SADC CROP WILD RELATIVES

Regional training workshop report

"Predictive characterization and pre-breeding of crop wild relatives"

13–16 April 2015, Pretoria, South Africa

'*In situ* conservation and use of crop wild relatives in three ACP countries of the SADC region' (short name - SADC Crop Wild Relatives) is a three-year project (2014-2016) co-funded by the European Union and implemented through the ACP-EU Co-operation Programme in Science and Technology (S&T II) by the African, Caribbean and Pacific (ACP) Group of States. Grant agreement no. FED/2013/330-210.

Contents

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Introduction

The second regional training workshop, 'Predictive characterization and pre-breeding of crop wild relatives (CWR)' was organized by the Department of Agriculture, Forestry and Fisheries (DAFF), South Africa, Bioversity International and University of Birmingham (UoB), as part of the project '***In situ* conservation and use of crop wild relatives in three ACP countries of SADC Region'** (SADC Crop Wild Relatives for short), co-funded by the European Union (EU) and implemented through the ACP-EU Co-operation Programme in Science and Technology (S&T II) by the African, Caribbean and Pacific (ACP) Group of States. The training workshop was held at the Protea Manor Hotel in Pretoria, South Africa, on 13–16 April 2015 and was attended by 23 trainees from the three partner countries (Mauritius, South Africa and Zambia) and six other SADC countries.

The overall objective of the SADC Crop Wild Relatives project is to enhance the link between conservation and use of CWR in three representative ACP countries within the SADC region, Mauritius, South Africa and Zambia, as a means of underpinning regional food security and mitigating the predicted adverse impacts of climate change. One of the specific objectives of the project is to strengthen national capacities in the three partner countries to conserve and use CWR, and to help achieve this, two regional training workshops were planned. While the first training workshop, held in November 2014 in Mauritius, focused on the *in situ* conservation aspects and diversity assessment techniques of CWR, this second one focused on the use aspects of CWR, addressing predictive characterization and pre-breeding of CWR. Although the project itself is working only within Mauritius, South Africa and Zambia, other ACP countries from the SADC region were also invited to attend so that increased capacity for *in situ* conservation and use of CWR is developed within the SADC region.

Objectives and programme of the training workshop

The workshop had three main objectives:

1. To strengthen capacities in the SADC region in predictive characterization of CWR.[1] Specifically, the following points were addressed:
    a. Understand the concept of predictive characterization
    b. Necessary steps to carry out predictive characterization of a selected CWR for a specific trait
    c. Use of relevant CAPFITOGEN tools for predictive characterization

2. To strengthen capacities in the SADC region in the use of CWR in pre-breeding. Specifically, the following points were addressed:
    a. Definition of pre-breeding and application in crop improvement
    b. Genebank operations critical to pre-breeding programmes
    c. Underlying principles for parental selection and the generation and management of populations segregating for traits of interest

3. To understand the role of CWR use in the context of NSAPs, specifically on how predictive characterization results and pre-breeding projects can have an input into the development of NSAPs.

[1] The following resources were used in the training course: Predictive characterization guidelines, available at http://www.bioversityinternational.org/index.php?id=244&tx_news_pi1%5Bnews%5D=4967&cHash=7cd3c6c2b8360927b83fa6ef7cc28d99; CAPTIFOGEN tools, see http://www.capfitogen.net/

The workshop was held over four days. The work on predictive characterization included lectures and practical exercises on the CAPFITOGEN tools developed within a programme funded by the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA), which the participants carried out on their own computers. The sessions on pre-breeding were based on the 'e-learning course on Pre-breeding for Effective Use of Plant Genetic Resources', available cost-free from http://www.imarkgroup.org/projects/PBcourse.htm and jointly developed by Bioversity International, the Food and Agriculture Organization of the United Nations (FAO) and the Global Crop Diversity Trust under the auspices of the Global Partnership Initiative for Plant Breeding Capacity Building.[2] They included lectures, discussions and a group exercise, in which participants drafted an outline of a pre-breeding action plan for NSAPs.
The training curriculum, agenda and programme were developed by Bioversity in collaboration with UoB and FAO. The workshop programme is provided in Annex 1.

Participants and resource people

The workshop included 23 trainees from 9 SADC countries and eight resource people from Bioversity, FAO, UoB, ITPGRFA, University of Reading, UK and the University of Stellenbosch, South Africa.

The participants from the SADC region came from the countries listed in Table 1. The list of participants and resource people is provided in Annex 2.

