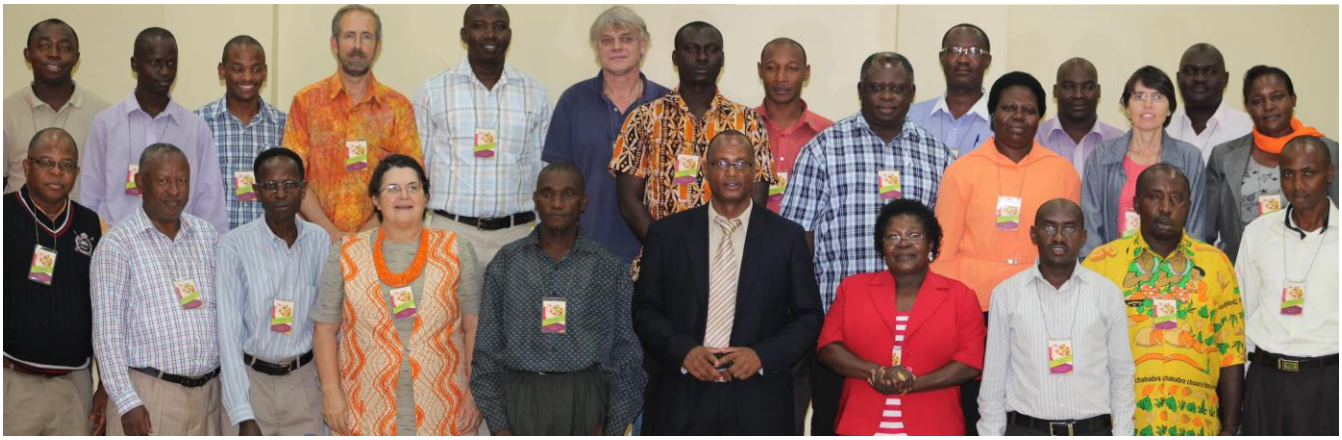
Report of the Eleventh Sweetpotato Breeders' Meeting held at Hotel Chez Lando, Kigali, Rwanda, April 22-26, 2013



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A INTRODUCTION AND OBJECTIVES

The 2013 annual sweetpotato breeders' meeting was held at Hotel Chez Lando, Kigali, Rwanda, April 22-26, 2013. This was the 11th meeting since 2003 and fifth since the start of the Sweetpotato Action for Security and Health in Africa project in 2009. Participants arrived on the 22nd, the same day interviews were conducted at the same hotel for selecting a replacement for the Assistant Sweetpotato Breeder, Dr. Silver Tumwegamire, who had left CIP in March 2013, to join the International Institute of Tropical Agriculture in Dar es Salaam. The sweetpotato community of practice and the International Potato Center (CIP) thank Silver for the great service rendered for the benefit of the poor in Sub-Saharan Africa and beyond. Silver worked with CIP for eleven years, and he contributed to the success of various sweetpotato projects on the continent.

Dr. Jim Lorenzen, Senior Program Officer at the Bill and Melinda Gates Foundation and Dr. Craig Yencho of North Carolina State University, USA, Technical Advisor for the SASHA project sent their regrets for being unable to attend to the meeting due to other commitments.

The Director General of the Rwanda Agriculture Board (RAB), Dr. Jean Jacque Mbonigaba Muhinda, opened the meeting. He highlighted the role of Agriculture and the increasing importance of sweetpotato in the region, particularly when the potential of the crop is exploited by value addition. The opening event was covered by the national television channel of Rwanda, TV10.

The objectives of the meeting in Kigali were:

a) Update participants on the Sweetpotato Potato for Profit and Health Initiative (SPHI)
b) Provide country reports to inform participants on:
    1) National sweetpotato breeding objectives
    2) Important sweetpotato landraces
    3) Types of trials conducted during 2012/2013 (crossing blocks, seedling nursery, observation, preliminary, advanced, and on-farm)
    4) Number of varieties released since 2009 to 2013
    5) Number of candidate sweetpotato clones in pipeline for variety release
    6) Supported sweetpotato breeding projects, funding source, amount, duration
    7) Number of scientists and technicians
    8) Constraints
    9) Proposed future activities
c) Update participants on progress on the Sweetpotato Support Platform activities
d) Provide input to graduate students' theses
e) CloneSelector training
f) Discuss Variety release/ clean-up of recent releases and promising clones, use of weather data, and breeding community of practice.

This report can be accessed at http://www.sweetpotatoknowledge.org/

B PRESENTATIONS

1. Update on Sweetpotato for Profit and Health Initiative (SPHI) – Jan Low

Highlights on 3.5 years of implementation of Sweetpotato Action for Security and Health in Africa (SASHA) were presented as part of the update on Sweetpotato for Profit and Health Initiative (SPHI). It was recalled that that SASHA Project is a 5 year project led by the International Potato Center that aims at developing the essential capacities, products and methods to reposition sweetpotato in the food economies of Sub-Saharan Africa and that the project serves as the foundation for the broader initiative under SPHI. SPHI is a multi-partner, multi-donor initiative that seeks to reduce child undernutrition and improve smallholder incomes in 10 million African families by 2020 through the effective production and expanded use of sweetpotato.

Under SASHA programs have been developed to address a variety of constraints identified including:

1) Lack of timely availability of adequate quantities of disease-free planting material
2) Varieties with limited yield potential in specific agro-ecologies and quality characteristics that do not meet demands of specific target groups
3) Damage due to the sweetpotato weevils in drier zones
4) Limited demand and inadequate market
5) Poor agronomic practices
6) Limited awareness of decision makers about potential contribution of the crop
7) Need for a critical mass of informed stakeholders with good information exchange to maximize investment return

The major programs developed under SASHA include: population development and varietal selection; weevil resistant sweetpotato using transgenics; seed systems; delivery systems (proof-of-concept); and management and sweetpotato support platforms. The descriptions and achievements of work done under the programs are summarized as follows:

a) Breeding and variety development

Work under this component seeks to generate a radically expanded range of sweetpotato varieties that combine different quality characteristics with significant improvements in yielding ability. To do this the focus is on **generation of populations** that would meet the dominant needs of the users across the target area including increased dry matter content in the newly developed varieties for all the regions. In the East and Central Africa region 130 parents are being used to improve populations for virus-resistance, orange-flesh, dual purpose for animal feed. For the Southern Africa region 56 parents are being used to improve populations for drought tolerance and orange flesh. The populations for West Africa are being improved for non-sweetness and orange and white flesh. The work done under this program also incorporates the partnerships of national sweetpotato programs in Uganda, Mozambique and Ghana.

A second part of the work done under this component has been the **redesign of sweetpotato breeding systems in Africa** to produce varieties in fewer years (3-4) than currently (7-8 years) through "accelerated breeding'' scheme. Through this redesigned system 15 new OFSP that are more drought tolerant were released in February 2011 in Mozambique. New sweetpotato varieties have also been released in Rwanda and Malawi through this scheme.

Under this component additional breeding methods have also been tackled including a demonstration that hybrid vigor (heterosis) exists for root and foliage leaf weight. Work with heterotic gene pools resulted in hybrid populations with a mean root yield increase of 22.9% (on a dry matter basis) and 7.8% increase in biomass production. Potential of further yield jumps were demonstrated by selecting the best "hybrid family parents'' which were shown to yield up to 100% more root yield on a dry matter basis and 85% more biomass production. The development of these second hybrid populations is now underway in Uganda, Mozambique and Peru.

b) **Management and Sweetpotato Support Platforms (SSP)**

The focus of SSP is to organize the work around research for development platforms that integrate and support the work of institutional partners in each sub-region. The objectives SSP are to:

- provide technical backstopping with a special emphasis on Alliance for a Green Revolution (AGRA) supported national breeding programs and PhD training programs (ACCI and WACCI)
- assure clean germplasm exchange
- assure gender-sensitive design and implementation
- assure comparable data collection between countries engaged in the breeding and germplasm exchange
- facilitate information exchange

Through these sweetpotato support platforms (SSPs) the sweetpotat breeder (SP) breeder community of practice has been strengthened through activities including, the annual SP breeders' meetings in which 15 countries across SSA have participated; development and sharing of standard protocols for collecting data for SP breeding; and development of CloneSelector software to ease data entry and analysis for breeding trials.

In the sub-regionsSSPs have held meetings every six months to facilitate information exchange and training on various issues including, communication skills, seed systems and gender.

At each platform, quality laboratories with clean up capacity have been established and equipped with Near Infrared Spectrometer to facilitate rapid assessment of major macro and micronutrients. Screenhouses which are essential for maintaining stocks of disease free vines as primary foundation material have also been constructed.

Infrastructure and service on germplasm exchange has also been improved with the establishment of a new propagation house (with temperature control capabilities), a storage facility, and construction of three new greenhouses, rehabilitation of 10 glasshouses and a tissue culture lab.

A key goal for the SSPs is to implement ISO 17025-like standards with partners at the SSPs in Kenya, Mozambique and Ghana by Oct 2013 by continuing to: distribute clean, identity-verified sweetpotato germplasm designated under FAO and transferred via the Standard Material Transfer Agreement (SMTA) and through continued training and visitation by relevant resource people from CIP-HQ, and within the region on issues including, pathogen-testing, tissue culture procedures, and bar-coding technology for improved information systems.

