile crop with many functions. In Ethiopia, it has been put in the policy as a food security and nutrition crop. Farmers are not buying planting material but there is a potential market. NGOs are the main distributors to farmers, so they can be targeted as buyers.

- **Multiplication of plantlets using rooting hormones:** This idea is to reduce the number of tissue culture plants and reach a maximum possible number of plants by using acclimatized, hardened plants grown in pots in the greenhouse which otherwise are ready to be transferred to mobile net tunnels in the field. This could fast track (at least double) the number of cuttings

to be taken out to the net tunnels. According to preliminary observation, plants grown this way are as perfectly healthy and even sturdier than the original plants. The time and money vs. quality of the cuttings produced have to of course be verified and analyzed.

- **Use of table sugar:** The carbon source in the MS medium in the laboratory at TARI used to be chemical Sucrose. In an attempt to reduce cost of tissue culture plants, sucrose was replaced with table sugar which can be bought from local supermarkets. No problem has been observed in the sweetpotato plants grown on MS medium containing 30 grams of table sugar. The sugar concentration is now being fine-tuned by adjusting the concentrations upwards and downwards. Whereas preliminary observations show that there is an appreciable difference, the results are yet to be analyzed. We are now fine tuning the table sugar concentration just using high and low concentrations, however, our preliminary observation is that there seems to be any appreciable difference. Results have yet to be analyzed.

- **Farmer's unwillingness to pay for sweet potato QDS:** To date, in Tigray, no farmer has expressed interest to buy quality planting material. This poses a potential setback for the whole seed system that is being set up. Up until now, NGOs are buying the QDS from producers and distribute them to subsistence farmers, especially female headed households free of charge. This system can help incubate the seed system for some years; however promotion of both root production and consumption should be in place to motivate root producers to buy quality planting material.

6.1 General discussion

The following points emerged from a general discussion that followed the last roundtable discussion of the Community of Practice meeting.

Nomenclature

- There has been confusion about the terminology to use for different seed classes, but efforts have been made to harmonize terminology in the Seed Acts and policies in different countries. In Ethiopia and Kenya, QDS is used instead of QPDM. In Ethiopia, terminology was harmonized by drawing up a table with the official terminology and matching it against the terminology that was previously in use for sweetpotato.
- In the Organization for Economic Cooperation and Development (OECD), the first generation of seed after breeder seed is called pre-basic, but in the USA and Uganda, the term foundation seed is used.
- Further discussion and clarity is needed to distinguish pre-basic from basic seed. i.e. how many multiplication cycles are allowable for pre-basic seed.

Demand creation

- The development of sustainable seed systems requires that there is a demand for clean planting material from farmers. One way of ensuring demand is to synchronize the production of planting material with peak planting seasons. Another way is to ensure that awareness creation is done about the importance of using clean planting material.
- Creation of demand for pre-basic seed is a great challenge. This is because it is necessary to charge a higher price to reflect the actual production costs. To cut on costs, it may be more

strategic to produce in a low disease pressure zone that would facilitate production on a larger scale.

- Part of the factors that affect demand is the fact that in some countries, sweetpotato is not a priority crop. In Malawi, maize seed and fertilizer are subsidized while in Mozambique, farmers plant other crops before sweetpotato. These examples show that depending on the context, there may be need for more concerted efforts to promote the status of sweetpotato as an important food crop.

Creation of partnerships

- Many partners, especially those from the private sector, enter into short-term partnerships from which they expect an immediate benefit. To strengthen partnerships, it is necessary to create awareness about the nutritional and financial benefits of sweetpotato, highlight how different varieties perform at farmer level, share information resources about sweetpotato production, processing and marketing, and share feedback from farmers.

Financing pre-basic seed production

- Timely availability of funds was an area of concern for some participants. Experiences with access to and management of financial resources varied from country to country. For example, in Nigeria, approvals for funds takes place in committee meetings and projects pay a 5 percent administrative fee. In Malawi, a request was made for a joint account to be opened for DARS and CIP. Now, 80 percent of the revenue collected from seed systems work is deposited to that account; nonetheless, this revenue must be shared equally among 10 sections of the institution, regardless of their contribution to it. In Ethiopia, a law was passed that allows an institution to set up an account for specific activities; therefore, whereas the Director General of the institution must approve expenditure from this account, the person in charge of the activities has a say on how to allocate the funds.
- The merits and demerits of these examples were discussed at length and it was concluded that even though participants had to explore what worked best in their context, it would be helpful for them to gain a better understanding about how revolving funds work.

7.0. Learning journeys

A Learning Route is a planned journey with learning objectives that are designed based on i) the knowledge needs of development practitioners that are faced with problems associated with rural poverty and, ii) the identification of relevant experiences in which local stakeholders have tackled similar challenges in innovative ways, with successful results and accumulated knowledge which is potentially useful to others. The Route allows for the experiential encounter between travelers and hosts, both having mutually useful experiences and knowledge. For more information on LRs, visit www.africa.procasur.org.

On 29 April 2015, participants had the opportunity to go on one of the following learning routes, which they had preselected, based on their learning interest:

Route 1: Net tunnels: what have we learnt and where to next for low cost protection of basic planting material?

Route 2: Inspection of sweetpotato Quality Declared Seed: what is it and how do we institutionalize it?

Route 3: Rubona Research Station: tissue culture micro propagation and hardening: what are we learning to improve multiplication rates, and reduce costs?

This section of the report covers the preparations, process of the field visits, findings and reflections, as well as emerging research questions from each of the learning routes.

Process

Before the site visits, participants were required to carry out the following preparations:

- Read the brief on the background of the sites they were to visit
- Review each individual member's questions and agree on the learning objectives and priority questions
- Agree on protocol during the site visit e.g. program to follow (introductions, site visit, Q & A and open discussions); agree on specific tasks of the participants (leader, time-keeper, note-taker)
- Carry out a reflection session to collate and document: (a) highlights, key learning points and new perspectives; (b) individual action points arising from the visit; (c) new or more in-depth research questions that could be pursued in light of the visit – either by the host of the visit or in participants' own institutions; and present to the COP members in plenary.
- Nominate a topic and lead person for continued on-line (Google Group) discussion

7.1. Route 1: Net tunnels

The team

Erna Abidin; Issah Abukari; Joseph Okalebo; Kwame Ogero; Jude Njoku; Martin Chiona; Joseph Gafaranga; Jean Claude Nshimiyimana; Kwabena Asare; Margaret McEwan; Deusdedit Peter

The route

Cooperative Terimbere Muhinzi ''KOTEMU''is a farmer group located in Northern Province, Rulindo District, Bushoki Sector, and Gitaba Village. The group was formed in 2008 by Urugaga Imbaraga primarily for farmers training on good agricultural practices but was later expanded to address other socioeconomic issues. It comprises of 13 members, 11 women and 2 men.

KOTEMU group started vine production at group and individual levels in 2011 with starter material from RAB and later from SASHA. At first, the group undertook only rapid multiplication, but after realizing that the plants were being attacked by pests and viruses, the members adopted the net tunnel technology with the support of CIP. The first net tunnel was constructed in 2012, and two more in May 2013, and planted with Kabode and Vita OFSP varieties.

Participants on the learning route on net tunnels

The group produced 246,800 vines in the last four years. Some of these were given to neighbors for free while a considerable quantity was sold to various buyers. The main buyers were NGOs and the district of Gakenke.

In addition to vines, individual group members produce OFSP roots. The group has 0.2 ha of land for root production. Marketing is done collectively in the local market and directly to SINA. The total quantity of roots sold to local market and SINA is not easy to determine but according to the group leader around 20 tons per season is produced. Group members make doughnuts for home consumption only. In the future KOTEMU is planning to buy its own land so that it can save money spent on renting land. The group also plans to invest in livestock.

The learning objective: To identify lessons and explore possibilities for continued low cost protection of basic planting material.