Table 1: SADC countries and number of participants per country (project partner countries in bold)

Country	**Number of participants**
Botswana	1
Malawi	1
Mauritius	3
Mozambique	1
Seychelles	1
South Africa	10
Tanzania	1
Zambia	4
Zimbabwe	1

Workshop implementation

Day 1 – Opening ceremony

The opening ceremony was chaired by Dr Julian Jaftha, Chief Director of Plant Production and Health, DAFF. A list of guests is included in Annex 2. Dr Jaftha welcomed all participants and explained that South Africa is happy to be part of the project and to host the workshop. He underlined the importance that CWR have gained as starting material for breeding, but also noted that there is still limited focus on CWR in South Africa. He underlined that the Director General of DAFF played a major role in supporting South Africa's participation but the project could not happen without important key partners. During the opening ceremony he invited the following guests to provide brief welcoming remarks:

- Prof. Edith Vries, Director General, DAFF
- Dr Ehsan Dulloo, Programme Leader, Conservation and Availability, Bioversity International
- Ms Tlhagale, Director, Strategic Partnership, Department of Science and Technology (DST)

[2] http://www.fao.org/in-action/plant-breeding/en/

- Mr Schaefer, Minister Counsellor - Head of Operations, European Union delegation to South Africa
- Dr Shadarck Moephuli, CEO, Agricultural Research Council (ARC)
- Prof. Hammer, Acting Chief Director - Biosystematics and Collections, South Africa Biodiversity Institute (SANBI)

The Director General of DAFF, Prof. Edith Vries, also welcomed all participants. She pointed out that food security is likely to remain a global challenge, if business continues as usual. Food security is an issue in South Africa and food shortages are exacerbated by climate change. These issues are addressed in South Africa's national development plan that aims to eliminate poverty by 2030. She pointed out that South Africa is a hotspot of diversity and many indigenous vegetables contribute to rural food security. These are subject to genetic erosion due to water shortages, land degradation, and also climate change. South Africa shares the view that CWR contribute important traits. DAFF is responsible for conserving and enhancing the use of these genetic resources through the National Plant Genetic Resources Center (NPGRC). Prof. Vries highlighted the importance of capacity building of young scientists in this field and is glad that the SADC Crop Wild Relatives project has a strong capacity strengthening objective for the *in situ* conservation and use of CWR. She reiterated that South Africa is glad to be part of the project and is confident that staff will gain experience and expertise to further work on CWR. She thanked Bioversity for the support and cooperation and looked forward to the agreements with cooperating institutions being finalized within the following two weeks.

Dr Ehsan Dulloo, Bioversity International, project coordinator of the SADC Crop Wild Relatives project, spoke about the overall and specific objectives of the project and then gave an overview of the importance of CWR uses and their importance for food security. He discussed the economic value that CWR bring to society in contributing valuable traits to crop improvement. He explained that the training workshop would teach participants how to most effectively identify such valuable traits that can be then used by breeders in their breeding work or used directly by farmers. However, he continued, CWR had not received the full attention they deserve, as they often fall between the cracks in conservation activities, as many of them grow in areas under the responsibility of the environmental ministries, while they are mostly of interest to the agricultural sector. Dr Dulloo expressed his sincere thanks to the host, Prof. Vries, Dr Jaftha and the staff that had worked hard to make the workshop happen. He welcomed the guests, trainees and resource people. He also expressed thanks to the EU for supporting and co-financing this work.

Ms Tlhagale provided an overview of the work carried out by the Department of Science and Technology's (DST) international resource section. She underlined the great importance of international collaboration in accessing networks and expertise. DST works with the EU and international researchers. The EU in particular, she explained, is addressing the needs of the country and the continent. The EU has been a strong research partner for a long time. Furthermore DST also has bilateral agreements, for example with Spain. DST is the national focal point in South Africa for Horizon 2020 and South Africa participated in the previous 7th framework programme. Ms Tlhagale explained that food security is highly ranked on DST's priority list and also indicated that a strategic African – EU partnership exists. She concluded by wishing participants all the best for the training and invited trainees to see what they could gain from the workshop to strengthen further their collaboration with the EU.

