Breeding in Africa for Africa

SASHA
Sweetpotato Action for Security and Health in Africa

AUG 2014

The final major methods experiment demonstrated that controlled cross breeding is superior to polycross breeding. Sixty varieties comprise the 2nd edition of the Catalogue of Orange Fleshed Sweetpotato for Africa, published in July 2014.

Controlled crosses require careful pollination by hand (credit R. Mwanga)

What is the problem?

Traditionally, sweetpotato breeding programs take a long time, 7 to 8 years, to produce a new variety. Frequently those new varieties do not suit the various geographic areas and the preferences of diverse farmers and consumers within a country. Indeed, as of 2008, most countries in Africa had no real breeding program or dedicated breeders and relied on testing materials developed elsewhere, which in some cases works well, but not when agro-ecological conditions are quite distinct.

What do we want to achieve?

We want to revolutionize conventional sweetpotato breeding. We seek to redesign sweetpotato breeding protocols in Africa to produce varieties in fewer years (about 4), maximizing yield gains and specific quality traits. We are investing in developing diverse sweetpotato types that will provide national programs with a wide range of "parents" with the preferred combination of characteristics to use in their own breeding programs. Particular attention is paid to preferences of women producers and consumers of all ages. We expect our national program partners to release at least 20 locally adapted sweetpotato varieties by 2015, a target they have already surpassed. We want to see a cadre of sweetpotato breeders, trained in the latest techniques, using common protocols, and capable of raising funds to support their programs.

Where are we working?

Three *Sweetpotato Support Platforms* (SSPs) have been established, with CIP sweetpotato breeders based in national breeding programs in Uganda, Mozambique, and Ghana to 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?

We are developing a new way of breeding sweetpotato using a combination of methods: First, in "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 creating very distinct sweetpotato populations in each sub-region, which, when crossed, should result in major improvements in yield due to heterosis. Third, we are developing molecular markers to apply to speed up the process of identifying and selecting plants that have resistance to viruses, the most important disease of sweetpotato in SSA. Finally, we are using near infrared reflectance spectroscopy (NIRS) for the rapid and inexpensive evaluation of important quality attributes, including key micronutrients and different sugars.

Our breeding effort draws on the genetic diversity of African sweetpotato germplasm, exploiting its genetic potential and increasing and diversifying forms of use, 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

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Sweetpotato for Profit and Health Initiative
Reaching 10 million African households by 2020

Key Partners

Major partners are the national sweetpotato programs in the target 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.

Farmers discussion selection criteria in Uganda (credit R. Mwanga)

a focus on creating populations with major traits demanded by each sub-region, namely: 1) Sweetpotato virus disease (SPVD) resistance and high beta-carotene content in storage roots (Eastern and Central Africa); 2) Drought tolerance and high beta-carotene in storage roots (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 is currently supporting 8 sweetpotato national programs with their breeding efforts and has sponsored 9 sweetpotato breeders for PhD training and two Masters. Sweetpotato "*speedbreeders*" meet annually to learn new techniques and share knowledge, with the goal of building a vibrant community of practice. Moreover, farmers are active partners in the process of selecting materials to meet their conditions and preferences.

What have we achieved so far?

a) We have demonstrated that heterosis can be applied in sweetpotato breeding to dramatically improve storage root and biomass yield.

b) The release in Mozambique in February 2011 of 15 drought tolerant orange-fleshed sweetpotato varieties in just four years proves that accelerated breeding (AB) can be applied in SSA. Since then, Rwanda, Kenya, Malawi and Uganda have released improved sweetpotato varieties following the AB scheme and Mozambique will be releasing more varieties in early 2015.

c) Since 2009, 8 SSA countries have released 46 new sweetpotato varieties, 37 of which are orange-fleshed.

d) Eight national sweetpotato breeding programs have obtained AGRA grants.

e) At CIP HQ in Peru, a five year study comparing the efficiency of controlled versus polycross breeding was completed in 2014. Controlled cross breeding (both parents known; technicians cross by hand) is superior for the traits studied to polycross breeding (known female parent pollinated by bees) except when technicians are not skilled enough to produce sufficient amounts of seed through controlled crosses (at least 5,000 annually).

f) Quality traits of over 23,775 roots were assessed using NIRS in Mozambique and Ghana from July 2012-June 2014.

g) Resistance to SPVD in some clones in germplasm introduced from CIP HQ to Uganda has held up under field conditions at levels comparable to the most resistant Ugandan clones.

h) A total of 59,400 seeds from Mozambican crossing blocks were distributed to 11 SSA countries, and 798,800 from the Ugandan crossing block were distributed to 6 countries.

i) In Ghana, breeding of less sweet sweetpotato for West Africa is progressing well. Consumer taste tests of genotypes in advanced trials indicate good consumer acceptance of emerging genotypes.

j) An easy-to-use Excel-based program, CloneSelector, has been developed that facilitates routine breeding tasks such as planting trials, and analyzing data. This tool enhances the power and efficiency of sweetpotato breeding in Africa for Africa.

k) A major review of sweetpotato breeding progress over the past 20 years was written by Wolfgang Grüneberg (CIP-HQ) in collaboration with 15 other breeders in Africa and other parts of the globe.

l) Ten NARS breeders contributed to the 2nd edition of Catalogue of Orange-fleshed Sweetpotato for Africa. This edition has 60 varieties, 31 more than the 1st edition in 2010.

What are the next steps?

Population development work in all three sub-regions will continue under SASHA Phase 2 (2014-2019) and AGRA will continue to support NARS breeding efforts. By applying more efficient methods validated in Phase 1, we expect at least 30 superior varieties to be produced by 2019 that meet diverse producer and consumer needs.

Quality Traits Team in Mozambique processes thousands of samples annually using NIRS (credit J. Low)

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