Guiding questions

- Are the materials for constructing the net tunnels locally available?
- How do you rate the quality of the net and are there alternatives?
- What is the cost of the net tunnel and is it affordable?
- Where did you get your starting material?
- What is the frequency of harvesting?
- What is the length of the vines that you sell to root producers?
- Do you sell the materials from the net tunnels at the same price as those multiplied conventionally?
- What management practices do you maintain e.g. weeding, fertilizer and pesticide application?
- What challenges have you encountered so far?
- Will you invest in establishing new net tunnels?
- Do you use organic or inorganic fertilizers?
- Do you think the size of the net tunnel should be increased?
- Do you think you can put two varieties in the same net tunnel?
- Will you buy planting materials to establish in the net tunnels?

Highlights and key learning points from the visit

Construction of net tunnels: All materials for constructing the structure are available locally but the insect proof net has to be imported. The standard size of the net tunnels are 1.8 m x 3 m. Constructing one net tunnel costs approximately 42 USD and DVMs can manage to invest in new tunnels since this amount is recovered after the first harvest.

Management practices: During establishment the DVMs remove all the weed roots so as to avoid regrowth. Manure is often applied before planting and urea after every harvest. DVMs usually spray the net tunnels after opening, and this can be done before harvesting to remove weeds. The net tunnel cannot be opened if there is no pesticide.

Pricing planting material from net tunnels: DVMs can harvest ten times from a tunnel over two years. The price of planting materials from the net tunnels is high since they are assured of quality. The price also depends on the type of the buyer: Vine multipliers pay 5 RWF per cutting. They sometimes buy materials directly from the net tunnels. They put a lot of emphasis on quality rather than quantity. Root producers pay 2 RWF per cutting produced from the open field multiplication. Their emphasis is more on quantity. The price is also dependent on the relationship with the buyer

i.e. close friends are offered lower prices than big buyers such as NGOs. Cost recovery of building expenses is fast, and can happen after the first sale of vines (At RWF 3-5 per vine, a total of RWF 30,000 can be received from vine sale/harvest). They can sell up to 5 times per year, depending on the management.

Root Production: The group is producing roots on a 0.2 ha land and they introduced the use of ridges. They practice staggered planting with a spacing of 30 cm by 80 cm. Neighboring farmers have also adopted the use of ridges instead of flat ground. The ridges have the advantage of increasing yields, enabling precise application of organic manure and protecting roots from rats. This is a good example whereby farmers appreciate technologies and improved farming techniques that have been proven to work.

Challenges: Management of weeds in the tunnels is a challenge; and the DVMs have noted that over time the vine length becomes shorter. Security is also difficult to maintain, because people poke holes in the net tunnels out of curiosity. The group has responded by explaining to their neighbors what the technology is all about.

Technology adoption by farmers: The farmers are willing to pay the total costs (Rwf 30,000 = USD 42) of establishing new net tunnels. This is because they understand that net tunnels contribute to the quality of planting material. They feel that the nets are of better quality compared to other alternatives such as mosquito nets and polythene sheets which are sometimes used to protect plants from pests. The technology is also gender-friendly.

Research questions to be pursued

1. Are there any alternative materials for net construction? (In particular the insect proof netting)?
2. Are there any management options to reduce/minimize weeding?
3. How are different varieties responding to net tunnel technology?
   - Degeneration
   - Cuttings/harvesting

Participants' action points from the visit

- Uganda Soroti Sweetpotato Producers and Processors Association (SOSPPA) – start using net tunnels for vine conservation at least four (constructed) and will start the use of Triple S; disseminate net tunnel technology among farmers and groups belonging to the association
- Rwanda –experiment on yield assessment using planting materials from net tunnel and open fields , come up with different strategies for weed control, use of well decomposed organic manure and use of different types of mulching
- Nigeria – construct net tunnels for six DVMs in six states of Nigeria
- Ghana – Look at response of varieties to net tunnel technology and the effect of cultural practices on net tunnel weed management and implementation of net tunnel and Triple S technology at selected locations in Ghana.
- Tanzania –review the durability of the net tunnel construction materials and explore different strategies for weed management *(the KOTEMU group leader said they usually dig deep into the soil during establishment to remove the roots of the weeds hence avoid re-emergence)*.

Lead person to lead online discussion: Jude Njoku - *How can the netting material be brought near to farmers? (i.e. investigate supply chain options which are not dependent on project support)*

7.2. Route 2: Inspection of sweetpotato Quality Declared Seed

The Team

Miheretu Cherinet, Sam Namanda, Gorrettie Ssemakula, Fekadu Gurma, Koussao Some, Jose Ricado, Francis Mwatuni, Yuventino Obong, Geoffrey Kananiji, Antony Masinde, Christine Nyirahabimana, Aime Ndayisenga, Valentine Uwase

The route

Dufatanye farmer group is located in Southern Province, Muhanga District, Shyogwe Sector, Vunga Village. It was established in 2002 to assist vulnerable children and families. This group begun with 200 Rwf: contributions from 10 children which was used to buy 2 exercise books and 1 pen. Currently, it has 28 registered members. Its main activities are cultivation of OFSP on rented land. The group also bought 1 cow and pays health insurance for its members. Dufatanye farmer group received technical assistance from SASHA, RAB and YWCA. RAB provided inputs (Naspot 9 (Vita) and Kabode vines) equivalent to 50000 Rwf, ($72) SASHA and YWCA assisted in production advice and Marketing of the produce. In addition to these, SASHA also provided the assets that have value of 1,500 Rwf.

Tuvemubwigunge group is located in south province, Muhanga district, Shyogwe sector, Rubugurizo village. The group was established in 2000 and it was formed by few women with contributions of 100frw/month that were invested in vegetable farming for supply to Shyogwe secondary school.

Tuvemubwigunge farmer group has 16 members. Their activities are geared towards improvement

Participants on the learning route inspect sweetpotato Quality Declared Seed

of agricultural practices including planting on ridges, using better inputs and planting few cuttings of vines that produce higher yields. The group is also involved in savings and credit. Apart from assorted agricultural produce, they distribute sweetpotato vines and process OFSP into mandazis.

The learning objective: To carry out inspection of sweetpotato QDS and explore ways of institutionalizing it

Guiding questions

- Where is the source of clean planting material?
- What varieties do you multiply at field level?
- Who are the primary buyers of your material?
- What is the inspection frequency?
- Do buyers have enough awareness about quality planting material?
- As planting material producing farmer, are you aware of quality planting material production protocol such as QDS protocols?
- Is there price difference between the inspected and non-inspected planting material?

Highlights and key learning points from the visit

To the majority of the team the procedure of QDS inspection was new. QDS is a tool that a sweetpotato farmer can use to produce quality planting material. One DVM can manage more than one seed variety. Since land is very limited, rotations can easily be implemented if different farmers are involved in multiplication. To help make it more effective, QDS protocol should be translated into local language as reference material. Close monitoring and technical backstopping by extension staff is required to ensure that the protocols are followed.

QDS can provide increased income for the DVM; however, to facilitate increased demand, there should be awareness creation on part of the buyers to understand the importance of quality planting material. All plots and varieties inspected met an acceptable standard based on the Tanzanian QDS Standards. (See *Annex 4* for the sampling protocol, standards, scoring sheet and report format used).

Research questions to be pursued

1. What is the effect of defoliating the cuttings on the quality, quantity (weight or numbers) and economic implications?
2. Would there be varietal differences on the above characteristics?
3. What are the recommended criteria on packing and transportation of planting material?
4. What is the effect of close and wide spacing on the quantity of planting material produced?