Mr Schaefer from the European Union delegation to South Africa confirmed that the EU appreciates the important role that CWR play in breeding for supporting farmers in their livelihoods. Increasing knowledge about these resources is very important, and the EU has allocated 23 million euros to the second phase of the ACP Science and Technology programme to promote research on many aspects of agriculture in ACP countries. He said that the EU has a special relationships with the ACP, which includes nearly 80 countries. The first phase of support to ACP countries aimed to support achievement of the Millennium Development Goals 1, 7 and 8. The second phase aims to gain knowledge from

science and technology innovations to improve food security and resilience against internal and external shocks. Phase 2 involves 21 new partnerships, particularly in the area of agriculture and food security. The EU is pleased to know that implementation of the CWR project is proceeding well. It realizes that partner countries are putting a lot of effort into the conservation and use of CWR and trusts that this project will strengthen the capacities in these countries.

Dr Moephuli, President and CEO of the Agricultural Research Council (ARC) explained that the ARC is a public entity. Its primary mandate is to conduct research. Research areas do not cover forestry and sugar, as these sectors have their own research institutes. The ARC reports to the Ministry of Agriculture. Research stations are scattered across the country in different agro-ecological zones and the ARC has the largest set of breeders in a specific area. It is domestically funded. 60% of its budget is provided by the government, the remaining 40% come from sales, competitive research (e.g. under Horizon 2020) and other bilateral projects. Dr Moephuli expressed the commitment of his organization, which is an important partner in the South African SADC Crop Wild Relative project component, to collaborate to ensure the successful outcome of the SADC CWR project.

Prof. Hammer, Acting Chief Director - Biosystematics and Collections, South Africa Biodiversity Institute (SANBI), gave an introduction to SANBI's work and its role in the SADC Crop Wild Relatives Project. She explained that SANBI manages the network of National Botanical Gardens, undertakes scientific research, monitors and reports on the state of biodiversity and provides science-based evidence to support policy and decision making. It also provides access to biodiversity information and scientific knowledge. Furthermore, SANBI provides science-based policy tools and advice for the effective management of biodiversity assets and ecological infrastructure and drives human capital development, education and awareness in response to SANBI's mandate. She then summarized SANBI's main activities within the project, which are to compile baseline information on diversity, conservation status and threats to targeted CWR in South Africa and to provide information to facilitate the identification of national *in situ* CWR hotspots and priority sites for *in situ* conservation and *ex situ* collection. In this context she underlined the importance and key role that herbaria specimens have.

Keynote Presentation

Prof. Willem Botes, Stellenbosch University, South Africa, delivered a keynote address on pre-breeding, entitled 'From wild relative to relative – making pre-breeding matter'. His presentation focused on wheat breeding and pre-breeding. Wheat is an important staple and global wheat production needs to increase under every more unstable climate conditions, with fewer hectares of arable land available and increased biotic and abiotic stresses. He explained that wheat rusts cause large losses in some seasons and breeding for resistance will help sustain wheat farmers. He then explained aspects of vertical and horizontal wheat breeding and the phases required for a breeding cycle. A traditional breeding programme will deliver a new variety to the farmer after 16 years. Since 1998 Prof. Botes has run a wheat pre-breeding programme that concentrates mainly on rust resistance and uses male sterile mediated marker-assisted recurrent selection breeding (MS-MARS). He illustrated the various aspects of this breeding method and pointed out that wild species are good sources of novel resistance genes and that transfer between wheat and wild relatives is possible. He concluded that the current MS-MARS based pre-breeding activities are being expanded to a national platform. The primary aim is the improvement of yield and physiological traits are of primary interest. UAV based high throughput phenotyping will also be implemented.

Day 1 – Introduction of workshop objectives and participants

Imke Thormann (Bioversity) provided an introduction to the workshop objectives and explained how the workshop programme was structured and what the approaches of work would be on the two main areas,

predictive characterization and pre-breeding. After clarification of some logistic issues, all participants were then invited to introduce themselves to several other people in the room, whom they did not yet know. This way of breaking the ice was appreciated by all participants.

Day 1 and 2 – Introductory lectures and practical work with CAPFITOGEN tools

Training activities during days 1 and 2 focused on predictive characterization of CWR. The first training session commenced with an introduction to the concept of predictive characterization provided by Imke Thormann (Bioversity) and to the application of ecogeography in plant genetic resource conservation, provided by Mauricio Parra-Quijano (ITPGRFA). Following these introductory lectures, Dr Parra-Quijano presented the CAPFITOGEN programme and the tools developed within the framework of this programme to support the use of ecogeographical approaches to plant genetic resource conservation and use. Six tools from this suite of tools with particular relevance for predictive characterization would be used over the first two days of the workshop.
Each participant received a flash drive containing the tools as well as background papers and all presentations on CAPFITOGEN tools that would be delivered during the training sessions. The tools are also available online for free download from http://www.capfitogen.net/en/. Participants installed them on their respective laptops to allow them to carry out practical exercises. Occurrence data for all SADC countries represented in the workshop had been prepared in advance to allow participants to carry out exercises with data from their home countries. The introduction to the tools alternated with exercises using the respective tool introduced during the training sessions on days 1 and 2. Ada Molina (Reading University) provided support to Dr Parra-Quijano during the lectures and practical exercises. Also resource people from Bioversity and UoB supported participants during the practical exercises. During the workshop participants learned how to use the following tools:

