

Breeding in Africa for Africa

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Since 2009, breeders in 9 partner countries have released 49 varieties, 38 with orange-flesh, as a result of improved breeding capacity through collaboration with AGRA.



■ Cooked leaf quality is an important trait to consider (credit C. Bukania)

❖ What is the problem?

Traditionally, sweetpotato breeding programs have taken a long time, 7 to 8 years, to produce a new variety. Moreover, as of 2008, most countries in Africa had no real breeding program and relied on testing materials developed elsewhere. Now, with 13 active breeding programs in SSA, the challenge is how to breed for diverse groups of users.

❖ What do we want to achieve?

We will continue to strengthen conventional sweetpotato breeding in Africa. During the first phase of SASHA, we redesigned sweetpotato breeding protocols ("accelerated breeding") to produce varieties in fewer years (about 4). We will continue investing in developing diverse sweetpotato types that will provide national programs with a wide range of "parents" having the preferred trait combinations. Attention is paid to preferences of women producers and consumers of all ages, with increasing attention to traits desired by

processors. We expect national programs to release at least 30 locally adapted sweetpotato varieties by 2019. We want to see an expanding cadre of sweetpotato breeders, trained in the latest techniques, using common protocols, and raising funds to support their programs.

❖ Where are we working?

CIP breeders, based at three *Sweetpotato Support Platforms* (SSPs) in Uganda, Mozambique and Ghana, provide technical backstopping at the sub-regional level for the 17 countries targeted under the Sweetpotato for Profit and Health Initiative.

❖ How are we making it happen?

First, using "accelerated breeding", we conduct multilocational testing from the earlier stages of selection, in contrast to the conventional approach of using one site for two or more initial evaluations. Second, we are working to develop appropriate approaches to exploit heterosis ("hybrid vigor") in each sub-region, through the creation of populations that will enable systematic long-term boosts in yield. Third, we are using near-infrared reflectance spectroscopy (NIRS) for the rapid and inexpensive evaluation of important quality attributes, including micronutrients and sugars. Finally, we are linking our breeding efforts to a project to develop genomic tools for sweetpotato that began in 2014.

Our breeding effort exploits the broad genetic diversity of African sweetpotato germplasm to produce new locally adapted sweetpotato varieties in Africa. These population improvement programs are linked to national variety development programs, led by National Agricultural Research Systems (NARS) breeding programs. We are breeding in Africa for Africa, with a focus on creating populations with major traits in storage roots, namely: 1) Sweet potato virus disease (SPVD) resistance and high beta-carotene content



Key Partners

Major partners are the national sweetpotato programs in the target SPHI countries. The Sweetpotato Support Platform (SSP) for Eastern and Central Africa is based at the National Crops Resources Research Institute (NaCRRI) in Uganda and the Kenyan Plant Health Inspection Service (KEPHIS). For Southern Africa, the SSP is based at the Agrarian Research Institute of Mozambique (IIAM) in Maputo. The West Africa platform is located at the Council for Scientific and Industrial Research-Crops Research Institute (CSIR-CRI) in Kumasi, Ghana.



■ Selections being made in the seedling nursery in Ghana (credit T. Carey)

(Eastern and Central Africa); 2) Drought tolerance and high beta-carotene and high-iron (Southern Africa), and 3) High dry matter and low sweetness (West Africa). This is a collaborative effort with the Alliance for a Green Revolution in Africa (AGRA), which has so-far supported 9 sweetpotato national programs with breeding grants, 4 with seed systems grants, and has sponsored 10 sweetpotato breeders for PhD training and 3 Masters. Sweetpotato “speedbreeders” meet annually to learn new techniques and share knowledge. Moreover, farmers are active partners in the process of selecting materials to meet their conditions and preferences.

✦ What have we achieved so far?

- We have demonstrated that heterosis can be exploited in sweetpotato breeding to dramatically improve storage root and biomass yield.
- Mozambique, Rwanda, Kenya, Malawi and Uganda have released improved sweetpotato varieties following the accelerated breeding scheme.
- Since 2009, 9 SSA countries have released 49 new sweetpotato varieties, 38 of which are orange-fleshed. The 2014 Catalogue of Orange-fleshed Sweetpotato for Africa describes 60 varieties.
- A five year study found controlled cross breeding (both parents known; technicians cross by hand) is superior to the traits linked to polycross breeding (known female parent pollinated by bees) except when technicians are not skilled enough to produce sufficient amounts of controlled crossed seed.
- Quality traits of over 41,885 root samples were assessed using NIRS in Mozambique, Uganda and Ghana from July 2012-June 2015.
- Resistance to SPVD in some clones in germplasm introduced from CIP headquarters to Uganda has

held up for 4 seasons at levels comparable to the most resistant Ugandan clones.

- 94,329 seeds from Mozambican crossing blocks were distributed to 11 SSA countries; 798,800 seed from Ugandan blocks were sent to 6 SSA countries; 6,400 seeds from Ghana went to 2 SSA countries.
- The easy-to-use Excel-based program, CloneSelector, that facilitates routine breeding tasks such as planting trials and analyzing data, was enhanced through linking in the use of bar code labels to improve the power and efficiency of sweetpotato breeding *in Africa for Africa*.
- The population development program in SSA is monitoring genetic gain through annual progress in their preliminary yield trials, with yield gains ranging from 8.5% to 11.5% from 2014 to 2015 in Uganda and Mozambique.
- The 12 countries in the *Speedbreeders* Community of Practice have expanded to include Madagascar and Burundi and genomics has been integrated into the annual meeting as a key topic.

✦ What are the next steps?

Population development work in SASHA Phase 2 (2014-2014) continues, with trials validating heterosis being undertaken in Mozambique and Uganda. Nine more drought-tolerant varieties will be released in Mozambique by the end of 2015, including the first purple-fleshed variety. Purple-fleshed varieties are rich in anti-oxidant anthocyanins. By the end of 2016, Ghana will release several improved, non-sweet varieties. Breeders will begin engaging more with a diverse range of endusers (traders, processors, urban consumers) in the varietal selection process.



■ Receiving samples coming into the NIRS lab in Mozambique (credit M. Andrade)

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