Participants' action points from the visit

- Train partners in Ethiopia on QDS
- Build capacity of stakeholders in Burkina Faso to implement QDS standards
- Improve the inspection system and QDS model
- Standardize QDS standards for Uganda

Lead person to lead online discussion: Sam Namanda - *Packaging and transportation of planting material*

7.3. Route 3: Rubona Research Station: Tissue culture micro propagation and hardening

The team

Beyene Demstu;Temesgen Bocher; Emily Ndoho; Christine Bukania; Maggie Chiipanthenga; Nessie Luambano; John Jagwe; Jean Ndirigwe; Bramwel Wanjala; Tefra; Diana Niyonizeye; Lydie Kankundiye

The route

Sweetpotato is an important crop for Rwanda as it is consumed daily and orange fleshed sweetpotato has had a great impact. However establishing a functional seed system has been a challenge, primarily because of limited availability of clean (virus tested) in the right quantity and at the right time. The Rubona Research Station is trying to bridge this gap.

Rubona station is located in Rusatira sector of Huye district in Southern Province of Rwanda. The station was started in 1924 by the Belgium government. The climate is characterized by a bimodal rainfall pattern with the short season (2.5-3 months). The station is located at mid elevation zone of 1650 masl longitude of longitude of 29º46' East and latitude 2.29º South (ISAR, 2005). Apart from sweetpotato, which has just about 10% coverage, Rubona Research Station is working on banana, cassava, coffee and livestock etc.

Production of *in vitro* plantlets started in 2009 with a capacity of 7,500 plantlets per month. Currently, 14 released varieties are maintained and multiplied. The varieties that are mostly multiplied varieties are *Cacearpedo, Gihingamukungu, Vita, Kabode and Ukwere*. During a

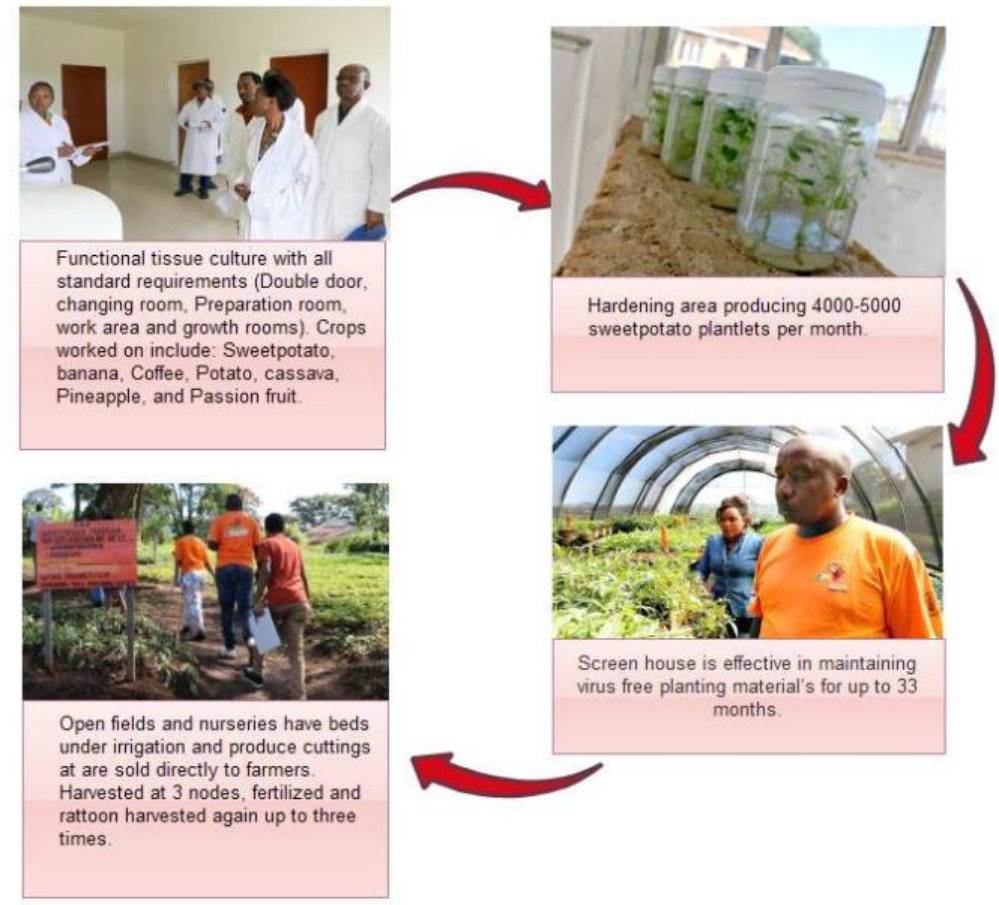
production period of 4 weeks, 4,000-5,000 plantlets are hardened costing USD 254. The original seed is virus cleaned at KEPHIS and send as *in vitro* material.

The learning objective: Learn how we can improve multiplication rates for Pre-basic and Basic seed and reduce cost of sweetpotato planting material

Guiding questions

- Why is the lab producing under capacity (4,000 plantlets instead of 7,000)?
- What is the total cost for producing 1.8-2 million cuttings?
- How much is produced as pre-basic, basic and QDS? And what is the cost of production and selling price?
- How much support do you get from the government?
- Do you have a revolving fund from the sale of planting material?
- To whom do you sell the pre-basic, basic and QDS? Is it to NGOS or government?
- How do you synchronize production and onset of rain season?
- Why are you conserving and multiplying many varieties, and which ones are in high demand?
- How do you maintain quality status of the distributed plants, and what methods do you use to test and index for viruses?
- What challenges do you encounter during multiplication and supply of planting material?

The team visited all the areas of clean seed production as shown in the diagram below:



Highlights and key learning points from the visit

- Nomenclature of the product is still unclear. Distinction between basic and pre-basic seed is not clear.
- Seed business in public institutions is not commercialized. Sustainability is project dependent. Projects buying vines for the DVM/individual farmers buy too.
- Ongoing activity to create a revolving fund.
- Supply of chemicals and equipment locally is a challenge. Most of the things have to be imported.
- Labs have capacity but are underutilized.
- The work flow in seed production is well managed (TC-Hardening-screen house-net tunnels-nurseries-open fields)
- The lab has cost cutting mechanism e.g. replacing sucrose with sugar, tap water to minimize electricity cost, rain water harvesting

Research questions to be pursued

- Increase multiplication rate on micro propagation (explore use of embryogenesis and bioreactor technology) for sweetpotato. Mass production of plantlets from single cell.

Action points from the visit

- Find out the number of generations that we can multiply and still call it pre-basic.
- Enhance diagnostic capacities as equipment have been sourced e.g. PCR machine
- Commercialize seed system (product/buyer/seller/business plan)

Person to lead online discussion: Bramwel Wanjala/Christine

8.0. Strengthening the Sweetpotato Seed Systems CoP

8.1. How are we going to mobilize resources? - *Gorettie Ssemakula (NaCRRI, Uganda) and Jude Njoku (NRCRI, Nigeria)*

The CoP was established to facilitate networking, exchange of experiences and learning in order to generate new knowledge. It was launched in April 2014 in Entebbe, under the umbrella of SPHI. Identification of resources will be critical to enable the achievement of the Seed Systems CoP vision. Participants discussed various ways through which resources can be mobilized and the following was suggested:

- Develop an outline of activities that can interest funding agencies
- Incorporate key stakeholders in NARS into what the CoP is doing by developing an advocacy strategy
- Carry out exhibitions, talks and open days to interest people
- Develop proposals that include building capacity while answering questions on issues on sweetpotato seed systems

Participants' suggestions

- We should learn from the CoP on integrated soil systems that is active in West Africa and learn what works and what does not.
- We have to strengthen our communication capacity; we should try to reach out to as many people as possible, including other research communities, and raise trendy, relevant and interesting issues.
- It is time to get the CoP more formalized and do an analysis of the capabilities within each country. This will help us to strategize on our resource mobilization.

8.2. Strengthening communication and learning

Formalization: As mentioned above, one of the suggestions made to strengthen the CoP was formalization. However, due to lack of time, participants agreed to hold online discussions about the strategy and procedures for achieving this.