Another area that has also been a major focus is the development of weevil resistant sweetpotatoes through the use of Bt genes from the soil bacterium *Bacillus thuringiensis*. The work under this area

which is being undertaken in partnership with NaCRRI, Universities of Jomo Kenyatta, Valencia, Ghent University, Puerto Rico and Danforth Plant Science Center, is placing heavy emphasis on the training of African biotechnologists (3 PhDs and several technicians). While there had been success in the transformation of several African sweetpotato varieties, roots with the gene construct did not kill the weevils but now events with new gene constructs have been developed and will be tested in 2013/14

Another area in which there is a major focus is seed systems research that seeks to establish demand-led cost-effective seed systems for the dissemination of new varieties and high quality planting material. Work under this area is being conducted in partnership with NRI, FERA, MARI, LZARDI, KARI, CRI, NaCRRI and Makerere University. Under this area strategies for the multiplication and dissemination of sweetpotato varieties are being developed and tested. Additional efforts are also focused on the development of field level diagnostic kits for virus detection. Some of the key outputs in the form of innovations that have been developed include, the Triple S System which is basically an improvement on an existing practice to help farmers in areas with a prolonged dry season access vines at the beginning of the rains through the storage of roots which are later sprouted and planted out to produce vines. The second innovation from the work done under this area is the development of net tunnels which protect vines under propagation against virus transmitting insect vectors. These net tunnels have been found to be economically feasible and can be maintained for up to 33 months producing large quantities of vines.

During the period, dissemination work on Marando Bora (better vines) was completed. Marando Bora, working with 8 Implementing Partners (Catholic Relief Services, LZARDI, MARI, Helen Keller Intl, 7 local NGOs) has covered 16 districts and an accumulative total of 112,000 households (74% of the original target; 76% women) received vines over three dissemination seasons. Many lessons have learnt from this project and which will shape future thinking on going-to-scale with vines including the training and use decentralized vine multipliers (DVMs) to multiply and distribute vines, and provide technical support to neighboring farmers (~10-12 km) targeted through a voucher system. Lessons were also learnt on the better adapted SP varieties and the need for farmers to evaluate new varieties for longer periods before going to scale. Also noted was the need to establish demo plots before embarking on seed multiplication.

The other major focus was on Proof-of-Concept Projects (PoCPs). The main objectives of these projects were to understand the entry points in the value chain to improve market efficiency or diversify use especially for women, and to design and test scalable approaches for improving food-based nutrition programs based on OFSP to combat vitamin A deficiency. Two major studies undertaken were on: Mama SASHA (Agriculture-Health Proof-of-Concept Project) and Rwanda Super Foods (Sweetpotato Value Chain Project). Also undertaken were two smaller efforts: sweetpotato as an animal feed for dairy cows and pigs and potential for sweetpotato processed projects in Nigeria. The work undertaken under the Mama SHASHA project engaged partners including, PATH (an International Health NGO) and two national NGOs and sought to answer the questions: Does integration of an OFSP agricultural-nutritional intervention into health service delivery for pregnant women and their children <2 years old lead to higher increases in consumption of OFSP and other vitamin A rich foods than existing primary health services and varietal access alone? Can linking an agricultural intervention and nutritional training to existing health services provide an incentive to pregnant women to increase health service utilization? The achievements from the implementation of this project include baseline study conducted among 968 pregnant women and 1,918 mother-child pairs; operations research conducted at the end of one year of

full implementation; eight intervention and eight control health facilities have been established with 4654 pair vouchers distributed by December 2012 of which 72% were redeemed.

Under the Rwanda Super Foods project that brings RAB, SINA Enterprises (private sector), CRS, Imbaragga, YWCA as partners, the questions being addressed include whether: the development of a value chain based on a sweetpotato processed product help re-position white and orange-fleshed sweetpotato and their products in the urban consumer market; men and women farmers will have increased income through accessing high value sweetpotato markets and benefit through access to high quality planting material; and benefits differ between contracts with individual farmers and access through farmer group membership. Under this project two models are being tested: in Model 1 contracted individual farmers are linked directly to processors while in Model 2 farmer groups with collective and individual SP plots are linked to processors. Some of the outcomes of the implementation of this project included multiplication of 3000-4000 plantlets every month by RAB. The hardened clean plants were distributed to contracted groups resulting in increased yields.

A study on SP marketing opportunities in Nigeria was also undertaken and a stakeholders meeting held in Abuja in July 2012.

Work has also been conducted in collaboration with East African Dairy Development Project, ILRI, University of Nairobi, and Farmer's Choice to identify the appropriate adapted dual purpose and forage SP varieties for specific agro-ecologies; determine the most appropriate low-cost combination of SP vines/roots with other available feedstuffs in SP silage; and to model and test feeding strategies based on optimizing SP combined with other feed resources in pigs. The work done under this area has had a strong capacity building component resulting in the training of four MSc students and a technological innovation known as improved silage tubing for SP.

Monitoring and evaluation

To ensure that SASHA is on track, SASHA management team meetings have been held every quarter, senior management team meetings to review mid-term and annual progress reports have been held biannually, annual technical and executive steering committee meetings are held around September. Quarterly milestone and expenditure reviews have revealed that out of 180 milestones: 51% were achieved; 18% on track; 16% behind.

Gender mainstreaming

SASHA has also been kept on track by mainstreaming gender. This comes from the project's commitment to gender analysis, with a focus on ensuring that women in particular benefit from interventions, given that women are: key players in sweetpotato production systems in SSA; responsible for the nutritional well-being of their families; at risk of being excluded from market opportunities; and also at risk of micronutrient deficiencies, especially when pregnant or lactating. Work in this area has been conducted in partnership with Hellen Keller International (specialist seconded to SASHA). Specific project actions taken in this area include: conducting gender variables in baseline/endline surveys and monitoring tools; setting targets for number of women benefitting in delivery system projects; conducting training on learning to use a gender lens; gender situation analysis tool; and also conducting a special study on gender and vines in Tanzania.

"Partnership Health Check-up" self assessment

With a focus on SPHI delivery system components with multiple partners from different organizational and disciplinary cultures, a review of partnership processes and not letter of understanding (LoU) compliance issues has been conducted. To do this a rapid check-list (19 items) was developed to assess perceptions around "key elements of success" using Liekert Scale (1-5). Responses were solicited through an e-mail invitation to all partners (including CIP) to participate, with option for confidentiality. The results from this assessment were aggregated for discussion during annual meetings where issues raised were brought to table in a neutral way for discussion and action points identified.

Knowledge sharing

The knowledge generated from implementation of activities and research in this program has been shared through various platforms including the sweetpotato knowledge portal (www.sweetpotatoknowledge.org), and associated project annual meetings.

The Sweetpotato for Profit and Health Initiative (SPHI) has a goal of enhancing the lives of 10 million African households by 2020. The initiative has 17 priority countries in three sub-regions. Currently 12 of the target countries have some activities on-going under this project. Through visits and meetings awareness about this work is increasing.

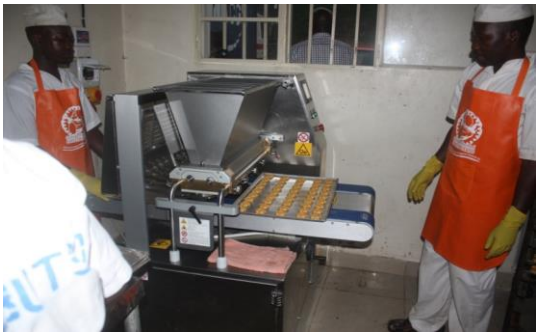


Fig. 1. SINA Enterprise is collaborating with partners to develop high quality sweetpotato-based processed products and value chains in Rwanda.

Fig. 2. Participants at the 2013 breeders meeting looking at net tunnels designed to protect sweetpotato from disease in a farmer's field in Rwanda

2. COUNTRY AND REGIONAL SUPPORT PLATFORM REPORTS

2.1 South Africa: update of sweetpotato breeding – Sunette Laurie

The objectives of the sweetpotato (SP) breeding program in South Africa is to develop and release SP varieties which are sweet tasting, high in beta-carotene, high dry matter, high yielding, good storage root quality, and with resistance to Alternaria blight, and virus diseases and drought tolerance.

Among the important landraces in the country are A2392, A35, Tshakuma 2, Maggi, A2118, A5799, A29, Carrot, A46, Lobed, Manguzi, Purple and A2910. The important varieties in the country are Blesbok, Beauregard, Ndou, Bophelo, Impilo, 199062.1, Monate, Resisto, A40, and W-119.

During 2012/13 , there are 13 parents in the crossing blocks. Hybridization in the breeding program is achieved through the polycrosses and controlled crosses. Plans are also underway to employ mutation breeding approach.

In the seedling nursery, 5885 seeds from 53 families were planted, 4399 successfully stabled.. Observation trials were conducted in 1 location in which 70 clones were planted, 10 of which are checks. Preliminary trials with 63 clones (seven of them checks) were planted at one location.. No intermediate trials were underway at the time of reporting but the plan was that these would be conducted at three locations this year. Sixteen clones together with seven checks had been planted at three locations as part of advanced yield trials. At the time of reporting three on-farm trials were underway in the country. They have released 13 varieties since 2003 and have four varieties lined for release by October 2013.

Among the projects undertaken by the SP program in the country include:

a) Demonstration agronomy of OFSP – National Department of Science and Technology (2010-2013)
b) Collaboration with rural-based universities – National Department of Science and Technology (2010-2013)
c) On-farm trials in Gauteng – Provincial Department of Agriculture and Rural Development (2011-2012)
d) Mutation breeding – International Atomic Energy Agency (2009-2013)
e) Agro-processing strategy for sweetpotato – National Treasury (2012-2014)

The program is supported by three Scientists (PhDs), one MSc, five technicians together with four MSc students. There is also an agro-processing component that is supported by two researchers, two technicians, an economist and an artisan. Five peer-reviewed papers have been published by the program over the last two years.

