Breeding in Africa for Africa

SASHA
Sweetpotato Action for Security and Health in Africa

AUG 2013

Investment in Breeding in Africa for Africa is beginning to pay off. Since 2009, eight Sub-Saharan African countries have released 46 improved sweetpotato varieties, of which 31 are orange-fleshed.

Participants in the 2013 Speedbreeders meeting in Kigali, Rwanda.

What is the problem?

Traditionally sweetpotato breeding programs have taken 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). 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 the development and dissemination of new, improved sweetpotato varieties within their countries.

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: Uganda, Kenya, Tanzania, Ethiopia, Rwanda, Burundi, and DR Congo in East and Central Africa; Mozambique, Malawi, Zambia, Angola, South Africa, and Madagascar in Southern Africa, and Ghana, Nigeria, Benin, and Burkina Faso in West Africa.

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

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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.

Preparing roots for analysis in Mozambique (credit J. Low).

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.

Each sub-regional SSP is developing a program to carry out and support the research in breeding, seed systems, and other areas targeting specific needs of each region. This is a collaborative effort with the Alliance for a Green Revolution in Africa (AGRA), which is currently supporting 7 sweetpotato national programs with their breeding efforts. Sweetpotato "*speedbreeders*" meet annually to learn new techniques and share knowledge, with the goal of building a vibrant community of practice.

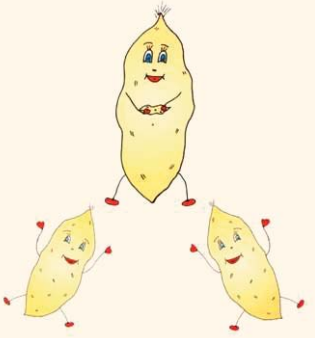
Our breeding effort draws on the genetic diversity of African sweetpotato germplasm, exploiting its genetic potential and increasing and diversifying forms of use, to produce new locally adapted sweetpotato varieties in Africa. We are breeding *in* Africa *for* Africa, with a focus on creating populations 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).

These population improvement programs are linked to national variety development programs, led by National Agricultural Research Systems (NARS) breeding programs. Farmers are active partners in the process of selecting materials to meet their conditions and preferences. We also expect that varieties and improved populations from each sub-region will have value in other sub-regions when exchanged and evaluated to select superior varieties.

What have we achieved so far?

These have been the major sweetpotato breeding achievements to date:

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 can be applied in SSA.
c) Since 2009, eight SSA countries have released 46 new sweetpotato varieties.
d) Seven national sweetpotato breeding programs have obtained AGRA grants.
e) At CIP HQ in Peru, preliminary results are now available for a large experiment that critically evaluates the efficiency of breeding using controlled crosses versus polycrosses.
f) Quality traits of over 12,000 roots were assessed using NIRS in Mozambique and Ghana from July 2012-June 2013.
g) Resistance to sweetpotato virus disease (SPVD) in germplasm introduced from CIP HQ to Uganda has held up under field conditions at levels comparable to the most resistant Ugandan clones. There is a strong possibility that the frequency of SPVD resistant genotypes in breeding populations will increase significantly in the near future.
h) 45,600 seeds from Mozambican crossing blocks were distributed to 11 SSA 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 11 other breeders in Africa and Asia.



Understanding heterosis—crossing dwarfs to get a giant.

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