Improve online discussion: Communication and forum discussions are a core tool for networking and information sharing for the CoP. To facilitate online communication, the CoP registered a Google groups D-List. However, by the time of the Third Consultation meeting in Kigali, most members had not started using this online tool. It was agreed that CIP would take lead in ironing out any technical issues and supporting participants to actively engage in online discussions using the D-List. To this end, some participants volunteered to moderate upcoming discussions.

Learning from existing communities of practice: Some participants have already participated in, or are aware of active communities. It was agreed that participants who have access to such CoPs would establish contact and collect lessons and ideas that would help to improve the functioning of the Sweetpotato Seed Systems CoP.

Joint fundraising: The cost of running an active CoP and especially holding face-to-face meetings that incorporate members from across the continent is high. Therefore, participants agreed that

they would pursue a fundraising strategy in which they jointly responded to concept notes and proposals. Participants agreed that rather than developing blind proposals, it would be more effective to form proposal writing teams based on specific calls.

8.3. Reflections from the meeting and issues moving forward

The following points have been synthesized as the main issues identified throughout the meeting and the learning routes. These will form the basis of the issues which the CoP will continue to deliberate on through on-line discussions and individual country follow up before the next meeting.

Nomenclature & terminology	• Create a common understanding about formal and informal seed systems and their complementary roles • Harmonize the terminology to use for different seed classes • Agree on the number of generations that seed can be multiplied as pre-basic seed
Demand creation	• Create awareness among farmers about the importance of clean planting material • Synchronize seed production with peak planting seasons • Promote sweetpotato as a priority crop for health, nutrition and food security
Demand projection	• Test and refine Monare's method for projecting seed demand and improve on data collection to validate the tool • Undertake training on how to use the demand projection tool
Revolving fund mechanisms	• Create awareness among CoP members on revolving funds and how to take advantage of features that would increase the pace of financial transactions and procurement of supplies.
Cost Analysis	• Compare cost structure and production costs for each segment of the seed value chain for different countries
Partnerships	• Test different approaches to strengthen linkages between the different segments of the seed chain through to root producers • Identify and obtain additional sources of funds to support CoP activities
Tissue Culture Plantlet production: Reduce costs	• Substitute low cost alternatives e.g. sugar for sucrose • Improve efficiency of TC plantlet production
Identify and test methods to increase multiplication rate in screen house e.g. Sandponics	• Greenhouse and screen house specifications • Nutrient solution- Economic optimum N rates calculated • Optimize conditions for sand hydroponics • Plant husbandry • Variety differences • Field performance-effect of fertilizer on plant quality • Integration of micro propagation with seed production system • Determine economics of sand hydroponics under local conditions
Net Tunnels	• Are there any alternative materials for net construction (in particular the insect proof netting)? • Are there any management options to reduce/minimize weeding? • How are different varieties responding to net tunnel technology? - Degeneration - Cuttings/harvesting

Triple S	• **Roots:** maturity, and health status as selection criteria for pre-storage and pre-planting. Varietal differences: roots with higher dry matter content are better than those with lower dry matter. • **Storage containers and medium:** Containers that can be used include paper boxes, plastic basins, papers or bags. The sand medium should be dry with a relatively course texture. • **Storage environment:** Thatched storage conditions are better than iron-sheet houses due to the buildup of heat. • **Watering and watering frequency:**
Crop and Seed Management: If a farmer's field is completely infected by SPVD – how can she get & maintain clean planting material?	• What actions can we recommend for the farmer? • How can she benefit from clean planting material? • What kind of action research do we need to determine degeneration of varieties as a result of issues such as high viral load? • How do we monitor the performance of varieties over time? • What kind of trial do we conduct? And where? • How do we get farmers/growers to adopt the use of pathogen tested seed? • Proper labeling of varieties could ensure the varietal purity, is it true? • Cost analysis of vine production • What crops will be appropriate to intercrop with? • Can intercropping maize/onion with sweetpotato be important in crop risk management? • **Fertilizer** trial including use of **manure** and **compost**. Can we include this in our seed system action research? • What are the suitable methods for seed systems in the dry areas?
Appropriate quality assurance mechanisms	• Pilot and adapt QDS inspection schemes with regulatory authorities at country level

9.0. Evaluation

The Seed Systems CoP was attended by 41 participants. At the end of the meeting, participants were asked to fill out questionnaires to provide feedback that would help improve the usefulness of future meetings. The meeting was predominantly attended by men who made up almost 80%. An overwhelming majority of participants expressed their satisfaction with the content of the meeting - 44% thought it was good, while 52% thought it was very good.

Expectations: Half of the participants felt that by the end of the meeting, all their expectations were met; the other half felt that most of their expectations had been met.

The most useful part of the meeting

Participants stated that the meeting was useful, interactive and educative. They appreciated the fruitful consultation and group discussions. The most useful part of the meeting was the field trip, as expressed by 36% of the participants. This was followed by the session on development of a business plan (17%). At third

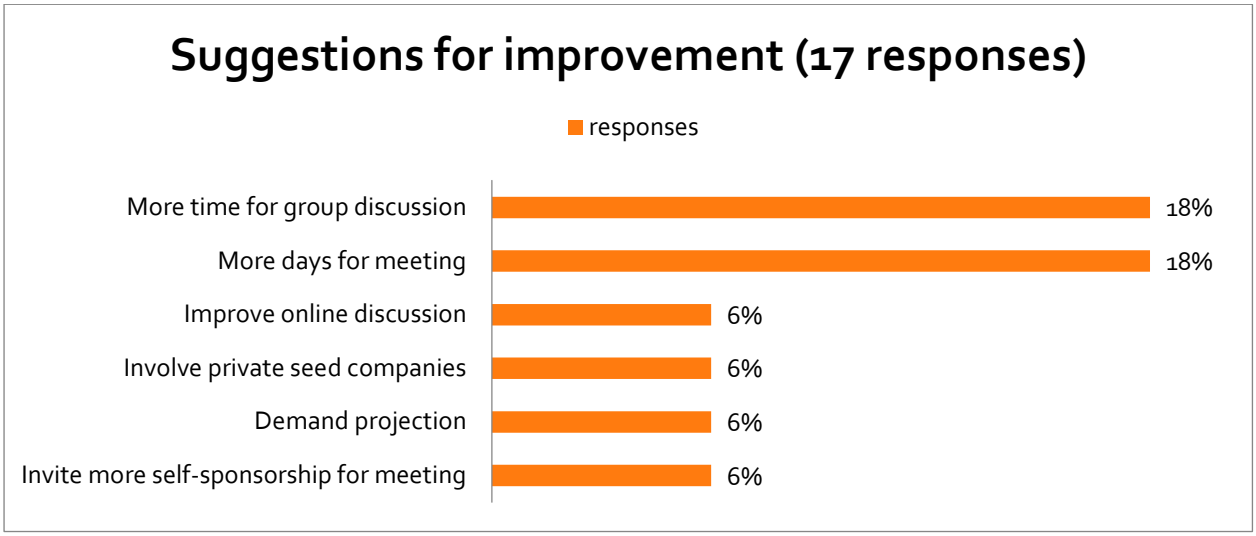
"The venue was fantastic and the presenters were well prepared. It provided a lovely background about seed systems (pre-basic project)."

place were two items: general information on seed systems and country experiences, (11%).

Suggestions for improvement of the Sweetpotato Seed Systems CoP meetings

Seventeen participants made suggestions for improvement of future meetings of the Sweetpotato Seed Systems CoP. As can be discerned from the figure below, most of the respondents would like the overall time for the meeting, as well as the time allocated to group discussions, increased.

Figure 11: Suggestions for improvement



"I would like to see a functioning Cop which can stand on its own after the exit of CIP. CIP has to make sure it supports this."