The program plans to do on farm yield trials, mutation breeding and agroprocessing. Their breeding is constrained by stringent intellectual property regimes limiting germplasm exchange and acquisition of royalties from variety releases and slow procurement process.

2.2 Progress on sweetpotato breeding in Ghana – Kwadwo Adofo

The objective of the breeding program in Ghana is to develop an release sweetpotato (SP) varieties that are less sweet, high in dry matter, high beta carotene, and resistant to weevils and viruses.

For the SP trials during the 2012/13 period, there are 48 parents in the crossing blocks under SASHA and nine for the national program. A total of 5864 seeds from six families had been collected from the open pollinated crosses in the national program. From the national and SASHA programs respectively, 3938 and 3763 seeds were collected from controlled crosses made among 30 and 359 families. A total of 2647 seeds from 176 families had been planted in the seedling nursery with 2262 successfully establishing. In introductory trials seven clones and two checks were planted at four locations while 12 clones and two checks in advanced trials were were planted in five locations. Four clones and three checks were planted in four locations as part of varietal trials. Twelve on-farm trials in two provinces were in progress at the time of reporting. While there was no variety lined up for release in 2013, four varieties (mainly introductions from other programs) had been released through the program.

The program which has two core scientists, two technician and seven collaborators has additional funding from the second phase of the West African Agricultural Productivity Project (WAAPP) and the Government of Ghana. The program is limited by funding needed to support staffing and development of irrigation infrastructure. In future, the program plans to collect sweetpotato, hybridize landraces with improved lines and do intensive promotion of released varieties.

2.3 Sweetpotato Support Platform for East and Central Africa – Robert Mwanga

The objectives of this platform are to generate/breed new populations using new methods and develop varieties to feed into the national breeding programs. The aim is to generate a radically expanded range of sweetpotato varieties that combine different quality traits with significant improvements in yielding ability. Another objective is also to generate by population improvement new populations that address the major needs of users in the region including, sweetpotato virus disease (SPVD) resistance for the East Africa region, nutritional traits (including high beta-carotene) and release of dual purpose varieties.

The platform is also working on the development and application of new breeding techniques for sweetpotato improvement such as heterosis and the use of molecular markers for screening virus resistance. The platform has also focused on the redesigning of the sweetpotato breeding scheme by reducing the usual 8-10 years breeding cycle to 3-4 years (accelerated breeding scheme). Under the accelerated breeding scheme new breeding lines are multiplied in screenhouses, glasshouses and irrigated fields and then planted at more sites at earlier stages in the breeding cycle to substitute for fewer sites over more seasons. In a heterosis study following up the work done at CIP/Lima, Peru, two gene pools distinguished by molecular marker characterization have been established in separate crossing blocks in Uganda and crosses are being made between parental genotypes in the two gene pools at NaCRRI.

To develop populations for the SPVD and quality traits, two distinct genepools (Population Uganda A and Pop Ug B) were formed using molecular markers (18 SSR markers). Controlled crossing (inter- and

intra-gene-pool) for population improvement and polycross crossing were undertaken. To further contribute to the goal of identifying new sources of SPVD resistant populations, evaluation of new sources of SPVD resistant populations is done under high SPVD pressure at Namulonge, Uganda. To do this 1,410 sweetpotato genotypes (47 families from a diallel cross), true seed from CIP, Lima were germinated in screenhouse at Namulonge. The plants were grown in the field for 3 seasons, 3 locations – Namulonge (Central), Kachwekano (Western), Serere (Eastern Uganda). NASPOT 11 was planted at all the sites as a resistant check. The plants are evaluated for SPVD at two months after planting and also two weeks before harvest. As part of the methods for evaluating new sources of SPVD resistance, real time PCR is used to quantify viruses (SPFMV and SPCSV) in sweetpotato clones. Promising clones with resistance (Acc 24.7 which has low virus titers and no manifestation of sysmptoms) or tolerance (Acc 21.4, and 23.11 which even though have considerable virus titers manifest less symptoms) have been identified.

Work at the platform has also focused on providing support to the program's collaboration with AGRA to support national sweetpotato improvement programs. Under this arrangement, projects from Malawi, Rwanda, Tanzania, Kenya, Nigeria, Zambia and Mozambique have been supported by AGRA. An additional project from Ghana has been approved but currently needs a breeder. A proposal from Uganda has also been submitted and is currently waiting for approval. An additional proposal from Kenya was rejected while another submitted from Ethiopia was not supported because the government in Ethiopia needed support to cover a national support.

An additional activity undertaken entailed collection of data and pictures for all new released orange-fleshed sweetpoatto (OFSP) varieties since 2009 for the purpose of updating the OFSP catalogue. Data was collected from Mozambique (15 varieties), Rwanda (2), Malawi (4), Tanzania (2) and Uganda (2).

The challenges at the platform included the delays in the procurement system, especially for the national programs delaying the progress of work, changing of breeders in the platform in the national programs and at CIP, the need to follow up on the improvement and use of CloneSelector program.

2.4 Progress and Plans at the Sweetpotato Support Platform for West Africa – Ted Carey

The SP support platform in West Africa is focused on breeding of SP and facilitating exchange of seed/planting materials among the participating partners, and platform partnerships for R4D and impact. The platform provides support to SPHI target countries in West Africa including Ghana, Nigeria, Burkina Faso, and Benin.

Breeding

Objectives under the breeding component are to undertake SP population improvement at a sub-regional level and also link with participatory varietal selection at the national level. The selection sites are located where sweetpotato is important.

- The platform has established a crossing block in Ghana. The breeding focuses on: a) Population improvement at a sub-regional level, and Linking with participatory varietal selection at the national level. Other constraints in the region are drought, weevil, SPVD, and low soil fertility. Having adopted the accelerated breeding scheme, the platform conducts research at four sites

in the five major sweetpotato agroecological zones in Ghana. Consumer preference is also given high priority through consumer participation in the selection of the varieties. The platform has established a NIRs platform currently used for nutrient analysis (minerals, sugars and β-carotene) by partner countries. Other attributes the clones are selected for, include commercial yield, dry matter, foliage yield, flesh color, reduced sweetness and taste. Recently the platform acquired a bar coding equipment that staff are being trained to use for easing data collection and management.

Activities in the program are also focused on capacity building with several students undertaking research for advanced degree programs.

Seed system research program

The objective of this program is to establish a regional platform for safe and efficient exchange and maintenance of germplasm. This is done through improved indexing, virus cleaning, in vitro maintenance and genetic fingerprinting. The aim is to establish an ISO 17025-compliant germplasm indexing and distribution capacity. The target was to put in place a regional germplasm distribution for the SSP-WA by October 2013.

Currently there is demand for OFSP planting materials from RAC and FRI. There are also opportunities with school feeding programs. Decentralized multiplication/dissemination of OFSP is also currently being undertake with 25000 vines distributed to multipliers in five regions. Cleanup of released varieties is also on-going.

Value chains

A regional value chain assessment supported by BMGF was undertaken. Among the findings established were that sweetpotato is an increasingly important cash crop in Ghana, Nigeria and Burkina Faso. It was recommended that there is need to strengthen fresh market linkages, target school feeding programs and animal feed potential.

2.5 Sweetpotato breeding activities for 2012 at the NRCRI Umudike, Nigeria

The main objective of this program is the development of new sweetpotato varieties that satisfy the agronomic, processing and nutritional requirements of various end users. The specific objectives are:

- Develop OFSP populations through OP and controlled crosses;
- Evaluate promising progenies at various yield trial stages for yield, SPVD resistance, dry matter and carotenoid content;
- Conduct on-farm trials with farmers for enhanced selection process and varietal adoption;
- Select and release new OFSP and WFSP varieties.

The important landraces in the country are Ex-igmariam, Atsak pupu, Mutter milk, Dan Zaria, Landrace5 and Landrace6.

A crossing block with 15 parents has been established. A total of 3179 seeds have been collected from open pollinated crosses from 15 families, and 520 seeds have been collected from controlled crosses

arising from eight families. Of the harvested seed 2514 have planted in a nursery out of which 1541 seedlings have established for a total of 10 families.

During the period reported observational trials were established at two sites where 521 clones together with two checks were planted. Preliminary trials in which 140 clones were planted were established at three locations. Advanced yield trials with 15 clones were also undertaken at seven locations. A total of 48 on-farm trials were undertaken in seven states in the country. The program has so far released two varieties with another three lined up for release by October 2013.

The program in the country is supported by seven scientists (two breeders, an entomologist, weed scientist, food scientist, agronomist and entomologist). There are also two technicians in the program.

The program faces several constraints including:

- Lack of funds for breeding activities outside AGRA
- Lack of technical know-how and equipment for effective high throughput beta-carotene and sugar determination and SPVD phenotyping
- Lack of infrastructure to support irrigation for dry season nursery activities.

The program plans to conduct on-farm evaluation of advanced breeding lines, preliminary and advanced trials of promising breeding lines and MET trials of elite lines for yield stability.

2.6 Rwanda Sweetpotato Breeding progress – Jean Ndirigwe

The overall objective of the SP breeding program in Rwanda is to develop varieties which are high yielding, high in quality (high dry matter and beta carotene), resistant to pests and diseases, with wide adaptation and with dual application (roots and feed). The work is conducted at three sites across the country. The strategy deployed has involved:
Collection, evaluation and selection from local germplasm; introduction of promising genotypes from other countries/ NACCRI and evaluating them; and development of new varieties using ABS, more parents, more controlled crosses and a rapid selection scheme with farmer participation.

