Location of work: Ethiopia, Tanzania and Kenya

**Background**
The contract was awarded to support the implementation of a study on the institutional arrangements for sustainable sweetpotato seed systems. The study was implemented over the period November 2011 to March 2014. The study was a complementary research study to the implementation of the Marando Bora component of the BMGF funded SASHA project. It was also being implemented in collaboration with the CIP-USAID funded project “Better Potato, Better Lives” in Ethiopia.

The study sought to contribute to an understanding of:

1. the constraints to more effective interactions and information flows among the different components of existing seed system practices, and how user conditions influence the organisation of making of quality planting material;
2. whether decentralised vine multipliers (DVMs) can act as an interface between the “formal” seed system and farmer-to-farmer diffusion for quality planting material; and
3. how to design appropriate inspection models for community based quality declared sweetpotato seed systems.

**Study Objectives**

a. To review the seed policy and regulatory environment for clonal crops in Tanzania and Ethiopia and identify potential models for implementing those policies for sweetpotato.

b. To carry out a participatory characterization of stakeholder interaction and information flows in the existing sweetpotato seed system to assess the performance of such interactions in terms of perceived usefulness by the actors involved.

c. To identify the constraints to more effective interactions and draw conclusions on how to support appropriate institutional arrangements that best support the emergence of sustainable seed systems in different contexts.

The study focused on Tanzania and Ethiopia, and targeted areas within these countries where sweetpotato is an important staple food crop.
Key activities accomplished

1. Implementation of a pilot for a community based quality assurance inspection scheme for quality declared planting material in Lake Zone, Tanzania. This was conducted over two seasons (January – March 2012 and August–November 2012).

   a. Two technical reports on findings from each inspection cycle
   b. Protocol for sweetpotato quality declared planting material standards and inspection procedures
   c. Two sweetpotato stakeholder workshops (Lake Zone and National) co-hosted with LZARDI and TOSCI to review and revise guidelines for standards and tolerance levels for sweetpotato planting material and inspection protocol and propose next steps for validation and institutionalisation.

Findings

In the context of the SASHA Marando Bora research-for-development project, a case study approach was used to pilot three different inspection models with decentralised vine multipliers (DVMs). The models were based on the concepts of self-inspection; team inspection; and external inspection. Two cycles of inspection visits were implemented. The findings for disease and pest incidence in different varieties under each inspection model were compared against two sets of tolerance levels: the FAO QDPM standards and slightly higher tolerance levels adapted to the “Marando Bora” project context. The technical, social and institutional implications for future inspection models are discussed.

In the first inspection cycle a total of 64 varietal plots were inspected, with 41 plots (64%) meeting the “Marando Bora” standards, and 25% meeting the FAO standards. In the second inspection cycle 65 varietal plots were inspected with 55% meeting the marando bora standards and 14% acceptable using the FAO standards. No sweetpotato leaf curl virus (SPLCV) or alternaria blight symptoms were observed during either inspection cycle. Signs of weevils and purpling on leaves were the main parameters which led to the failure to meet the FAO tolerance levels.

The costs of conducting QDPM inspections consist of initial start-up training costs and then operational costs related to site visits: staff time (for travel to the site and the actual inspection), transport, allowances, stationary and airtime. For both models the initial training costs depends on where the training is undertaken, difference in allowances for different categories of staff, and difference in transport costs. The cost of inspecting one site is an estimated $25.30 using the District based Plant Protection Officer (DPPO) compared to $10 when using the village based extension officer (VEO). As two inspection visits are recommended (one month after planting and two weeks before harvest); the total inspection cost per site is estimated at $50 and $20 for inspection by a DPO and VEO respectively.

Technical challenges and implications

The findings show that the quality of planting material as defined by the number of plots which met acceptable standards deteriorated between the first and second round of inspections. Using the “Marando Bora” tolerance levels 64% of plots inspected in the first round were acceptable
compared to 55% in the second round. However, there were considerable variations across varieties and multipliers. Polista (local WFSP) and Kabode (Uganda bred OFSP) consistently scored well in the inspections. There was no apparent pattern in terms of performance in different agro-ecologies.

The four DVMs that were inspected at all four inspection points have been able to maintain around 60% acceptable inspections, with Tunu DVM in Geita succeeding in meeting the FAO tolerance standards in the November 2012 inspection for three varieties. The two substitute DVM sites – which were inspected for the first time in November 2012 (Umoja and Jipe Moyo) appeared to have worse results than the other sites. While it should be cautioned, that as a case study approach, we cannot draw statistical significance from the data, one explanation is the process of inspection contributes to the improvement or at least maintenance in the quality of the material. The last inspection visit in November 2012 included untrained farmer multipliers, whose plots performed as well if not better than the trained multipliers. Two in particular had obtained vines from trained DVMs and multiplied them up, and in one case managing to improve the quality of material i.e. getting a better score than their source.