Comments made by participants also suggested ways in which the CoP could be improved. For example, one responded expressed the need to expand membership of the CoP, as it is a good way to share experiences. Suggested actions included holding country-level meetings and discussing research questions via email. Another suggestion was to use the community to find connections between seed systems and demand for roots.

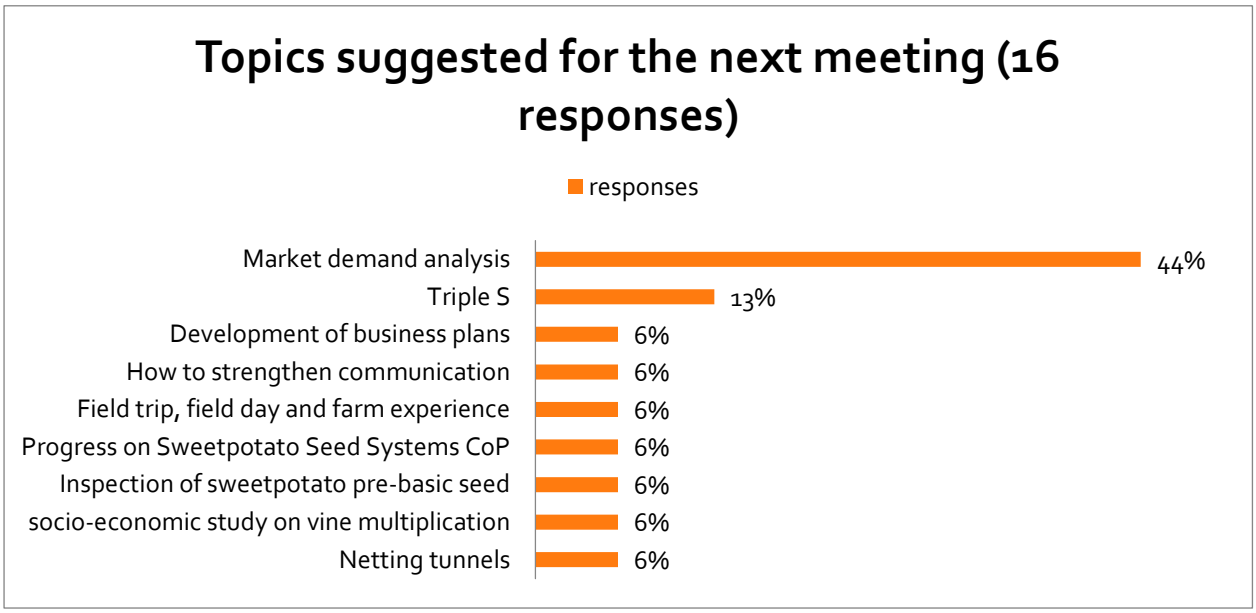
Whereas participants appreciated the good planning undertaken by the organizing committee, they felt that some of the flight arrangements had lengthy connections and by the time some participants arrived, they were too exhausted to participate fully on the first day. Furthermore, many respondents were of the opinion that it would be better for presenters to send in their abstracts at least two weeks before the meeting.

"It was a great meeting; but we need to have fewer topics for more in-depth discussion" - ***participant***

Suggestions of topics for subsequent Sweetpotato Seed Systems CoP meetings

16 participants made suggestions for the topics they would like to have in subsequent meetings. A majority of respondents (44%) suggested *market demand analysis*, followed by *development of business plans (*13%).

Figure 12: Topics suggested for the next meeting



ANNEXES

Annex 1: Opening speech by RAB Director General Dr Jean Jacques Mbonigaba Muhinda

RAB Director General

Dr Jean Jacques Mbonigaba Muhinda

Opening Speech

Sweetpotato Seed Systems Community of Practice: Third Consultation

Kigali, Rwanda

Hotel Villa Portofino

28-29th April, 2015

Distinguished guests from eleven countries across East, Central, Southern and West Africa, Representatives of organizations based in Rwanda,

Ladies and Gentlemen –

Welcome to Rwanda, our beautiful and fertile country. "The land of a thousand hills".

Welcome to the Sweetpotato Seed Systems Community of Practice: Third Annual Consultation, taking place for the next two days in Kigali.

We are here today to start our consultation around a key input for farmers to be successful – that is, **Seed**.

Seed is the starting block for yield improvement and for meeting end user preferences for different product characteristics. However, the seed of any crop is more than its genetic material. By using a combination of different formal and informal delivery mechanisms, seed provides a channel whereby farmers can exchange and gain knowledge around: seed traits and characteristics; improved agronomic and management practices; and in turn strengthen institutional and social networks.

In Rwanda, our Government's **Economic Development and Poverty Reduction Strategy** defines a large number of programs in the agriculture sector. However, without a functioning seed system – investments in breeding improved varieties will not reach and benefit farmers. Functioning seed systems are essential to contribute to improved food and nutrition security and livelihoods at household and national levels. This is particularly important for women, as they are often the main producers of sweetpotato, and responsible for feeding the family.

For the next two days we are focusing on **sweetpotato seed.** We all appreciate that this is most commonly propagated from vine cuttings. This poses particular challenges to ensure seed system functioning meets the needs of farmers.

In order to address the needs of farmers we have to focus our efforts on addressing the challenges related to: increasing the **availability** and **accessibility** of **healthy** planting material, in a **timely** manner. In Rwanda we are fortunate to have two rainy seasons so that sweetpotato is grown all year round – and thus vines for planting the next crop are available. I appreciate that some colleagues from the other countries participating in the meeting are also in this situation while others come from areas where there is only a single growing season in a year.

However, as we also know, re-cycling seed from season to season and continuous cultivation leads to an accumulation of sweetpotato virus diseases and subsequent reductions in yield. Thus, I would like to commend the efforts of our colleagues in the Rwanda Agriculture Board and other national sweetpotato programmes, NGOS, and the International Potato Center, for their work on developing

a clean seed system for sweetpotato. This requires investment of financial and human resource to address bottlenecks in all segments of the seed value chain. Progress has been made in improved methods for laboratory based virus indexing and virus elimination and in-vitro tissue culture propagation to ensure a supply of clean planting material. Colleagues in **Malawi, Mozambique Kenya Uganda and Zambia** have also been testing methods for increasing the multiplication rate for sweetpotato using and adaptation of hydroponic systems called "Sandponics".

But, this seed is expensive and is produced in relatively small quantities. So, it is also essential to ensure that sweetpotato vine multipliers and farmers can keep their planting material disease-free for as long as possible. I understand that colleagues in **Tanzania, Kenya, Ethiopia as well as Rwanda** have been testing a low cost net tunnel technology with farmer multipliers to protect their stock of planting material from aphids and whiteflies which spread different sweetpotato viruses.

A **second** challenge around the availability of vines, affects those countries with uni-modal rainfall systems where there is a **long dry season.** So farmers often lose their planting material. Again, I understand that colleagues in **Uganda, Ethiopia and Zambia** have been working on **root based vine multiplication systems – such as the Triple S (Sand, Storage and Sprouting)** to ensure adequate quantities of planting materials at the start of the rains.

I look forward to learning of new research updates and future directions for these promising technologies.

A **third** challenge is to put in place a quality assurance mechanism, whereby farmers can trust that the seed that they are buying is of the variety specified and healthy. I understand that in **Ethiopia and Tanzania,** standards for different classes of sweetpotato seed, including quality declared seed are in the final stages of ministerial approval.

We need to remember that in pursuit of quality, it is important to be cautious and ensure that over-regulation and bureaucracy do not stifle emerging seed entrepreneurs at birth. Increased yields are vital but only if farmers have access to output markets. A balanced strategy is needed, including: breeding to develop virus resistant varieties; strengthening the capacities of farmers to maintain seed quality; and, appropriate seed inspection systems.