During the 2012/13 period, the program had a crossing block with 30 parents. A total of 1100 seeds from open pollinated crosses representing 60 families had been collected. An additional 250 seeds from controlled crosses representing 60 families had also been collected. During the period observational trials with 5380 clones had also been established at three locations. Preliminary trials with 25 clones had similarly been established at three locations. Advanced screening trials with 52 clones had also been established. A total of 29 on-farm trials were also conducted across the country. During the period eight varieties including two OFSP were released.

The program in the country has five scientists (two breeders, one entomologist, one food scientist and one agronomist). There are also two extensionists and a technician working in the program.

Among the challenges the program currently faces include manifestation of SPVD on new WFSP/OFSP varieties coupled with a lack of capacity to test for viruses in planting materials for the newly released varieties.

For the future the program plans to introduce/develop new SP varieties with a focus on virus resistance. The focus will also be on cleaning, rapid multiplication and dissemination of released varieties

2.7 Participatory sweetpotato improvement, Tanzania (Lake and Eastern Zones) – Kiddo Mtunda

The objectives of the SP program in the country are to:

1) Improve and maintain sweetpotato germplasm by evaluating advanced sweetpotato lines/promising clones that are in uptake pathways and in pipeline for release and also to generate new sweetpotato genotypes including OFSP;
2) Improve access to sweetpotato planting materials through mass multiplication of vines, tissue culture technology and virus testing;
3) Promote value addition of sweetpotato through processing and product diversification technologies, utilization and access to markets
4) Improve capacity of the national program staff

Among the most important landraces in the Lake and Eastern zones of the country are Simama, Juhudi/Jitihada, Ploista, Ejumula, NASPOT1, Ukerewe, Berena, Kakamega, Sekondari, Mbuta, Shangazi, Carrot Dar and Simama.

During the 2012/13 period crossing blocks with a total of 41 parents were maintained in both the lake and eastern zones of the country. A total of 27610 open pollinated seeds representing a total of 47 families were collected from the crossing blocks. A total of 5456 seeds from controlled crosses representing 32 families were also collected. Of the seed collected, 12000 seeds were planted in a seedling nursery with 7589 seedlings representing 72 families established. An observational trial with 250 clones was also established. A total of 36 clones were established in advanced screening trials at two locations. On-farm trials planted with clones were established at 10 locations. The program had lined five clones for release by October 2013.

The program is supported by funding from AGRA and the government of Tanzania (Commission for Science and Technology) to the tune of 250,000 USD over a three year period. Twelve scientists and six technicians are involved in the program.

The constraints experienced include: unreliable rainfall, prevalence of pests and diseases and shortage of clean virus-free planting materials.

The activities the program plans to undertake in future include:

1) Breeding for specific traits, including high dry matter, drought tolerance, disease and pest resistance
2) Multiplication and dissemination of planting materials
3) Sweetpotato value addition (Processing andutilization)

2.8 Sweetpotato improvement in Ethiopia – Elias Urage

Ethiopia, a large country with diverse agroecolgies has SP grown on approximately 81,000 ha. Among the challenges faced in the production of the crop include: low yields – only 9 t/ha is attained on-farm compared to 25-36 t/ha on-station. Sweetpotato virus disease and sweetpotato weevil are the major pests

The sources of germplasm that have been used in sweetpotato improvement include: CIP, IITA, AVRDC and local collections.

Currently the SP program in the country is in the process of establishing own crossing blocks with the aim of developing high yielding and stable, drought tolerant, disease and pest resistant/tolerant varieties with acceptable quality.

At the time of reporting, a crossing block with 24 parents had just been established. An observation trial of 1700 WFSP and OFSP clones including seven checks was also established at one location. Participatory variety evaluation of 10 SP varieties (5 OFSP) was conducted at 10 locations. Screening for drought tolerance, SPVD and adaptation was conducted at two, one and seven locations, respectively.

The program is also undertaking activities on seed multiplication and dissemination and SP utilization.

2.9 Development of high yielding multiple resistant sweetpotato germplasm in Uganda – G Ssemakula

The SP program in Uganda is aimed at improving food security, human health and reducing poverty through increased farm incomes. This is done through: the development and deployment of high yielding, pest resistant and adaptable sweetpotato varieties that meet consumer and market demands; integrated pest and disease management packages; agronomic packages for optimal yields and high quality and quantity planting materials and whenever needed. To further contribute to improved human health OFSP varieties are promoted among the developed varieties.

The important SP landraces in the country are Nylon, Magabali, Araka, Silk, Otada, Dimbuka, Osapat and Tanzania.

During the 2012/13 period, the program had established a crossing block with 28 parents from which >20,000 open pollinated seed representing 25 families had been collected. Forty two families had been established in a seedling nursery at one location. Preliminary trials with 47 clones were established at three locations. Advanced yield trials with nine clones were also established at four sites. Seventy five on-farm trials were conducted across the country.

Since 2007 the program has released six varieties, none of which was released during the 2012/13 period but some two clones were lined up for release by October 2013.

The program is supported by various sources of funding, including McKnight, HarvetsPlus and SASHA. There are 4.5 scientists and six technicians working in the program.

The program faces constraints including

- Poor communication and lack of supporting budgets
- Unreliable electricity supplies interrupting activities and communication
- Limited funding
- Climate change

As part of future activities the program proposes to focus on activities, including gene introgression, population screening, on-farm testing, promotional activities, foundation and breeder seed production.

2.10 Progress of sweetpotato breeding in Malawi - Felistus Chipungu

The national sweetpotato breeding program in Malawi is mandated to develop varieties that:

1) Give high and stable yields (≥20t/ha) per unit area and time
2) Are resistant/tolerant to major and prevalent diseases (SPVD and Alternaria) and sweetpotato weevil (SPW) in Malawi
3) Give desired root quality color (white, cream, yellow, orange) to meet local cooking and consumption requirements (high dry matter content, sweetness)
4) Wide and specific adaptability to environmental conditions and cropping systems
5) Contribute to vitamin A source

The important landraces in Malawi are Zondeni, Yoyera, Kamchiputu, Babache, Mfumu, and landraces 6, 7, 8, 9 and 10.

The program established a crossing block with 36 parents from which 38000 open pollinated seed representing 36 families were collected. From controlled crosses, 1200 seeds representing 21 families had been collected. Of the seed collected, 8900 were planted with 8000 representing 30 families successfully establishing. Five hundred clones were established at two locations as part of observation trials. Fifty eight clones were established at three locations as part of preliminary yield trials. For advanced yield trials, eight clones were planted at five locations.

During the 2012/13 period 56 on-farm trials were conducted across the country.

Since 2011 the program has released seven varieties and is planning to release another three by December 2013.

Funding from the program has come from AGRA and the Malawian government. The program has six scientists and 12 technicians across the country.

Among the constraints the program is facing are:

1) SPVD, Alternaria blight and sweetpotato weevil prevalence
2) Drought and prolonged dry spells
3) Staffing- too many crops to handle

As part of the future plans, the program is proposing to intensify breeding for specific environments.

2.11 Breeding and promotion of sweetpotato genotypes for consumer preferred traits in time and space in Zambia – Martin Chiona

The objective s of the program in Zambia are:

1) To develop and select high yielding sweetpotato varieties with consumer preferences including high dry matter and beta-carotene content
2) To develop and select high yielding disease resistant clones that are preferred by consumers
3) To develop and select high yielding vegetable clones for consumers
4) To improve the skills of farmers, research and extension staff and stakeholders in the production, seed multiplication and plant protection of sweetpotato.

The important landraces in the country include: Matembele. L2-20/5, Carrot, L4-138/3, Zimbabwe and Unknown 2/1.

The program has established a crossing block with 42 parents. A total of 16190 seeds previously harvested from the crossing blocks were planted in a seedling nursery with 9740 seedlings representing 122 families successfully establishing. Twenty three clones were planted at two locations as part of advanced yield trials. Forty five on-farm trials were also conducted across the country. Five clones are lined up for release by October 2013.

The program is currently supported by AGRA and GRZ and has five scientists and four technicians.

The program faces challenges including lack of laboratory facilities for quantifying quality traits and virus index and cleaning.

2.12 Progress on sweetpotato breeding in Mozambique – Jose Ricardo *presented by Maria Andrade*

The objectives of the SP breeding program in Mozambique are

- To breed sweetpotato (SP) tolerant to drought with good levels of beta-carotene and good culinary qualities
- To test**/**evaluate, select, release and disseminate improved drought tolerant SP varieties for farmers in drought prone areas of Mozambique

Some of the important SP landraces in the country are: Xipone, Xitsekele, Mwamazambane, Nhacutse4, Canassumana, Cincominutos, Ligodo, Manhissane, Xiadlaxakau and Chulamete. The Program uses these 10 popular landraces for their population improvement along with a number of introductions. These landraces are also commonly used as checks in the yield trials. The main traits they breed for are drought tolerance, SPVD resistance, and high dry matter content. In 2009, the program established a crossing block of 38 parents. Two crossing blocks were established in 2011 with 56 parents each in collaboration with SASHA Southern Africa platform. During the 2012/13 period the crossing block had 112 parents.