- TesTable: Allows the user to verify if passport and input tables required in other tools are properly set
- GEOQUAL: Assesses the quality of the geo-referencing of the passport data (collecting sites)
- SelecVar: Supports the selection of most important and non-redundant ecogeographical variables for ELCmapas
- ELCmapas: used to develop ecogeographical land characterization (ELC) maps of the territory studied
- Complementa: used for complementarity analysis and coverage analysis for protected area networks
- FIGS_R: Applies the ecogeographical filtering method of FIGS (Focused Identification of Germplasm Strategy) for predictive characterization

Day 3 and 4 – Lectures and discussions on pre-breeding of CWR

The second part of the training workshop focused on the use of CWR in pre-breeding. It also included an introduction to the development of national strategic action plans (NSAP) for conservation and use of CWR and a group exercise on drafting an action plan for pre-breeding in the context of NSAP development.

Dr Chike Mba (FAO) led the training sessions on pre-breeding building on the 'e-learning course on Pre-breeding for Effective Use of Plant Genetic Resources', jointly developed by Bioversity International, FAO and the Global Crop Diversity Trust under the auspices of the Global Partnership Initiative for Plant Breeding Capacity Building. Participants were provided with a CD-ROM of the e-learning course. The course is also available at http://www.imarkgroup.org/projects/PBcourse.htm.

The lectures on various aspects of pre-breeding, each followed by a short discussion time, were provided by Dr Mba during day 3 and 2 and grouped into the following sessions:

- Introduction to pre-breeding
- Collecting and safeguarding of sources of heritable variation

- Pre-breeding project management
- Creating and managing variation

After conclusion of the training sessions on the e-learning course on day 4, Dr Magos Brehm provided an introduction to the development and structure of a NSAP for the conservation and use of CWR and explained how predictive characterization and pre-breeding link into the development and implementation of NSAPs. This lecture set up the group exercise, during which participants were requested to draft an action plan for pre-breeding as a component of a NSAP.

The participants were provided with the following two lead questions:

- Why embark on a pre-breeding project? This would elicit answers on the target crop; breeding goal(s); evidence of narrow genetic base of the parental lines – or the absence of the traits sought in the lines
- How? This would be the opportunity to put the project design into practice and demonstrate an understanding of the generating and handling of segregating materials.

Participants formed three groups, each group including the participants from one of the project partner countries. Groups were asked to discuss the lead questions and to summarize their discussions on a few PowerPoint slides.

Day 4 – Group presentations, hand-out of certificates and closure

Group presentations

Each of the three groups presented the results of their respective discussions.

Group 1 worked on the following target crops and countries:

- Mauritius: Sugarcane, tomato, onion
- Seychelles: Banana, sweet potato, cassava
- Zimbabwe: Small grains, sorghum, millets
- Mozambique: Rice, cassava

They outlined the breeding objective for each of the crops listed and described project design aspects in each country.

Group 2 focused on rice and cowpea, important for Zambia and neighbouring countries. They indicated that there is a lack of knowledge on the value of the CWR of these two crops. It is necessary to develop and identify varieties resilient to the effects of climate change, such as emerging pests and diseases, increasing temperatures and extreme precipitation. They identified as an overall goal for a pre-breeding programme the development of rice and cowpea pre-breeding lines resistant to pests and diseases and outlined methods and materials required to achieve this goal.

Group 3, mainly composed of the numerous South African participants focused on wheat drought tolerance adapted across different environmental conditions. They explained that the transfer of a gene adapted to higher temperatures and the transfer of a gene adapted to drought tolerance should be combined to form a pre-breeding population. They outlined then the evaluation criteria, resource requirements and sources, management structure and the time frame for such a pre-breeding project.