Here in Rwanda we need to learn from these developments so as to put in place appropriate and affordable models for inspection services for sweetpotato seed systems. Sweetpotato is becoming a very important crop and seed is in great demand.

The major theme for this Third Consultation of the Sweetpotato Community of Practice is **"The Business Case for Sweetpotato Seed Multiplication"**. Our assumption and expectation is that root yields will increase from the use of improved varieties. This will mean that farmers will be able to market their surplus and increase their income from sweetpotato production.

We then need to ask the question:

Will farmers be willing to pay for sweetpotato seed – and if so – will sweetpotato seed multiplication be a viable commercial enterprise?

Financial analysis of profits and margins for the different segments of the seed value can help us answer these questions. Understanding the profitability of seed value chains, and where public and or private sector investment is required, is an essential contribution to the scaling up of the potential benefits of increased sweetpotato production and consumption. I understand that we will review and discuss business plans for pre-basic seed production developed in Uganda.

Ladies and Gentlemen – colleagues –

We are here as a "**Community of Practice"** of the **Sweetpotato for Profit and Health Initiative,** with participants coming from **all corners of Africa.**

As **a member of the Executive Steering Committee of this Initiative** I have been asking myself:

What does this mean – and what is my responsibility to our Community of Practice.

We are not a "community" in the sense of a village. However, my own Government of Rwanda and other Governments have invested in improved internet connectivity and communication infrastructure.

So, **first**, we need to take full advantage of this, as we are a **"virtual community";** and use the information, technology and communication tools at our disposal**.** I understand that in the preparation and run up to this meeting you have already engaged in a number of dynamic on-line discussions and urge you to continue to do this after this consultation.

Second, as researchers and development practitioners, we have our common accountability to farmers to address the technical, economic, social and institutional bottlenecks which act as a brake to the efficient functioning of sweetpotato seed systems. This means: **learning** from each other; **exchanging** information; **drawing lessons;** and, **adapting and testing** ideas and technologies in our own country contexts. Thus we need to actively **Practice our Seed Systems** in order to achieve the changes we are striving for.

Therefore, I would like to warmly welcome you all, but in particular, our colleagues who are participating in the annual consultation of the Community of Practice for the first time.

In particular we look forward to learning about the experiences and future plans for sweetpotato seed system activities in **Burkina Faso**; and about practices around sweetpotato seed and root crop management with colleagues from **Ghana and Nigeria.**

In Rwanda, previously as ISAR and now as RAB, we have enjoyed a long and productive collaboration with the International Potato Center, with activities under, ASARECA (PRAPACE), HarvestPlus, DONATA, SASHA, SUSTAIN, in addition to collaboration on potato. Therefore I am very happy that you will have the opportunity to follow up on technical questions with visits to our tissue culture laboratory and field based activities in Rubona, Muhanga and Rulindo.

So, finally, colleagues - I urge you to take full advantage of the opportunities for learning and developing further research questions in this Community of Practice. I urge you to benefit from this annual consultation and trust that you will take back ideas to your country communities to test and put into practice for the benefit of sweetpotato farmers across sub-Saharan Africa!

Thank you.

Annex 2: Successes and challenges with current sandponics activities: feedback collected from Zambia and Uganda

Component	Successes	Challenges
1) Nutrient mix concentration	• In 1000L water, the mix is: • Calcium Nitrate =236g • Potassium Nitrate =504g • Magnesium Sulphate =100g • Microsol B =12g • MAP (Mono Ammonium Phosphate) =263g • This is for 3 weeks and 578 pots, fertigated every other day for 30minutes • This is water directly pumped from well	• Power cut to pump water into tanks
2) pH balance	• Sand bleaching using Jik works well in Zambia. Bleaching is once, only at stocking.	• None
3) Fertigation system	• Strictly cleaning of water tanks every 2 months • Letting water and solids to settle for 2hrs before fertigation to avoid system clogging	• Close follow up and supervision
4) Growth medium (e.g. sand or other) and granule size	• Sand works properly in Zambia	• None
5) Crop management (including plant population & temperature management)	• Protocols for management practices optimized which has resulted in 100% control of pests and diseases through: • spraying once a week with insecticides and fungicides- • Washing hands before entry • Foot bath at entry point • Screen head at entry that facilitate open and closing door before entry	• There is need for 2 screen houses to facilitate the thorough cleaning once a year as all plants are completely removed from the screen house under

Component	Successes	Challenges
	into the main screen house • Wearing of coats and gloves when working in the screen house • Sterilizing working materials such as knives • Closing of screen house for one month every year; this allows for thorough cleaning, screen maintenance and disinfection and replacing sand • Always checking for holes around the screenhouse and sealing with silicon • Spraying inside and outside screen house	maintenance • Essentially, restocking need to be done using tissue cultured plantlets- but in Zambia, we use the same cuttings through screen house movement • Need for planning- to time the maintenance period without affecting vine production • Possibility of transferring diseases from one plant to another through use of same knife for vine cutting • No facility for indexing- status of disease free is through visual inspection

Annex 3: Future sweetpotato sandponics research areas suggested by different countries

Component	Research areas	Comments	Country
1. Construction materials	1a) Are they readily available and sustainable? 1b) Different shade and net types (polyethylene, net, mesh, glass or no house) 1c) Low cost pad and fan system to regulate heat and humidity 1d) Greenhouse	1a) Usually available except for the white net and the black shading net 1b) The effect on temperature, total PAR inside, shading ability, will be studied 1d) Establish the effect of temperature on vine multiplication	**1a) Zambia** **1b) Ethiopia** **1c) Ethiopia** **1d) Kenya**

Component	Research areas	Comments	Country
2. Nutrient mix	2a) Are all the nutrients locally available? Can Microsol B be sourced locally or replaced or do without it? 2b) Can the concentration of each nutrient required be reduced to half or 3/4 without affecting growth? 2c) Leaf, tissue and roots chemical analysis to determine the amount of each of the 16 essential element required for good vine growth 2d) The effect of different levels of NPK fertilizers 2e) Compatibility, solubility of different fertilizers in the preparation of the stock solution 2f) Standard nutrient mix for sand-ponics by using various concentration of various fertilizer 2g) Optimize fertilizer application for maximum vine production	2a) Microsol B in Zambia is imported from Kenya, in 25kg packs, but enough for 3 to 4 years for the capacity we have here 2b) Trying to reduce costs 2c) This is to optimize the crop nutrient requirement and adjust our nutrient mix accordingly 2e) For example, fertilizers containing calcium must not be mixed with fertilizers containing sulfates or phosphates. Test different fertilizer brands available in Ethiopia, Kenya, Mozambique and Uganda to determine which ones should be mixed in one tank. 2f) 23-21-0 4s are the most locally available fertilizers.	**2a) Zambia** **2b) Zambia** **2c) Ethiopia** **2d) Ethiopia** **2e) Ethiopia** **2f) Malawi** **2g) Kenya**

Component	Research areas	Comments	Country
3. pH and EC	3a) The effect of agricultural lime 3b) Can plants perform with high or low pH? 3c) Is sterilizing sand through heat or steam pH ok, or it also needs bleaching to attain the required pH of 6 and 7? 3d) Interaction of media, physical characteristics, fertilizer and irrigation system on salt accumulation (EC) in the growth media	3b) In Zambia, pH testing is done only at planting. Sand is bleached once, but it may not be the same with other soils/ media. 3b) pH value 6-7 is too high for plants. SP usually grows from 5.7 – 5.8 pH growth medium. And pH testing should be done everyday	**3a) Malawi** **3b) Zambia**
4. Fertigation system	4a) Fertigation frequency: daily, alternating daysor 3x a week 4b) Establishing the sandponics fertigation system using drip irrigation 4c) Sand semi hydroponics system for effective utilization of water and nutrient 4d) Efficient water saving way of fertilization in Burkina Faso	4a) As a measure of reducing screen house costs	**4a) Zambia** **4b) Ethiopia** **4c) Ethiopia** **4d) Burkina Faso**