From 2010, the program has passed clones from seedling nurseries to advanced yield trials. For the 2012/13 period 119,758 open pollinated seeds representing 116 families were harvested. Another 32226 seeds representing 352 families were harvested from cross pollainated crosses. Of the harvested seed 19500 were planted with 16575 representing 42 families establishing successfully. During the same period 5912 clones were established at three sites as observation trials. The program has not released a variety yet but have 96 clones in pipeline for release. For preliminary, advanced and multi-location trials, 891, 509 and 108 clones were planted. The program has not released a variety yet but have 96 clones in pipeline for release by October 2013. The main support for this program comes from SASHA and AGRA. The major constraints they plan to address in the coming seasons are drought, floods and supplies.

2.13 Sweetpotato Support Platform for Southern Africa – Maria Andrade

The objective of the platform is to develop orange-fleshed sweetpotato (OFSP) populations for drought-prone areas in Southern Africa. The activities of the Southern Africa sweetpotato platform concentrate mainly on developing breeding populations of OFSP for drought prone areas and quality characteristics. The breeding work is done at four sites in Mozambique. The sites are: Angonia, Chokwe, Umbeluzi and Gurue. These sites differ in altitude and annual rainfall totals. The platform has also adopted the accelerated breeding scheme in which temporal variation has been replaced by spatial variation.
Major achievements for work undertaken through the platform include: the release the of the first 15 OFSP drought tolerant varieties bred using an accelerated breeding scheme (ABS) in February 2011 after evaluation in 430 trials. This work was initiated in 2006 with funding from AGRA, USAID and HarvestPlus (prior to SASHA). Other major achievements for the platform include:

- Two genetically separate populations developed with new drought screening techniques
- First recurrent selection cycle for drought stress adaptation in two independent controlled cross populations in Mozambique by an ABS achieved in 2011
- Drought adapted population disseminated as true seed (Half-sib) to NARS breeding programs from 12 SSA countries (5,000 seeds each) in June 2011

In 2012, 96 advanced clones were selected from several AYT for multi-location trials and on-farm to be planted in April and December 2013 for varietal release in 2014.

In the 2012/13 period, seedlings of 8669 clones from two independent populations (from a crossing block with 56 parents) were established in Gurue and Maputo/Chokwe of which 4987 were placed in observational trials. There were also 32560 controlled cross seeds and 123,370 open pollinated seeds in storage awaiting distribution in 2013. During the same period, 25 trials were harvested and 1066 samples processed and analyzed by NIRS.

A tissue culture laboratory for the production of clean planting material has been established by the platform. In 2012 93 SP genotypes (8993 plants) were multiplied in the laboratory with 44 genotypes (3959 plantlets) produced as virus free plantlets. The platform has also been involved in cleaning up of SP varieties for other countries in the region. For instance of 9 varieties submitted from Zambia in June 2010, five had been successfully cleaned up. Another four varieties received from Malawi were successfully cleaned up in 2012.

The platform has also conducted training of 1021 individuals (588 males and 431 females) drawn from 67 organizations in Mozambique and Zambia. Stakeholders have been trained in clean seed production, breeding and agroprocessing.

During the 2011/2012 a total of 92 hectares were planted with vines and benefited 114880 families.

The platform is also undertaking a study aimed at understanding G X E interactions in drought prone environments. Specifically the study seeks to:

1) To determine G x E interactions – especially G x E interactions – for yield and the quality trait (root dry matter) in drought prone environments with unstable rainfall
2) To obtain information about adaptation patterns and to identify genotypes adapted to drought prone environments
3) To determine associations among yield under drought stress levels and among yield stability and harvest index stability parameters
4) To assess index selection options to enhance the chances of right selection decisions under drought stress conditions.

The study was undertaken during the dry season at selected sites in Mozambique. Fifty eight clones comprising 37 FV farmers from Mozambique, 3 FV from other EA countries, 18 Breeding lines or MV were tested under irrigated versus non irrigated (IRR) treatments. It was found out that:

- Some sweetpotato genotypes exhibited elevated yields at both IRR and not IRR conditions
- Sweetpotato clones are extremely different in harvest index stability and it merits further studies to estimate the heritability of harvest index stability
- Harvest index stability is highly correlated with storage root yield GxE and storage root stability parameters
- The response to selection in drought stress environments was not large, whereas the response to selection in “no-stress” environment was significant

In summary the SSP which has been involved in information exchange, training/capacity building and knowledge management has learnt that:

a) Partnerships is a key aspect of the project
b) Proper communication skills are needed
c) Capacity building throughout is a must in all aspects, tissue culture (TC), capacity on the anagement aspect of the TC lab, quality laboratory
d) Knowledge in the seed system is very important for good dissemination strategy
e) Supplies and machine repair is challenging
f) Transportation of samples by plane from far away site is a challenge

The activities undertaken through this platform are implemented in collaboration with other partners, including networks, universities, IIAM, organizations on multiplication, dissemination, agro-processing and market related activities. The individuals and affiliated institutions together with organizations involved include: Jose Ricardo (IIAM), Felistus Chipungu(Malawi), Britta (CIP Angola), Martin Chiona (Zambia), Jean Marc (Madagascar), Sunette (South Africa), Private sector, Individual Farmers, Farmers Associations, Helen Keller, Government Extension, Ministry of Health and Ministry of Education.

2.14 Mitigating negative drought effects on sweetpotato productivity through tolerant cultivars in Kenya - Benjamin Kivuva

Drought is a major constraint to sweetpotato production in Kenya and hence the need to develop drought tolerant varieties to help increase productivity. This challenge has formed the basis of the current project whose objectives include:

1) Determination of sweetpotato production constraints in farmers' fields, as well as the determination of sweetpotato farmers' trait preferences;
2) Evaluation of drought tolerant cultivars for adaption to Kenya's agro-ecologies;
3) Studies of the gene action controlling drought tolerance in sweetpotato.

To achieve these three objectives, 600 questionnaires were administered on sweetpotato farmers, and a focus group discussion was also used. Field evaluations were conducted, and a diallel mating design used to recombine parents.

Highlights of key findings:

- No significant difference was observed between yield levels under stress and non-stress environments
- Moisture stress introduced at 3 months after planting did not affect root and biomass yield relative to optimum environment.
- 23 OFSP drought tolerant promising lines identified for further evaluation.
- For genetic studies, general (GCA) and specific (SCA) combining abilities will be determined, and the ratio GCA/SCA will be used to determine gene action.

2.15 Evaluation of dual purpose sweetpotato cultivars for root and fodder yield in eastern province of Rwanda - Remy Niyireba

In Rwanda the demand for livestock products is increasing at the rate of 20% per annum but the per capita capacity to keep cattle has been declining by > 4 animals per year. In response to this scenario, the government and people of Rwanda have opted for intensification of production; using high biomass food-feed crops to provide technically feasible; environmentally sustainable and socially acceptable options for food nutrition and income security in poor households. Government has begun the policy of intensification of livestock production, so there is the need to enhance the system by increasing choice of feed materials. Sweet potato has been chosen because Rwanda is a major SP growing country.

The goal of the project is to increase the contribution of sweetpotato to household food, nutrition and income security in Rwanda. The purpose is to identify dual purpose sweet potato cultivars for root-for-food (R4-Food) and vine-for-feed(V4-Feed) production in Rwanda. The specific objectives of the study are:

1) To determine the effect of cutting regimes on DM yield of selected sweetpotato cultivars
2) To determine effects of cutting management on promising dual purpose sweetpotato cultivars in nutritional characteristic of the roots and vines
3) To enrich the national feed database with dual purpose sweetpotato as an important item in the national feed resource inventory

Cultivars used : 8 - Kwezikumwe, Naspot 1, Mugande, Kakamega, Cacaerpedo, 2002-155, 2002-154, 2000-040. The study is being undertaken in three districts of Rwanda covering six divisions (Nyagatare,

Nyabitekeri, Kangarazi, Kibondo, Gazibo and Rwamagama. The locations differ in climate and production systems.

The design of the experiment is a split-plot with cultivars as the main plot and cutting management as the sub-plot replicates. This was replicated three times per farm. Three farms were planted per district.

Highlights of key findings:

1) Most of the cultivars are dual purpose: 3 cultivars produced more roots than foliage; 4 cultivars had more foliage than roots; 1 cultivar very good for both.
2) Root yield was generally low due to climate related stresses and less optimal quality of the vines used.
3) Ratooning doubled vine yield without affecting root yield in a significant way.
4) Crude protein among the cultivars ranged between 19.1-20.4%.

This study is done with the support of CIP (SASHA), RAB, University of Nairobi, EADD, and dairy cooperative members.

2.16 Adaptation and genetic analysis for earliness and yield of yam bean in Rwanda - Jean Ndirigwe

Yam bean which is a legume has potential root yield of up to 145 t/ha. The roots are edible and have protein content as high as 18% and are also rich in nutrients such as iron, zinc and calcium. There are three closely related cultivated yam bean species: *Pachyrhizus tuberosus, P. erosus and P. ahipa.* Rwanda is one of the countries in East and Central Africa where the crop has recently been introduced. The current study is being undertaken to fill current research gaps on lack of genetic control of maturity and also to shed light on inheritance for earliness and root yield in yam bean (YB) progenies.

