Tapping Crop Biodiversity for the Resource Poor in East, Central and Southern Africa

Morag Ferguson[1], Dan Kiambi[2], Robert Kawuki[3], Shadia Salih[3], Tom Hash[3] and Dave Hoisington[2]

[1] International Institute of Tropical Agriculture (IITA), P.O. Box 30709, Nairobi, Kenya
[2] International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), P.O. Box 30709, Nairobi, Kenya
[3] Biosciences eastern and central Africa, P.O. Box 30709, Nairobi, Kenya

Biosciences eastern and central Africa

NARS: Burundi, DRC Congo, Ethiopia, Eritrea, Madagascar, Mozambique, Kenya, Rwanda, Sudan, Tanzania and Uganda
BecA: Robert Kawuki, Shadia Salih (PhD Students)

Introduction

Knowledge of the extent, nature and structure of genetic diversity in crop germplasm accessions is important for defining strategies for conservation and utilization. This project aims at characterizing and assessing diversity at the phenotypic and genotypic levels in cassava and sorghum germplasm currently used in NARS breeding programs. This includes germplasm resources within national genebanks, international nurseries and important breeder germplasm. The project involves collaboration among the NARS of ten countries namely Kenya, Uganda, Tanzania, Rwanda, Burundi, Sudan, Ethiopia, DR Congo, Mozambique and Madagascar. It was developed and is funded by the Generation Challenge Program (GCP), Rockefeller (RF) and Biosciences eastern and central Africa (BecA), and runs from September 2005 to August 2008. Cassava activities are coordinated by IITA and sorghum by ICRISAT. The project aims at:

- Designing a database with passport data, farmer-knowledge, pedigrees phenotyping and genotyping data of accessions used by NARS
- Developing standardized phenotypic characterization methodologies
- Characterizing NARS germplasm using selected phenotypic descriptors
- Characterizing genotypically these accessions using SSR markers
- Analysing diversity at the national and regional levels in relation to that at the global level through comparison with GCP diversity studies

These activities will:

- Increasing the involvement of NARS in GCP
- Empower NARS to access and use information available through GCP to broaden the spectrum of crop diversity used in national breeding programs
- Work through the regional crop networks, EARRNET and ECASARM, to promote the sustainable use of standardized methodologies on a regional basis
- Empower a broader spectrum of stakeholders to link into regional and international research activities
- Initiate an active network of molecular breeders
- Expose NARS germplasm scientists to the facilities and support provided by the BecA platform.

The PhD students Shadia (left) and Robert (right)

Participants of the project inception meeting

Progress

The project inception meeting was held from 15-17 August 2005 in Nairobi, Kenya. Both technical and administrative logistics for project implementation were discussed and agreed upon. Databases for recording passport information were developed. Participants were also trained in the use of Microsoft Access which is being used to document passport information and record phenotypic data. As part of the project's capacity building efforts, two PhD students have been registered at the University of Free State in South Africa and their academic programs are well underway. In addition, four MSc students working on sorghum characterization are registered in local universities in Kenya, Sudan, Tanzania and Uganda. Phenotyping and genotyping is scheduled for 2006/7 followed by a data standardization and analysis workshop in 2008.

Sorghum

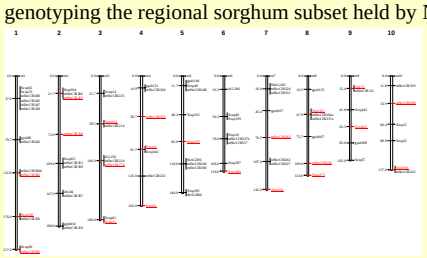
A project planning meeting was held on 3rd April 2006 in Nairobi, followed by a phenotyping workshop held from 4th-7th April 2006 at KARI, Embu, Kenya. Project partners reviewed progress and agreed to work on a regional composite of a total of 1720 accessions representing landraces, farmer varieties and breeders' lines. In the workshop, 27 descriptors representing all the sorghum developmental stages were selected and are now being used in morphological characterization. These are partially derived from the IPGRI descriptor lists for Sorghum.

Morphological characterization at the phenotyping workshop

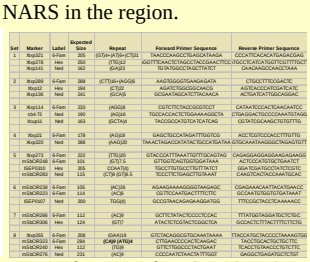
Country	No. of genotypes	Phenotyping sites	DNA extraction	Genotyping	Capacity building
Burundi	120	Mparambo – lowlands Mahwa – midlands	ICRISAT-BecA, Jan 2007	Feb-April 2007	Visiting Scientist
Eritrea	200	Hamelmalo – lowlands Halhale – midlands	ICRISAT-BecA, Feb 2007	Feb-March 2007	MSc
Ethiopia	200	Arsinigale – highlands Malkasa – lowlands	Addis University, Jan 2007	July-Nov. 2007	MSc
Kenya	200	Marimanti – lowlands Embu – highlands	KARI, Katumani, May 2006	June-Aug 2006	MSc
Rwanda	200	Rwerere – highlands Karama – midlands	ICRISAT-BecA, July 2006	Aug 2006	Visiting Scientist
Sudan	400	Wad Medani – lowlands Damazine – highlands	ICRISAT-BecA/Wad Medani Aug-Oct 2006	Jan 2007	PhD MSc
Tanzania	200	Ilonga – highlands Hombolo – lowlands	ICRISAT-BecA, July 2006	Aug-Sept 2006	MSc
Uganda	200	Serere – lowlands Parisa – highlands	Makerere University, Mar 2007	Apr-June 2007	MSc

Country summaries and schedules

Genotyping will be carried out both at the ICRISAT-BecA facilities and in the Applied Genomics Laboratory in ICRISAT Headquarters. Twenty two SSR markers which are part of the GCP global marker sets have been selected and optimized for genotyping the regional sorghum subset held by NARS in the region.



Location of selected markers (red) in the Sorghum map



SSR information for selected markers

Cassava

A cassava morphological descriptor list was developed largely from a translation of the descriptor list used by EMBRAPA. This was compared and adapted through comparison with the IPGRI and IITA descriptor lists. A cassava phenotyping workshop was held from 10th-12th January 2006, in Mtwapa, Coastal Kenya, hosted by the Kenya Agriculture Research Institute (KARI) to test and refine the descriptor list. The meeting was attended by 21 participants from seven countries. As a result of the meeting, 50 descriptors were selected for inclusion in the list.

Country	No. of sites	Site replication	genotypes/site	Planting time	Genotyping time
Uganda	2	Yes	270	March – April 2006	July 2007
Kenya	2	No	100	March – April 2006	June 2006
Rwanda	2	Yes	200	November 2006	Early 2007
DRC	2	Yes	200	November 2006	2007
Tanzania	2	No	150	October – November 2006	Early 2007
Madagascar	2	Yes	200	November- December 2006	2007
Mozambique	2	No	??	September –November 2006	2007

Country summaries and schedules

Acknowledgements

We wish to thank the GCP, Rockfeller Foundation and BecA for the financial support. Special thanks to Rosemary Mutegi for her help with the lab work and to Alice Muchiri for her tireless efforts in organization of the workshops.