Component	Research areas	Comments	Country
5. Growth medium	5a) Can manure be added to sand for moisture and nutrient retention 5b) The effect of using different growth media on fertilizer use efficiency and growth of sweetpotato 5c) Plug size, growing pot size and their interaction on the physio-chemical properties of the growing media and vine growth performance 5d) The potential of coffee husks as a growth media 5e) Sand will be the preferred source of media	5a) To reduce fertigation times 5b) The classification of media is based on the porosity, water holding capacity, water retention capacity and hydraulic conductivity. Budget not identified.	**5a) Zambia** **5b) Ethiopia** **5c) Ethiopia** **5d) Ethiopia** **5e) Kenya**

Component	Research areas	Comments	Country
6. Crop management	6a) Zambia screen house is 20x8m for 392 pots of 8x12cm. Can the plant population be increased by variety? In Zambia, Olympia hits the roof and turn downwards while Twatasha is still struggling to climb, the vine yield is therefore >3x for Olympia than Twatasha, can we maximize vine production for varieties like Twatasha through increased plant population? Compare floor beds vs. pots 6b) The effect of canopy management (training, pinching, branch number, old leaf removal) on cutting number 6c) The effect and economic benefits of using different plant growth regulators on flowers management, leaf density management and canopy management 6d) Developing strategies to combat the combined effect of extreme heat, humidity and moisture stress problem 6e)Optimize plant density per pot Pretreating vines with rooting media; Harvesting times; Effect of apical dominance	6a) To maximize vine production of plants that exhibit slow growth and are not bushy 6b) Not identified 6c) Not identified 6d) In Malawi Emily used plastic shade not nets. The microclimate inside the plastic shade was conducive as compared to the nets.	

Component	Research areas	Comments	Country
7. Greenhouse sanitation	7a) Through use of traps and pheromones, can insects and aphids find their way into the screen house despite weekly spraying regime? 7b) Can use of one cutting secateurs/knife across plants infect other plants? 7c) Efficiency of polyethylene plastic and other anti-algae chemicals to control green algae in the greenhouse	7a) Based on results, do we need to spray every week let alone with systemic insecticides? 7c) Green algae are the primary causes of poor sanitation in the greenhouse. It can be controlled by chemicals like Greenclean (commercial name) but if we can effectively collect and discharge excess water from greenhouse and keep the floor dry, it protects the growth of green algae.	**7a) Zambia** **7b) Zambia** **7c) Ethiopia**
8. Other	8a) When shall screen housed plants be destroyed or replaced?		**8a) Zambia**

Annex 4: Tolerance levels for different classes of sweetpotato planting material, Tanzania 2015

Parameters	Seed classes				
	Pre-basic	**Basic**	**Certified 1**	**Certified 2**	**QDS**
Minimum isolation distance (M) (With suitable barrier crop maize, Napier grass, etc.)	-	50	20	20	20
Crop rotation[3] (Minimum seasons[4])	-	6	4	4	2
Minimum number of inspections	1	2	2	2	1
Maximum permitted rattoons	3	2	1	1	1
Varietal purity (%)	100	100	99	99	98
Fungal infection (Maximum %)	0	-	-	-	-
SPVD (SPCSV, SPFMV, SPMMV, SPLCV etc.) (Laboratory testing) (Maximum %)	1	-	-	-	-
Virus symptoms (Maximum %)	-	0	2	2	5
a) Mosaic and stunting	-	0	2	2	5
b) Leaf curl	-	0	2	2	10
c) Other (e.g. purpling of old leaves, chlorotic spots, vein clearing)[5]					
Black rot (Maximum %)	0	0	0.5	0.5	0.5
Root knot nematodes (Maximum %)	-	1	2	2	3
Wireworms (Maximum %)	-	5	10	10	10
Scurf (Maximum %)	0	0	0.1	0.5	0.5
Wilt (bacterial) (Maximum %)	0	0	0.5	0.5	0.5
SSR-Pox (Maximum %)	0	0	10	10	10

[3] If high weevil incidence, extend the number of seasons the field has been free of sweetpotato by 1 season
[4] Season is a cropping period during which a crop is grown to maturity
[5] Should not be confused with nutrient deficiency

Parameters	Seed classes				
	Pre-basic	**Basic**	**Certified 1**	**Certified 2**	**QDS**
Alternaria blight (Maximum %)	0	1	2	5	5
Sweet potato butterfly (*Acrea acerata*) (Maximum %)	-	2	5	5	10
Caterpillars (Maximum %)	5	10	10	10	10
Weevil (*Cylas puncticollis*)) (Maximum %)	-	5	5	5	10
Mites/thrips (Maximum %)	5	5	5	5	5
Insect pests (Aphids, whiteflies) (Maximum %)	0	5	5	5	5

Sampling procedures and scoring sheets for QDS field inspection

Sampling: standard beds

i. First of all determine the number of standard (1.2 m x 6 m) beds for the variety being assessed. For every 10 beds select 3 beds at random, for example every other bed.
ii. The following procedure should be carried out for each of the 3 selected beds for each variety:
    a. Each bed should have 5 rows. Do not consider the two outer rows. Of the three inner rows, do not consider the middle row. There are now two rows to base the assessment on.
    b. Calculation of plant population.
        i. Fill in the form with the number plants in each selected row. Add up the number of plants in each selected row for the three beds and fill in the total column.

Non-standard bed sizes

The following procedure should be followed for sampling farmer multiplication sites, which are not laid out in standard beds:

First pace the area for each variety in the farmer's multiplication plot. For every 100 ^{m} of each variety select 3 samples of 0.4m x 1.5m. Start in the middle of the farmer's multiplication plot as the first sample. Peg out an area of 0.4m x 1.5 m using string and stakes. Choose a random direction and take three strides and peg out the second area in the same way. Repeat for the third sample. The areas pegged out will be the equivalent of the 2 selected rows from 3 standard beds in DVM multiplication plots. Count all the remaining plants in the marked area.

Sweetpotato QDS – Inspection Visit: First visit: 2- 3 weeks after planting Y/N. Second visit: 2 weeks before harvest Y/N							**Page 1**
Date of visit……. Inspection carried out by:…… Contact No……							
District:	**Ward:**				**Village:**		
Group/individual name:	**Contact person:**				**Contact No:**		
VARIETY:	Bed 1		Bed 2		Bed 3		Percentage affected /Total # of plants in sample
Row	**1**	**2**	**1**	**2**	**1**	**2**	
1. Remaining number of plants per row							
2. Total # of plants of other varieties							
3. % of plants of other varieties							
4. Total # of plants with mosaic and stunting (SPVD)							
5. % of SPVD plants							
6. Severity of mosaic and stunting (score 1-5)							
7. Total # of plants with leaf curl							
8. % of plants with leaf curl							
9. Total # of plants with purpling							
10. % of plants with purpling							
11. Total # of plants with signs of weevils							
12. % of plants with signs of weevils							
13. Total # of plants with alternaria							
14. % of plants with alternaria							
15. Total # of plants with signs of caterpillars							
16. % of plants with signs of caterpillars							
17. Plant vigour (V. good = 1 Good = 2; Poor = 3)							
Estimation of quantity of material							
18. Average # of 30 cm vines from best and worst plants in selected row							
19. Estimated remaining plant population/bed	Bed 1		Bed 2		Bed 3		

Example of format for report on sweetpotato QDS inspection

Name and position of inspector:

……

Address and contact number of Inspector:……

Date of inspection visit: ……

First inspection visit: (2-3 weeks after planting) y/n. Second inspection visit: (2 weeks before harvest) y/n

Name of multiplier: ……

Location of multiplication site (District, Ward Village):……..