The overall objective of the study is to establish the stability of root yield and collect the pre-breeding information on gene action for earliness and heritability of root yield of yam bean. The specific objectives of the study are:

1) Evaluate YB accessions for adaptation to different agro-ecological zones in Rwanda
2) Determine inheritance of earliness and its components in yam bean
3) Determine heritability of root yield and its components in yam bean

The study is being carried at three locations: High, mid and low altitude using nine accessions of *P. ahipa*. The accessions are being evaluated for fresh storage root and dry matter yield

Result highlights:

1) Nine cultivars were evaluated for yield performance.
2) Yield range was between 5.13 and 73.19 t/ha.
3) Genetic inheritance study for earliness and yield – still on-going: GCA, SCA, GCV, PCV, H_N will be calculated. Three accessions each of *P. ahipa* and *P tuberosum* are being used in the study.

2.17 Discussion on variety release/ clean up of recent releases and promising clones - Ted Carey (Moderator)

This presentation was preceded by a brief presentation highlighting key issue for consideration on the issue of germplasm exchange followed by a discussion session in which responses were made to specific questions raised by the participants. The issues highlighted were:

- The need to exchange germplasm to improve breeding efficiency and impact
- Regulatory environment regarding germplasm exchange. This focused on quarantine/phytosanitary issues and also on intellectual property matters
- That germplasm exchange requires systematic record-keeping/information sharing
- That germplasm exchange requires money and interest. For effective germplasm sharing, the interest must come from the breeders themselves. Seeds can be got from anywhere; the breeder initiates the process.

During the discussion the need to exchange genetic materials more at the West Africa sub-region as observed in the East and Southern Africa sub-regions was pointed out. It was also pointed out that germplasm could be exchanged at any stage in the breeding process. There would be no need to pay royalty but some amount would need to be paid when products from the shared germplasm are commercialized. It was also observed that there was need to strengthen the SSP-WA for germplasm cleaning for exchange at the sub-regional platforms to reduce losses of plants and plant vigor currently experienced during transfer of materials over long distances to/from Nairobi. Transfer of true seeds is preferable since it is easier to move around and is free of viruses. It is important that phytosanitory requirements are followed to the letter to prevent the introduction of alien viruses and diseases into new agricultural environments.

2.18 CloneSelector update – Luka Wanjohi

CloneSelector 3.0 is a tool developed to help plant breeders carry out field trials, analyze the results and make selection decisions. The tool has been developed and availed to aid in design and analysis of RCBD, Augmented block and Alpha (0,1). It also has capacity for handling G x E implementation for RCBD designs. Use of the tool would help in reducing the common errors that normally happen in data entry.

The software is OpenSource and is supported by International Potato Center under SASHA project. It is available for download at http://sweetpotatoknowledge.org/germplasm/research-methods/cloneselector3-0

In the 2013/2014 period the aim is to further optimize the tool to handle routine for automatic import of NIR's data and Alpha and Augmented block designs. The tool will also be installed and users trained in over 10 countries.

So far installation and training has been carried out in Kenya, Uganda, Tanzania, Ethiopia, Rwanda, Malawi, Zambia, Ghana, Angola, Sierra Leone, Benin and Nigeria. Approximately 40 new sweetpotato trials were entered into CloneSelector during the various trainings.

Users have also given a feedback on the need to include some new results for RCBD analysis: genotype and error mean squares and also the inclusion of a selection index for single location trials.

Going forward, a way to share breeding data is needed. A foundation that could be built upon to achieve this is standardized data entered into CloneSelector and stored in an online server.

It is desirable that all breeding platforms use the full complements of CloneSelector to enable a shift from the current situation where different breeding platforms use the tool for different things eg randomization, data collection, data analysis. The tool could also be used in the generation of barcodes that could be used in field trials, labeling of samples and planting materials.

2.19 Screening, yield evaluation and drought tolerance indices of orange-fleshed sweetpotato (*Ipomoea batatas Lam*) hybrid genotypes – Sammy Agili

Drought is one of the major constraints to the promotion of OFSP. The overall objective of the reported study was to identify through selection, high yielding, drought tolerant OFSP genotypes. The specific objectives were

1) Screen and select OFSP genotypes for drought tolerance
2) Multi-location screening for OFSP genotypes with high nutrition and drought tolerance
3) Selection for high yielding OFSP genotypes in drought conditions
4) Identify morpho-physiological traits responsible for drought tolerance in SP

The germplasm used in the study consisted of 59 genotypes from CIP. These genotypes had contrasting beta-carotene and mineral content levels.

In the first experiment, OFSP genotypes for drought tolerance were screened *in vitro* using polyethylene glycol to identify at early stages of development those OFSP genotypes that are either drought tolerant or susceptible. Ten genotypes were identified through this experiment as drought tolerant: 194515.5, 194539.36, 441724, 441538, 189135.9, 401055, 441768,192033.5, 440027 and 440429. All showed higher leaf expansion, higher stem length elongation, high root and shoot growth and high dry matter production at high PEG concentration level.

In the second experiment, rapid field screening and selection of OFSP genotypes having drought tolerance potential and high β-carotene was undertaken with the aim of identifying from a set of 59 genotypes, 10-20 promising drought tolerant OFSP genotypes that could be advanced for further evaluation, testing and selection. Two checks: - drought susceptible - K566632 and drought tolerant – Marooko were used. The study was undertaken at a dry site in KARI-Kiboko and supplemental irrigation was done to enable the genotypes to establish well before the evaluation commenced. The research highlights from this study were:

- Dark orange to orange genotypes recorded high number of roots compared to the cream to white-fleshed genotypes.
- Total root yield ranged from 7.43 to 45.83 t/ha.
- 47.5% of the genotypes screened had a dry matter content of 25%; 25.4% had dry matter content below 20% and 27.1% of the genotypes screened had dry matter content greater than 30% that was above that of Resisto and Ejumula.

In the third experiment, the identified potential drought tolerant genotypes were evaluated at multiple field sites with the aim of selecting for high yielding OFSP genotypes under drought prone conditions. Eighteen (18) genotypes were tested at two locations against 2 local checks: Marooko (drought tolerant) and K566632 (drought susceptible). All plants were irrigated for the initial four weeks and thereafter a subset of the plants was left exposed to drought conditions for the purpose of evaluating their performance. Among the genotypes tested, entries 420014 and 440286 were found to have good performance and high drought tolerance at both sites.

In experiment four the adaptation of OFSP genotypes under moisture stress conditions was evaluated under glasshouse conditions.

Outcomes of the study:

Genotypes 420014, 440287, 421066, 194573.9, 192033.3, 187017.1, 441724 and 189135 were found to have high values for beta-carotene in addition to having higher storage root yields and were also observed to be tolerant to drought stress conditions.

The best six genotypes, namely, 420014, 440286, 440287, 189135.9, 194549.6 and 441725 were submitted for national performance trials in 5 sites in Kenya.

2.20 Breeding at CIP headquarters – Wolfgang Grüneberg

The breeding work at CIP headquarters has focused on a number of areas including:

Modification of the general breeding scheme to the **accelerated breeding scheme** (ABS) for clonally propagated crops. Through this work the breeding cycle of sweetpotato has been reduced from seven to four years.

The **development of new OFSP type that is high in dry matter**, high starch and less sweet. The development of the dry and starchy OFSP (Type III) is making use of the accelerated breeding scheme to develop dry and starchy OFSP varieties for high sweetpotato virus pressure zones of Uganda and other countries of East Africa. These varieties are being additionally developed for drought tolerance targeting drought prone areas of Mozambique and Southern Africa. The work done in this area has resulted in the release of 26 new OFSP varieties in Peru, Uganda and Mozambique.

The focus is also on selection of parents for the purpose of **exploiting heterosis**. Heterosis in sweetpotato has been demonstrated for dry matter storage root yield. The strategy has been to fix heterosis exploitation by establishing two gene pools. The heterosis experiment has provided "good" information of parent – offspring correlations in sweetpotato. The current steps in heterosis research include: generation of seed from eight parents in genepool A with eight parents of genepool B in a diallel (inter-genepool crossing) and corresponding intra-genepool crosses which is basically the comparison of means of intra-genepool versus inter-genepool crosses in Uganda (2 locations and 2 reps in a design similar to heterosis experiment in Peru. Seed obtained from Uganda (8x8) will be used to conduct similar

experiments in Mozambique under drought stress. In Peru, selection of parents on basis of offspring performance in heterosis experiment (16 PZ and 20 PJ parents) and intra-genepool crosses to select parents for the next heterosis experiment has been done. By selection and crossing response to selection will be determined after genepool sub-division and one step of reciprocal recurrent selection leading to new OFSP hybrid population H1 with wide adaptation together with new OFSP hybrid (H2), non-sweet and new OFSP hybrid population (H2), high in Fe and Zn. Effort is also being made in Peru,also focusjng on sub-division of East Asian sweetpotato genepool.

Other effort is focused on understanding the genetic gains associated with **polycrosses versus controlled crosses**. To do this a set of Mega-clones (22 clones) has been recombined in a polycross nursery (P1 and P4) and in two controlled crossing designs: A partial diallel (P2) and a factorial crossing design (P3) . Multiplication and first selection in polycross population P1 "simulating" applied polycross breeding was completed. Field trials have been completed in Satipo and in the field in La Molina, Peru. Further field trials will be conducted in 2013 at the same sites.

Work has also been undertaken to develop resistance to SPVD. Clone VJ08.330 was found to be resistant to SPCSV. The progenies derived from the clone compared favorably with SPCSV-clean materials in virus titre values.

2.21 Sweetpotato breeder's survey 2013: preliminary results - Margaret McEwan *Presented by* Jan Low

There were 21 respondents to the survey. Of these respondents categorization was as follows: 67% NARIs, 5% University, 24% CGIAR (CIP) and 5% other. By fields of expertise, 86% were breeders and 10% agronomists. By gender, 76% were male and 24% female. By age, 48% were 35-49 years old; 33% were 50 years and above while 19% were under 35 years.