The implementation of the pilot inspection scheme showed that it is difficult to ensure that the same plot is inspected at both inspection points in the same cycle. The DVMs sequence the planting or replanting of their multiplication beds depending on: the emergent seasonal conditions, the growth characteristics of the variety and anticipated vine demand from customers. The DVMs may have shifted multiplication sites, or destroyed plots, and so this highlights the challenge during the two inspection visits to ensure that the inspection is conducted on the same bed, even when the bed is tagged at the first visit. So an improvement noted at the second visit, may be because a different bed is inspected. It is also difficult to ensure that the age of the material is standard across the two inspection visits. Thus the stage of growth will influence the results. Some DVMs are using conventional spacing to obtain both roots and vines, which in turn is reflected in the age of the plots which are inspected. This illustrates a trade-off in that to avoid pest and disease build-up it is better to plant beds or plots which are dedicated for vine production, and can be harvested after 2-3 months. Yet, in an uncertain market for vines, farmer multipliers want to spread their risk and plant for roots to ensure an additional source of income – although this then means that the planting material may be harvested at five to six months.

**Recommendation:** The introduction of low cost “net tunnel” technology at decentralised multiplier level to protect foundation material from insect vectors could play a key role in maintaining the quality of the material. The QDPM tolerance levels should be used as a learning tool with DVMs to show how the presence of pests and diseases affects the quality of planting material and the standard of planting material which they should be aiming for.

**Recommendation:** A challenge which is still to be addressed is how to verify the quantity of vines which is produced from a plot which has been inspected. This is important if a labelling system is used to signify that the planting material has been inspected and reaches a certain standard. At large-scale sites this may be possible if vines are harvested and packed in the presence of the person
mandated for inspection. However, at smaller sites, where one or two customers may come each day for a bundle of vines, this is not viable.

**Logistical and financial challenges and implications**

We have now been able to estimate the costs of inspection using an external inspection model (e.g. the DPPO) or the local extension office (e.g. VEO). The main recurrent cost elements are transport and allowances. Given the dispersed nature of the decentralised vine multiplication approach these cost elements are critical. While the increased yield and income benefit from using improved varieties and cleaned up planting material is more than sufficient to cover the cost of inspection; the data shows that when the cost of inspection is calculated as a percentage of the value of the planting material this ranges from 375% to 0.2% depending on the scale of the multiplication site and who conducts the inspection. Therefore it could be argued that physical inspection visits are only justified for larger sites. We have also seen that it is important from a technical perspective to conduct the inspection when the material is one month old and two weeks before harvest; however chronological age (i.e. days after planting) and physiological age may diverge due to differences in site agro-ecological and management conditions. Thus there is a logistical challenge to meet the technical requirements for inspection. This reinforces the argument to focus on fewer larger scale sites so that the site inspection visits can be timed in terms of the physiological age of material.

**Recommendation:** From cost, logistics and technical perspectives it is recommended to focus physical inspections at larger sites or sometimes what are called secondary multiplication sites and emphasise training of farmer multipliers in pest and disease management at smaller sites and ensuring sustainable linkages to the larger inspected sites from which fresh material can be sourced.

**Recommendation:** Analysis of the yield difference of using improved and cleaned up varieties shows that from a financial perspective there is an income benefit from using quality planting material and income benefit more than covers the cost of inspection. However, more study is needed to understand from the farmers’ perspective: whether the yield difference is sufficiently apparent that they are willing to purchase planting material; how “ordinary” planting material can be distinguished from “quality” planting material; and whether access to quality planting material is convenient. Moreover farmers need to be confident that there is a stable market for any increased root production resulting from the use of quality planting material.