It was noted during the subsequent discussions that island states were mainly characterized by a narrow genetic base, as many crops have been introduced, while in countries on the mainland the genetic base is reported to be broad and plant genetic resources are abundant – but at the same time no resources and/or skills are available to harness them. It was further noted that not all countries, in particular the island states, would harbour CWR on their own territory of those crops for which they have identified the

need for crop improvement aspects that would require pre-breeding. The interdependency of countries on PGR from outside their own borders was flagged. It was indicated that countries should discuss within the development of NSAPs, whether they should also include the conservation of those CWR growing within their own borders for which no crop improvement is required within its own borders but which represent important CWR of a regionally or globally important crop. Furthermore the requirement for CWR resources from outside the country important for those national crops, for which crop improvement needs have been identified but no PGR exist within the own countries, could be discussed within the NSAP discussion section.

It was indicated that more emphasis should be placed on research on crops traditionally grown in the countries rather than recently introduced crops. This was explained with the following example: Maize has been introduced to Zimbabwe and sorghum and small millets have been neglected in research while much research was conducted into the adaptation of maize to local conditions. Now maize is starting to fail in several areas because the climate is changing and farmers are turning back to the small grains. More emphasis should therefore be placed on the breeding of these small grains.

Certificates of attendance
A certificate of attendance, signed by Dr Ehsan Dulloo (Bioversity), Dr Nigel Maxted (UoB) and Dr Julian Jafta (DAFF) was handed to each trainee.

Closure
During the closing session, Imke Thormann (Bioversity) highlighted the key topics that participants were exposed to during the week, namely predictive characterization and pre-breeding. She hoped that participants would now be able to create their national checklist and inventory of CWR. Participants would take home new skills and Ms Thormann invited them to get in touch with the resource people, if they needed assistance with implementing the CAPFITGEN tools or identifying aspects of pre-breeding projects. She indicated that in particular the last discussion session that had followed the group presentations, had provided interesting aspects on the content and extent of the NSAP which the partner countries could take up for further discussion at their upcoming national stakeholder workshops planned for the second half of the year, at which the writing of the NSAPs should be started. She thanked DAFF once again as local organizer and host of the workshop for allowing this successful workshop to take place.

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Annexes to workshop report

Annex 1. Workshop agenda

Monday 13th April 2015		
8:30 – 9:00	Registration	All participants
	OFFICIAL OPENING CEREMONY	
9:00	– Welcome address	Prof VRIES (DAFF)
	– Introduction of SADC Crop Wild Relatives project	Dr DULLOO (Bioversity)
	– Address by Agricultural Research Council	Dr MOEPHUDI (ARC)
	– Address by South African National Biodiversity Institute	Prof HAMMER (SANBI)
	– Address by Department of Science and Technology	Ms TLHAGALE (DST)
	– Address by European Union delegation	Mr SCHAEFER (EU)
	– Welcome remarks from SADC Plant Genetic Resource Centre	Thandie LUPUPA (SPGRC)
10:00	– Keynote address: From wild relative to relative – making pre-breeding matter	Willem BOTES (Stellenbosch University)
10:45 – 11:15	**TEA/COFFEE**	
	INTRODUCTION	**Chair: Ehsan DULLOO**
11:15	– Workshop objectives and programme overview – Participant introductions	Imke THORMANN (Bioversity) + All
	PREDICTIVE CHARACTERIZATION – setting the context	**Chair: Ehsan DULLOO**
11:45	– Introduction to predictive characterization	Imke THORMANN
12:00	– Introduction to CAPFITOGEN program	Mauricio PARRA-QUIJANO (ITPGRFA)
12:30	– Basis of the application of ecogeography in plant genetic resources	Mauricio PARRA-QUIJANO
13:30 – 14:30	**LUNCH**	
	PREDICTIVE CHARACTERIZATION – installing tools[3] and basic review of functions and formats	**Chair: Imke THORMANN**
14:30	– Tools (USB) delivery / CAPFITOGEN installation – review of basic functions	Mauricio PARRA-QUIJANO

[3] Each participant will receive a USB stick with the CAPFITOGEN tools

15:15	– Review of passport and other table formats	Mauricio PARRA-QUIJANO
15:45 – 16:15	**TEA/COFFEE**	
	PREDICTIVE CHARACTERIZATION – CAPFITOGEN tools 1	**Chair: Hannes Gaisberger**
16:15	– Introduction to TesTable and GEOQUAL tools	Mauricio PARRA-QUIJANO
16:45	– Utilizing TesTable and GEOQUAL tools	Mauricio PARRA-QUIJANO / Ada MOLINA (Reading Univ.)
17:55	– Wrap-up, day 1	Joana MAGOS BREHM (UoB) + All
18:00	**CLOSE OF WORKSHOP, DAY 1**	