All the respondents considered themselves to be members of the community of practice. On the question of communication frequency, with other members of the sub-regional SP platform on professional issues (by email, phone, and visits), 39% communicated rarely, 22% communicated on a monthly basis and 39% communicated on a weekly basis. On the question of visits made to or received from other countries as a part of the SP platform activities, 82% had made a visit to another country's breeding program with Mozambique, Kenya, Peru, Uganda cited more frequently. Another 67% received a visit from colleagues in another program mainly from Mozambique, Tanzania, Kenya and Uganda.

Eighty five percent had signed up for membership with the Sweetpotato Knowledge Portal (SPK) but 65% rarely used the portal and another 25% used it monthly, 10% on a weekly basis and none used it on a daily basis. The main reasons given for low usage included poor internet connectivity and the fact that the site does not have all the information about sweetpotato.

With respect to participation in SASHA technical meetings since 2009, 37% had attended more than 5, 26% attended 3-5 meetings, 26% attended 1-2 meetings, while 11% had not attended any meeting.

On trainings received on the CloneSelector, 67.7% rated the training as very good, 11.1% as good, 5.6% as very low while to 16.7% the question was not applicable. For the breeder's course held in 2012 in

Belgium, 66.7% rated the training as very good, 13.3% as good, and 20% as question was not applicable. All responded that they had shared new skills and knowledge gained through the SSP with others. The knowledge sharing was through: shared resource materials (100%); one-to-one briefing (94%); presentation to group (88%) and replicated training (60%).

On the question of the need for continued or additional training in other areas in which interest for additional/continued training, the intensity of interest from the 21 respondents is summarized in the following Table 1.

Table 1. Respondents' proposed areas where more training is desired.

Area for training	**No of respondents with interest**
a) Interpretation of GxE analysis	3
b) Setting up experiments that have unbalanced genotypes. What designs are appropriate for these kind of experiments and how to analyze them	4
c) Use of GGE Biplot analysis in CloneSelector; using to analyze taste data	5
d) POST HARVEST	7
e) Data management/analysis	8
f) Procedure for making the variety descriptors	9
g) Leadership course	11
h) Effective phenotyping of SPVD	13
i) Use of the Knowledge portal	4
j) Field plot techniques for our technicians for us to reduce the sources of variation in our trials	4
k) Intellectual Property and Plant variety protection	6
l) Consideration of agronomic traits (fertilizer, irrigation)	8
m) Gender mainstreaming	11
n) Application of marker-assisted selection in sweetpotato breeding programs	13

On germplasm exchange, 57% had received botanical seed, and 52% had received SP germplasm as part of support platform. Various suggestions were made on how to make SP germplasm exchange more useful or efficient. These are listed in the following box:

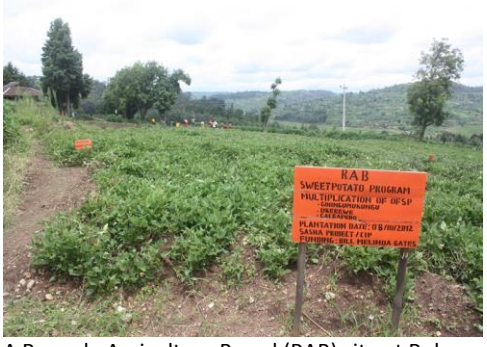
Box 1. Points raised on how to make SP germplasm exchange more useful or efficient

1) The need to strengthen the following procedures for exchange of germplasm among countries: Import permits, transfer agreements, and issuing of phytosanitary certificates
2) Policy issues on benefit sharing among countries within regions need to be streamlined to allow easy germplasm exchange
3) Capacity to eliminate viruses from vines need to be built up to avoid sharing viruses.
4) It is good for breeders who receive germplasm and seed to give feedback on performance of germplasm
5) Stringent phytosanitary regulations make germplasm movement difficult
6) Germplasm exchange needs to be an integral part of work plans for SSPs

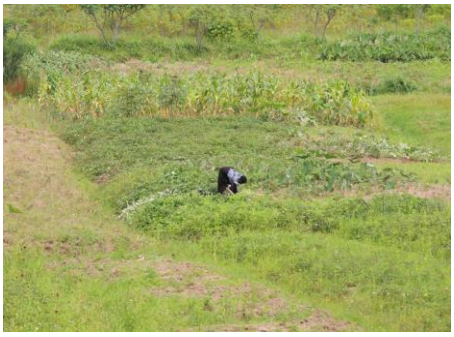
7) Sub-regional exchange of materials is recommended since the generation of botanical seed is not common in most of the sweetpotato growing areas.
8) Important to observe MTA for future acknowledgement or inclusion of the donor in IPR benefits
9) Broaden breeding objectives and share seeds with other countries
10) Received OFSP varieties used in our breeding program; sent OFSP materials to Senegal (USAID) and Mali (IER) and Cote d'Ivoire (HKI) for OFSP promotion and research
11) Sharing of information about availability of germplasm that can be shared, in what form (seed, vine cuttings, in-vitro materials) and requirements for sharing
12) Availing information on line for partners on available germplasm; giving passport information for the same to help partners make right choice of what

With respect to financial support and publishing, 33% had submitted proposals to at least one donor since 2009; 40% had received AGRA grant (one before 2009). Among 11 who responded, 7 (64%) said their national research program received funds from other sources for their SP program since 2009. Of the respondents polled, 76% had published articles on sp research and development since 2009 and 71% presented posters on sp research and development since 2009.

The importance of proposal development and funding opportunities, technical backstopping visits, Web-based Sweetpotato Knowledge Portal, short-term training, germplasm exchange, general networking opportunities, physical meetings focusing on specific topics and long term training of MSc and PhDs as part of sweetpotato support platform activities were rated as being of high to very high importance by 89-95% of the respondents.



A Rwanda Agriculture Board (RAB) site at Rubona for multiplication of OFSP varieties developed and disseminated under the SASHA project.


A smallholder farm in Rwanda with a mixture of crops. The OFSP varieties targeted for integration into these systems have to offer farmers competitive advantage with respect to adaptation, yield, nutritional quality, and appeal to consumers.

Annex 1: Evaluation of Speed Breeders Meeting held in Kigali, Rwanda, April 22-26, 2013

The sweetpotato Speed Breeders held in Kigali was good to very good for quality of presentations, usefulness of Sweetpotato Knowledge Portal, CloneSelector and the field trip. About 70% of the participants indicated they need additional training in CloneSelector. A summary of the evaluation responses is given below (Annex 1) followed by general comments by participants.

Sex	Sample 25 participants	6 females (24%), 19 males (76%)
Is this the first time you have been to a Sweetpotato Breeders Meeting?	1-Yes, 2-No	7 participants (28% first time)
1. Did the meeting meet your expectations?	1-Not at all 2-Somewhat 3-Most 4-Completely	Range 3-4, mean 3.36, 12 (46%) participants scored 4
2. How would you rate the quality of the meeting in terms of content?	1-Very poor 2-Poor 3- Alright 4-Good 5-Very good	Range 4-5, 12 participants (46% scored 5)
3. Overall, how would you rate the quality of the different presentations?	1-Very poor 2-Poor 3- Alright 4-Good 5-Very good	Range 4-5, 4 participants (16% scored 5)
4. At the end of the meeting, how would you rank your abilities to use CloneSelector?	1-Basic 2-Intermediate (can do all the steps with the manual by my side) 3-Good (can do all the steps by myself) 4-Excellent (could train others)	Range 1-4, Mean (24 participants) 2.75, 3/24 (12.5% scored 1, 4/24 (16.7%) scored 4
5. After you return to your station, do you see your breeding program adopting CloneSelector for its multi-location trials?	1- Yes, completely 2-In some cases, have rules that we must follow using a different system 3-No	18/22 (81.8%) said yes, 1/22 said no
6. Do you need additional training for you and your staff on CloneSelector?	1-Yes 2-No	15/22(68%) said Yes
7. Do you think the Sweetpotato Knowledge Portal will be useful in your work?	1-Yes and I will definitely contribute 2-Yes but I may not contribute (time constraints, connectivity problems) 3- No	23/25 (92%) said 1 Yes; 2/25 said 2 Yes in some cases
8. Was the field day useful, in terms of helping you to better implement your breeding and seed system programs?	1- Not useful, time would have been better spent doing something else 2- Somewhat useful 3-Alright 4- Useful 5-Extremely useful	13/24 (54%) said 5 extremely useful; 10/24 (4.2%) said 4, useful.
9. How would you rate the meeting in terms of organization (logistics, communication)	1-Very poor 2-Poor 3- Alright 4-Good 5-Very good	14/25 (56%) said 5 very good, 11/25(44%) said 4 good

Annex 1 (cont)

