# Breeding in Africa for Africa

SASHA Sweetpotato Action for Security and Health in Africa

SEP 2016

**By July 2016, activities at CIP-Headquarters in Peru to exploit heterosis through reciprocal recurrent selection (RRS) or cyclic selection were ahead of schedule. In Uganda, results on the potential to exploit heterosis confirm selecting strongly for virus resistance using RRS and in Mozambique seven new drought-tolerant cultivars were released in February 2016.**

**Fig 1.** Crossing in the screenhouse in Ghana (credit M. Amofa)

CIP INTERNATIONAL POTATO CENTER A CGIAR RESEARCH CENTER

## 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 2005, most countries in Africa had no real breeding program and relied on testing materials developed elsewhere. Now, there are 12 countries with active breeding programs in Sub-Saharan Africa (SSA) and three more engaged in varietal selection. The challenge now is to have sustained support for these breeding programs, and deal with increasing demands to meet very diverse needs of different user groups.

## 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 additional locally adapted sweetpotato varieties between 2015 and 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. We want to see countries align their variety release regulations with the accelerated breeding approach.

## 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, since 2014, our breeding efforts have been

**Key Partners**

Major partners are the national sweetpotato programs in the target countries. The 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.

Fig 2. Women farmers helped in selection of best clones in Nampula province, Mozambique (credit G. Makunde)

linked to a project developing genomic tools to increase the efficiency of sweetpotato breeding.

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) Sweetpotato virus disease (SPVD) resistance and high beta-carotene content (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) (Fig 1). This is a collaborative effort with the Alliance for a Green Revolution in Africa (AGRA), which has so-far supported 9 national sweetpotato programs with breeding grants, 4 with seed systems grants, and has sponsored 10 sweetpotato breeders for PhD training and 4 for Masters. Sweetpotato "*speedbreeders*" meet annually to learn new techniques and share knowledge. Moreover, farmers and value chain actors are active partners in the process of selecting materials to meet their conditions and preferences (Fig 2).

## What have we achieved so far?

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

b) Burkina Faso, Kenya, Malawi, Mozambique, Rwanda, Uganda and Zambia have released improved sweetpotato varieties following the accelerated breeding scheme. Mozambique released seven more drought tolerant varieties in February 2016, their second round of accelerated breeding.

c) Since 2009, 9 SSA countries have released 56 new sweetpotato varieties, 40 of which are orange-fleshed and two are purple-fleshed. The 2014 Catalogue of Orange-fleshed Sweetpotato for Africa describes 60 varieties.

d) Quality traits of over 61,172 root samples were assessed using NIRS in Mozambique, Uganda and Ghana from July 2012-June 2016, and contributed to breeding decisions.

e) Resistance to SPVD in some clones in germplasm introduced from CIP headquarters to Uganda has held up for 5 seasons at levels comparable to the most resistant Ugandan clones.

f) 42,705 seeds from Mozambican crossing blocks were distributed to 12 SSA countries; and 34,000 seed from Ugandan blocks were sent to Malawi.

g) 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.

h) The population development program in SSA is monitoring genetic gain through annual progress in their preliminary yield trials, with gains ranging from 8.5% to 11.5% from 2014 to 2015.

i) The *Speedbreeders* Community of Practice expanded to 14 countries to include Madagascar, Burundi, and Côte d'Ivoire (Ivory Coast) which have selection activities; the other 12 countries (Burkina Faso, Ethiopia, Kenya, Ghana, Malawi, Mozambique, Nigeria, Rwanda, South Africa, Tanzania, Zambia, and Uganda) have active sweetpotato breeding programs with crossing blocks.

J) The SASHA sweetpotato breeding and genomics (GT4SP) projects collaborated in introducing training on and use of molecular markers at the *Speedbreeders* annual meeting at BecA, Nairobi, in June 2016.

## What are the next steps?

Population development work in SASHA Phase 2 (2014-2019) continues, with trials designed to exploit heterosis under drought and high SPVD pressure in Mozambique and Uganda, respectively. By the end of 2016, Ghana will release improved, less-sweet varieties. Breeders will increasingly engage with a diverse range of end users (farmers, traders, processors, urban consumers) in the varietal selection process (Fig 3). In collaboration with the genomic tools project, an improved data collection and analysis tool known as the Highly Interactive Data Analysis and Productivity Tools for Breeding (HIDAP) should be ready by the end of 2016.

Fig 3. Breeder Robert Mwanga discussing virus problem with Agnes Kalya in Mukono, Uganda (credit H. Rutherford)

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

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