**Institutional challenges and implications**

The Tanzania Official Seed Certification Institute (TOSCI) is the legal entity responsible for certifying the health and physiological state of seed. For seed for grain crops this responsibility is devolved to the DPPO who acts as a seed inspector. The results from this pilot of a community based sweetpotato QDPM scheme have shown that there is a high level of convergence when comparing the results of the team model (multiplier plus local extension agent) and the independent validation inspection and the results of the external inspections (district plant protection officer) with the independent validation inspections. Moreover, it would appear that there was little difference in the percentage of results confirmed by the validation inspection between the team inspection and the
external inspection. This implies that if training in varietal characteristics, the identification of pests and diseases, and sampling and reporting protocols is provided, the responsibility for conducting inspections for sweetpotato planting material could be delegated to a decentralised level. However, at this point the cost of conducting inspections across multiple dispersed small-scale sites is high when considered as a percentage of the value of the planting material. One option could be to inspect more than one crop during a field visit. However, this requires identifying those crops which have the same: multiplication cycle, ideal inspection window, and seed producers who are dealing in multiple crops.

**Recommendation:** it is recommended to focus physical inspection efforts at larger sites (e.g. “secondary multiplication sites” in a three tier seed system). These sites would need to show their source of their material e.g. pathogen tested plantlets, and that inspections are conducted to assess compliance with agreed tolerance levels for different parameters. In addition these sites would need to track and document the number of generations the current multiplication cycle was from the foundation generation. In turn, the dispersed and numerous decentralised vine multipliers would need to know how and how often to source material from the secondary sites. This emphasises the requirement for institutionalised linkages and communication flows across the different actors and tiers in the seed system.

Therefore the production of quality planting material requires a strategy which involves a combination of identifying farmers who are already experienced in sweetpotato production (both roots and vines), or are committed to developing this experience and who have access to suitable sites for multiplication, can be supported with appropriate training, technologies and on-going mentoring; and who have a market for their planting material. Demand creation campaigns for the benefits of quality planting material and awareness about the meaning of different labels are also needed targeted towards farmers and government and NGO extension staff. The use of standards or tolerance levels can act as a training tool and quality targets which multipliers can aim towards. However this process needs to be institutionalised to ensure strengthened linkages across the sweetpotato seed system and seed value chain. Stakeholder planning meetings should be conducted each season to forecast quantities and timing of seed required and strengthen coordination across the system.

2. **Support to implementation of sweetpotato QDPM inspection scheme in Ethiopia**
   a. Implementation of two workshops for researchers, Bureau of Agriculture, NGOs and multipliers on inspection of sweetpotato QDPM in Hawassa, Ethiopia
   b. Support to field pilot of guidelines and draft of sweetpotato QDPM inspection protocol for Ethiopia

**Findings**
In July 2012 a workshop had been conducted in Hawassa to introduce the QDPM approach and draft guidelines. The inputs contributed to the finalisation of the “Guidelines for the Production of Quality Declared Planting Materials of Sweetpotato, Ethiopia” (prepared by Dr. Dereje Gorfu, pathologist of the Ethiopian Institute for Agricultural Research (EIAR) at Holetta Research Centre, and Dr. Elias
Urage (National Sweetpotato and Root and Tuber Crop Coordinator) at Southern Agricultural Research Institute (SARI), Hawassa. A second workshop was conducted 13-14th November 2012 with 32 participants from research centres, Woreda Bureaus of Agriculture (BoA), NGOs and private sector multipliers.

The pilot of informal seed inspection system for sweetpotato vines was conducted by committee constituted at woreda level. Three inspection visits are proposed in the guidelines (1 month after planting; two weeks before harvest and a third at actual harvest and packing). The pilot was conducted for the second visit in the multiplication cycle (i.e. 2 weeks prior to harvest) at the multiplication sites for three commercial vine multipliers (~2 ha) supplying to FAO and INGOs. The committee included: seed agronomist, agronomist, input coordinator, (from the Woreda BoA), sweetpotato breeder, Hawassa Agriculture Research Centre (HARC). Three sites managed by private multipliers were inspected. In summary no site met the tolerance levels, and the recommendation was that the planting material was not acceptable for distribution. The problems identified during the inspections related to: presence of sweetpotato viruses, alternaria, sweetpotato butterfly and vectors. A number of challenges were noted during the inspection visits: lack of records for: source of planting material, rotation practice and date of planting; scattered fields and fields at different stages, making the inspections difficult and time consuming.

In 2014 the Federal Ministry of Agriculture established a “Potato and Sweetpotato QDPM Task Force” to take forward this process at the national level. Validation workshops will be conducted in each region and then a national workshop will draft the policy for the certification process for sweetpotato.

Recommendations: The chair of the Ethiopia Potato and Sweetpotato QDPM Task Force, the Commissioner for Plant Health MAAIF, Uganda, and the ASARECA Policy Analysis and Advocacy Programme Manager participated in the Tanzania national sweetpotato stakeholders meeting held in March 2014. All found the exchange of experiences extremely useful for the sweetpotato certification activities in their respective countries and sub-region. In both Ethiopia and Uganda the process of developing policy and operational guidelines for the certification of sweetpotato planting material is on-going. Opportunities to continue sharing experiences among different countries would benefit both national processes and contribute to ensuring harmonisation in standards and procedures across countries.