Evaluation Form for Sweetpotato *Speed* Breeders Meeting 22-26 April 2013

10. Please list the 3 things in the meeting that were most useful to you
1. Updated what different countries were doing 2. Drought related presentations/breeding for drought tolerance 3. Involvement of the Director General in opening ceremony, media event and field day 4. On-farm data analysis in CloneSelector 5. Field day/visit to SINA– to see progress on the ground 6. To meet again with old colleagues and link up with new ones/ meet African SP breeders 7. Introduction to SASHA project and progress reports from CIP/Hqs, platforms and national programs 8. Collaboration 9. Introduction to CloneSelector/CloneSelector application/ Review 10. Use of statistical tools in data analysis 10. Important information on sweetpotato breeding 11. Germplasm exchange 12. Hybrid vigor in sweetpotato 13. Managing large quantities of clones in accelerated breeding 14. To see the sweetpotato value chain 15. Add value of OFSP 16 Setup of on-farm trials using split plot arrangement 17. The right lay out of split plot design 18. Processing sweetpotato (40%) in biscuits 19. Presentations of findings from research work 20. Health breaks 21. Use if standard reporting template for various reports 22. Yam bean presentation 23. Chance to discuss challenges with other professionals 24. Information sharing about germplasm and AGRA funding opportunity 25 Presentation on animal feed 26. Use of CloneSelector guidance for presentations 27. Student presentations 28. The presentations as a service of on the Sweetpotato Knowledge Portal 29. Visit to Rwanda 30. Discussions of improving shared capacity
11. Please list 2 areas in which you would like to see improvement, either in content or organization
1. More data interpretation exercises 2. More time for presentation of new research findings 3. More time for practical on CloneSelector 4.Field trip should have started earlier 5. Presentation scope 6. Make it compulsory for all SP breeders to attend breeders meeting 7. All the presentations should be available to breeders in soft copy 8. Accelerated breeding scheme made clearer 9. Powerpoint presentation need improvement (font used too small) 10. Time management (presentations) 11. How can we use efficiently weather data? 12. Use of CloneSelector in analysis of on-farm trials

13. Use of video so that everyone has at least one after the meeting
14. Practice on augmented and alpha-lattice (0,1)
15. Progress reports by countries
16. Setting goals together on the way forward
17. Current development in sweetpotato in the world should be seen in the meeting
18. Future prospects of sweetpotato for different utilization, e.g. biofuel
19. Harmonizing protocols among breeders
20. Public address system should be improved on
21. Time for presentation can be increased by 3 minutes/ some presentations had no question time
22. Coffee is in little rooms
23. Field tour to include farmers' fields
24. Search for more concurrency of meetings
25. Country reports should not be over-restricted to template
26. Visits should not be too far from the meeting site

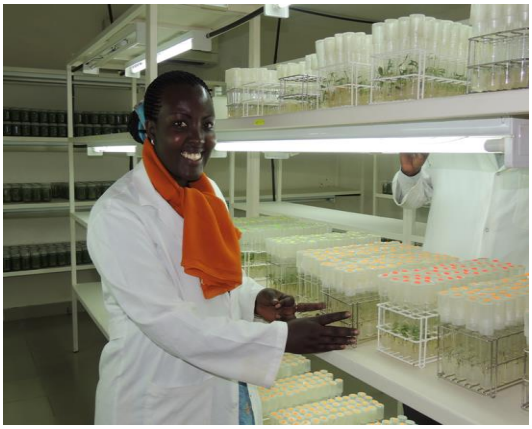
12. **Please list any topics you would like to see covered in next year's meeting that were missing in this year's meeting**

1. Have people bring things to load on Sweetpotato Knowledge Portal
2. Consider joint meeting with cassava breeders
3. GGE (genotype by genotype environment) biplot analysis
4. Modern sweetpotato breeding
5. Technology transfer to end users
6. More on statistical analysis tools, experimental designs
7. Breeding drought tolerant sweetpotato
8. Breeding of sweetpotato at CIP-Peru
9. CloneSelector should be used as suggested in the meeting
10. Progress reports from countries
11. A section of the meeting for recent progress/ findings on the sweetpotato knowledge portal
12. Use of weather data
13. Include other related interesting topics other than breeding
14. Include value chain topics in the breeding meeting
15. CloneSelector always needs revision/new features of CloneSelector
16. Include more on seed systems in breeding
17. Virus elimination and keeping material clean to enhance quality vine production
18. More emphasis on accelerated breeding process
19. Review protocol for on-farm implementation
20. Data scoring to ensure standardization

13. Any other comments on how to strengthen the sweetpotato breeding community of practice?

1. Consider adding in e.g. dinner/cocktail to next year's meeting, to allow people to interact outside the meeting venue
2. Need for commitment on information exchange
3. I liked it
4. Exposition on intellectual property and breeders rights
5. Prepare and distribute a simplified guide to use CloneSelector
6. Consider and integrate students doing studies on breeding of SP specifically in Africa
7. Sweepotot Breeders meeting is a Community of Practice, members should support the meeting by honoring the invitation to attend
8. Strengthen germplasm exchange and virus cleaning
9. Emphasize on data management and data analysis

10. Alpha (0,1) design training practice
11. Use of more IT skills/software
12. Members should make use of procedures/protocols, e.g. on-farm trial protocol, and CloneSelector
13. Need organized Annual Breeders Meeting in Kigali, Rwanda
14. If possible, someone from outside Africa who is working on sweetpotato breeding to share new ideas on SP breeding (e.g. molecular, mutation)
15. Exchange visits
16. Content of organization was o.k.
17. Rotation of breeding meetings across community of practice across regions
18. South Africa feels little bit left out in terms of backstopping
19. Improved interaction, e.g. once in a while share data to analysis using CloneSelector and discuss results
20. Need some field plot technique training for our technicians in country
21. Keep on supporting breeders by ensuring maximum interaction, so that we are strengthened and become more capable
22. Sweetpotato breeders awards given annually
23. Regular follow up emails on some set goals (questions/otherwise)



A tissue culture laboratory (left) at Rubona in Rwanda where clean OFSP varieties are being multiplied before further multiplication in screenhouse (right) and field for dissemination to the farming communities.

Jean Ndirigue (right, in orange shirt) and his colleagues did an excellent job in organizing and hosting the breeders meeting in Rwanda. Right, participants at Rubona in front of Rwanda Agriculture Board (RAB) Building administrative building at Rubona.

Annex 2: List of participants

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Annex 3: Agenda

	Activity	**Responsible**
22 Mon	Arrival	Jean Ndirigwe
23 Tues	Arrival and Meeting Preparations	Jean Ndirigwe
8:00-8:30 am	Registration	Martha Ameru
8:30-9:00 am	Welcome remarks/Self introductions	J. Ndirigwe/ Robert Mwanga
9:15-9:45 am	Opening Address	RAB
9:45-10:15 am	Update on Sweetpotato for Profit and Health Initiative (SPHI)	Jan Low
10:15-11:00 am	Health Break and Group photo	Jean Ndirigwe/Sammy Agili
	Chair: Felistus Chipungu/ Country Reports	Note taking, Benard Yada
11:00-11:15 am	Ethiopia	Elias Urage
11:15-11:30 am	Ghana	Adofo Kwado
11:30-12:00	Sweetpotato Support Platform, E. Africa	Robert Mwanga
12:00-12:15 pm	Sweetpotato Support Platform, W. Africa	Ted Carey
12:15-12:45 pm	Discussion	
12:45-2:00 pm	Lunch break	
	Chair: Maria Andrade	Note taking, Ted Carey
2:00-2:15 pm	Nigeria	Solomon Afuape
2:15-2:30 pm	Rwanda	Jean Ndirigwe
2:30-2:45 pm	Tanzania	Kiddo Mtunda
3:00 – 3:15 pm	South Africa	Sunette Laurie
3:15-3:30 pm	Uganda	Gorrettie Ssemakula
3:30-4:00 pm	Health break	
	Chair: Gorrettie Ssemakula	Note taking, Benjamin Kivuva
4:00-4:15 pm	Malawi	Felistus Chipungu
4:15-4:30 pm	Zambia	Martin Chiona
4:30-5:00 pm	General Discussion	

24 Wed	Field Trip Day	Jean Ndirigwe, Robert Mwanga
	Chair : Laure Sunette	Note taking, Benard Yada
8:00-8:15	Sweetpotato Support Platform, S. Africa	Maria Andrade
8:15-8:30	Mozambique	Maria Andrade
	Field Trip	
08:30 am-pm	SINA and storage root producers, Rubona station/breeding, On-farm trial(s), Net tunnels	Jean Ndirigwe/ Robert Mwanga
25 Thurs	**Chair:** Martin Chiona	Note taking, Solomon Afuape
8:00-8:15 am	Mitigating negative drought effects on sweetpotato productivity through tolerant cultivars in Kenya	Benjamin Kivuva
8:15-8:30 am	Evaluation of dual purpose sweetpotato cultivars for root and fodder yields in Eastern Province of Rwanda	Remy T. Niyireba
8:30-8:45 am	Testing for yam bean adaptation for E. Africa	Jean Ndirigwe
8:45-9:00 am	General discussion variety release/ Clean- up of recent releases and promising clones	Ted Carey
9:00-09:30 am	CloneSelector update, Use of PDAs, bar codes	Luka Wanjohi
09:30-09:45	Screening drought tolerant clones	Sammy Agili
09:45-10:00	Breeding, CIP Headquarters	Wolfgang Gruneberg
10:00-10:30 am	Health break	
10:30-1:00 pm	Analysis of split plot in CloneSelector	Wolfgang Gruneberg/L. Wanjohi
1:00-2:00 pm	Lunch break	
2:00-4:00 pm	On-farm trial data analysis	L. Wanjohi and R. Mwanga
4:00-4:30 pm	Health break	
4:30-5:00 pm	Use of weather data	Wolfgang/Ted Carey
5:00-5:30	Discussion: Breeding Community of Practice	Ted Carey
26 Friday	Departure / Revision of manuscripts for APA	J. Ndirigwe/M. Ameru/ R. Mwanga
27 Sat	Departure	J. Ndirigwe/M. Ameru