……

INSPECTION REPORT

1. Isolation from other SP plots: (at least 100 m from other sweetpotato plots)……..

2. Site history: (rotation has been practised and the site is visibly free from pests and diseases)……

3. Source of material is documented: what was the source of the current material used for multiplication. Is this source documented? Is this source known to be free from pests and diseases?
   ……

   ……

4. Labelling of multiplication beds: are all the beds labelled with variety and date of planting?.....

5. Varieties inspected: ……

6. OVERALL RECOMMENDATION:……

   ……

SIGNED:……..

DATE:……..

PLACE:……..**Table A: Recommendation by variety**

Variety	Percentage affected plants							
	Mosaic & Stunting	**Leaf Curl**	**Purpling**	**Other varieties**	**Weevil**	**Caterpillar**	**Alternaria**	**Recommendation**

Annex 5: Meeting Agenda

Sweetpotato for Profit and Health Initiative-

Regional Technical Support Platform for East, Central and Southern Africa

Sweetpotato Seed Systems Community of Practice: Third Consultation- The Business Case for Sweetpotato Seed Multiplication

Hotel Villa Portofino, Kigali, Rwanda.

28-29 April 2015 AGENDA

TIME	SESSION	PRESENTER
DAY 1: Morning session. **Moderator:** Kirimi Sindi. **Rapporteur:** Kwame Ogero.		
8.00 – 8.15	**Registration**	Diana Niyonizeye & Emily Ndoho
8.15 – 8.30	**Introductions and objectives of meeting**	Gorrettie Ssemakula (NaCRRI, Uganda)
8.30 – 8.45	**Sweetpotato seed systems in Rwanda:** Experiences with coordinating the seed value chain	Jean Ndirigwe (RAB, Rwanda)
8.45 – 9.00	**Sweetpotato seed systems: progress with our community of practice**	Margaret McEwan, CIP-SSA
9.00 – 9.30	**Is there a business case for pre-basic seed production –** presentation of draft business plans for the public and private sectors in Uganda	John Jagwe (Consultant – Uganda)
9.30 – 10.00	***Official Opening and Group Photo***	*Dr. Jean Jacques MBONIGABA MUHINDA, DG RAB*
10.00 – 10.15 Tea/coffee break		
Sustainable pre-basic seed production: the financial and institutional issues		
10.15-10.35	**The business case for existing local vine multipliers**: Uganda and Tanzania experiences	Yuventino Obong (N-ZARDI, Lira Uganda – Project for the commercialization of sweetpotato multipliers)
10.35 – 10.50	**Plenary questions and discussion**	Moderator: Kirimi Sindi
10.50 – 11.15	**Discussant:** Seed Demand	Temesgen Bocher (CIP-SSA)
11.15 – 11.35	**Ethiopia:** Coordinating demand – and managing supply	Beyene Demstu (TARI, Ethiopia)
11.35 – 12.30	**Round table discussion on pre-basic seed production:** Ethiopia, Uganda, Kenya, Rwanda, Tanzania, Malawi, Mozambique.	Moderator: Margaret McEwan Discussants: Nigeria, Burkina Faso and Zambia
12.30 – 13.00	**Re-visiting the business case for pre-basic seed production and next steps in collection and analysis of cost data**	John Jagwe and Temesgen Bocher
13.00 – 14.00 - Lunch		
DAY 1: Afternoon session. **Moderator:** Jude Njoku. **Rapporteur:** Nessie Luambano.		
Sustainable pre-basic seed production: the technical issues		
14.00 – 14.15	**Increasing the multiplication rate for sweetpotato:** overview of the sandponics system	Bramwel Wanjala (CIP-Nairobi)
14.15 – 15.15	**Round table discussion on the research questions:** a. the nutrient mix b. temperature regime	Mihiretu Cherinet (CIP-Ethiopia)

TIME	SESSION	PRESENTER
	c. cutting management	José Ricardo (IIAM, Mozambique Maggie Chipanthenga (DARS, Malawi)
15.15 – 15.30	**The Learning Route:** preparation for field trip (3 groups)	Margaret McEwan (CIP-SSA)
15.30 -15.45 Tea Break		
Updates from sweetpotato seed systems, technologies and other seed systems		
15.45 – 16.00	**RTB seed system case study: - Rwanda Super Foods**	Jean Claude Nshimiyimana (CIP-Rwanda)
16.00 – 16.15	**Status of Sweetpotato Seed System in Malawi: Experiences, lessons and way forward**	Geoffrey Kananji, Scaling Seeds and Technologies Partnership (SSTP), and Maggie Chipanthenga, DARS, Malawi
16.15 – 16.30	**Seed system approach & production activities for high iron bean in Rwanda**	Lister Katsvairo/Jean D'Amour (Harvest Plus – Rwanda)
16.30 – 16.45	**One Acre Fund Rwanda:** TUBURA sweet potato field trial results and planned distribution approaches.	Kaitlyn Smoot (One Acre Fund)
16.45 – 17.30	**Triple S: new findings and future research areas**	Sam Namanda (CIP-Uganda) and Mihiretu Cherinet (CIP-Ethiopia)
17.30 – 17.45	**Discussion in plenary**	Moderator: Jude Njoku
18.00 – 20.00	**Cocktail & display of information & promotional materials**	Participants to bring information materials from their activities (FCI /SSOSPA/FIPs)
End of day 1		
DAY 2: Morning session - A learning journey		
06.00	**Departure for field trip:** 3 separate groups visit different sites	Breakfast available at 5.15
	Route 1: Net tunnels – what have we learnt & where to next for low cost protection of basic planting material	Lead: Deusdedit Peter & Kwame Ogero
	Route 2: Inspection of sweetpotato Quality Declared Seed – what is it and how do we institutionalize it?	Lead: Sam Namanda & Gorrettie Ssemakula
	Route 3: TC micro propagation and hardening – what are we learning to improve multiplication rates, reduce costs	Lead: Bramwel Wanjala & Beyene Demstu
11. 30 – 12.45	**Return to Kigali**	
13.00 – 14.00 Lunch at Hotel		
DAY 2: Afternoon session **Moderator:** Francis Mwatuni. **Rapporteur:** Bramwel Wanjala		
Reflections on our learning journeys and follow up actions		

TIME	SESSION	PRESENTER
14.00 – 15.00	**Learning Journey**: write ups	Margaret McEwan (CIP-SSA) (Group work)
15.00 – 15.20	**Sweetpotato crop & seed management – new findings and future research areas**	Erna Abidin, Kwabena Asare (CIP-Ghana), Issah Abukari (CSRI, Ghana) Some Koussao (INERA, Burkina Faso), Jude Njoku (NRCRI, Nigeria)
15.20 – 16.00	**Sweetpotato Seed Systems – Community of Practice – How are we going to mobilize more resources?**	Gorrettie Ssemakula (NaCRRI, Uganda) and Jude Njoku (NRCRI, Nigeria)
16.00 -16.15 Tea/coffee break		
Feedback from Learning Journeys		
16.15 – 16.35	**Route 1:** Net tunnels – what have we learnt & where to next for low cost protection of basic planting material	Roundtable presentation to Groups 2 & 3
16.35 – 16.55	**Route 2:** Inspection of sweetpotato Quality Declared Seed –how do we support piloting and institutionalization of QDS in more countries?	Roundtable presentation to Groups 1 & 3
16.55 – 17.15	**Route 3:** TC micro propagation and hardening – what are we learning to improve multiplication rates, reduce costs	Roundtable presentation to Groups 1 & 2
17.15 – 17.30	**Plenary discussion:** strengthening communication and learning	Margaret McEwan (CIP-SSA)
17.30 – 17.45	**Evaluation and wrap - up**	Margaret McEwan and Temesgen Bocher

Annex 6: Participants' List

SPHI, Sweet Potato Seed Systems Community of Practice Meeting

April 28-29, 2014,

Kigali - Rwanda

PARTICIPANTS LIST

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

SASHA
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