3. Literature review on sweetpotato seed systems and institutional arrangements
   a. Literature review on sweetpotato seed systems (in collaboration with CR- Roots Tubers and Bananas).
   b. Two sweetpotato seed system workshops held in Geita and Musoma Rural Districts, Tanzania to review institutional arrangements
Findings

Sweetpotato seed system development – goals and actors
The findings from this review, pointed to the highly contingent and emergent nature of sweetpotato seed systems in SSA. Therefore, any approach to model decision making needs to be complemented by a process orientated and participatory approach to be able to identify what mechanism might trigger a desired outcome and respond to local specificities. On the ground, this is related to understanding that the evolution of a sweetpotato seed system may not mirror western models of seed sector development, where the prime goal is to contribute to agricultural and national development. Depending on the local context the sweetpotato seed system may be responding to goals related to food security and nutrition, local entrepreneurship, or enhancement of social capital.

This means that there will be a wide range of and different types of configurations of conventional and non-conventional (e.g. health and education) sweetpotato seed system actors. Therefore varieties need to respond to different needs and market demand (farmers, rural and urban consumers, traders, processors and livestock fodder).

Recommendation: It is critical to ensure that more genetic material is flowing through the system and evaluated under different agro-ecological and socio-economic conditions. There is also the need to integrate the breeding and seed system as both have and will continue to need substantial public sector involvement. Returns on investment in public sector breeding can be increased through linking and designing the two together.

Seed production – planning for demand
Seed production opportunities are location specific in both a technical and economic sense due to the influence of environmental conditions on production costs, seed quality and market requirements. This needs to be considered in assessing the most appropriate organizational structure and the functional integration between the farmer based and formal seed systems for sweetpotato. The relative strength and importance of each will be context specific. Seed demand and seed needs are context and season specific, and a systematic but iterative planning process is needed which involves all stakeholders. The institutional linkages for sweetpotato seed systems are complex – crossing organizational mandates (research and extension); crossing administrative and geographical boundaries (district, AEZ, national). Organisational issues are normally dealt with at the individual multiplier or group level (organization of production, training, input source, marketing), and not necessarily at the seed system level.

Recommendation: Recognition of and effective linkages among the different actors from public, private, civil society in the seed system is essential for improved coordination, information flows and trust. However, due to the current low prioritisation of the crop there is often a lack of clear coordination roles and communication channels.
**Recommendation:** The financial and social sustainability of sweetpotato seed systems needs to be built upon a context specific analysis of: climatic and agro-ecological conditions and risks; pest and disease incidence; an understanding of existing farmer seed practices; strong links to farmer and market demand (varieties, quality, quantities and timing) for vines and roots; socio-economic and gender constraints analysis; and clear institutional arrangements to support coordination, information flow and linkages between different actors in the seed and root value chains.

4. **Drafting two papers for peer reviewed publications.** These papers are in preparation and are expected to be finalised by August/September 2014
   a. “*What is Quality - how is quality sweetpotato planting material made?*” This paper explores farmers’ and multipliers’ practices and perceptions of “quality” planting material through observations and semi-structured interviews to throw light on how sweetpotato farmers and multipliers characterise their choice of planting material for their root crop and, or for further multiplication. This describes how farmers produce planting material and manage its quality through a series of choices and interactions around the: source of planting material, means for maintaining it, multiplication technique and seasonal conditions. The paper then turns to study what practices around the selection and multiplication of planting material change in the hands of trained decentralised vine multipliers. The paper contributes to a discussion on processes around skilling and de-skilling when a task becomes specialised as improved agricultural technologies are introduced.
   b. “*The Social Life of Vouchers - Re-shaping Sweetpotato Seed systems in Lake Zone, Tanzania?*” The paper argues that social-technical interactions underlay the configuration of a seed system and that the use of a voucher based distribution system superimposed on existing social relations acted to catalyse different interactions among the actors and components of the seed system, changing behaviours and influencing intermediate outcomes. The paper concludes with the argument that through social interactions the vouchers became part of the material manifestation of the seed system and acted as a mechanism to coordinate the seed system. The paper is a contribution to re conceptualising how voucher based distribution systems work in practice, and how they influence the social technical configuration of a seed system.

**Margaret McEwan, Nairobi, May 2014.**