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Tuesday 14th April 2015		
	PREDICTIVE CHARACTERIZATION – CAPFITOGEN tools 2	**Chair: Chike MBA**
8:30	– Introduction to SelecVar and ELCmapas tools	Mauricio PARRA-QUIJANO
9:00	– Utilizing SelecVar and ELCmapas tools	Mauricio PARRA-QUIJANO / Ada MOLINA
10:45– 11:15	**TEA/COFFEE**	
	PREDICTIVE CHARACTERIZATION –CAPFITOGEN tools 3	**Chair: Chike MBA**
11:15	– Introduction to FIGS_R, ColNucleo and rLayer tool	Mauricio PARRA-QUIJANO
11:45	– Utilizing FIGS_R tool	Mauricio PARRA-QUIJANO / Ada MOLINA
13:15 – 14:15	**LUNCH**	
	PREDICTIVE CHARACTERIZATION –CAPFITOGEN tools 4	**Chair: Joana MAGOS BREHM**
14:15	– Introduction to Representa and DIVmapas tools	Mauricio PARRA-QUIJANO
14:45	– Utilizing Representa tool	Mauricio PARRA-QUIJANO / Ada MOLINA
16:15 – 16:45	**TEA/COFFEE**	
16:45	– Finalization of exercises	Mauricio PARRA-QUIJANO
17:15	– Question and answers + wrap up CAPFITOGEN tools	Mauricio PARRA-QUIJANO
17:45	– Wrap-up discussion, day 2	Imke THORMANN + All
18:00	**CLOSE OF WORKSHOP, DAY 2**	
19.30	**SOCIAL DINNER**	

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Wednesday 15th April 2015		
	PRE-BREEDING – introduction	**Chair: Imke THORMANN**
08:30	– Introduction to pre-breeding ○ What is pre-breeding ○ Problems addressed through pre-breeding ○ Examples of pre-breeding	Chike MBA (FAO)
9:30	– Introduction to e-learning tool on pre-breeding	Chike MBA
	PRE-BREEDING – Collecting and safeguarding of sources of heritable variations	**Chair: Hannes Gaisberger**
9:45	– Genebanks: What are genebanks; types of genebanks	Chike MBA
10:30 – 11:00	**TEA/COFFEE**	
11:00	– Planning and carrying out collecting missions	Chike MBA
11:45	– Type of collections	Chike MBA
12:15	– Introduction to germplasm characterization and evaluation	Chike MBA
13:00 – 14:00	**LUNCH**	
14:00	**PRE-BREEDING – Project management**	**Chair: Mauricio PARRA-QUIJANO**
14:00	– Elements of a project design for pre-breeding	Chike MBA
15:00	– Managing and assessing a pre-breeding project	Chike MBA
16:00 – 16:30	**TEA/COFFEE**	
	PRE-BREEDING – Creating and managing variation	**Chair: Joana MAGOS BREHM**
16:30	– The identification of parents	Chike MBA
17:30	– Transferring traits from non-adapted materials	Chike MBA
18:15	– Wrap-up discussion, day 3	Hannes GAISBERGER (Bioversity) + All
18:30	**CLOSE OF WORKSHOP, DAY 3**	

Thursday 16th April 2015		
	PRE-BREEDING – creating and managing variation	**Chair: Imke THORMANN**
8:30	– Managing segregating populations	Chike MBA
9:30	– Molecular genetic tools enhance efficiency in crop improvement	Chike MBA
10:30 – 11:00	**TEA/COFFEE**	
	Predictive characterization and pre-breeding: relevance for NSAP development	**Chair: Hannes GAISBERGER**
11:00	– The role of predictive characterization and pre-breeding activities in NSAP development	Joana MAGOS BREHM
	PRE-BREEDING – drafting an action plan for pre-breeding	**Chair: Hannes GAISBERGER**
11:30	– Group work: drafting an action plan for pre-breeding for NSAPSs	All trainees
13:00: – 14:00	**LUNCH**	
14:00	– Group work: drafting an action plan for pre-breeding for NSAPSs (cont.d)	All trainees
15:30– 16:00	**TEA/COFFEE**	
	GROUP PRESENTATIONS	**Chair: Joana MAGOS BREHM**
16:00	– Group presentations and discussion	Chike MBA + All
17:45	– Final wrap-up discussion	Imke THORMANN + All
18:00	**CLOSE OF WORKSHOP**	

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Annex 2. List of workshop participants, resource people and guests at the opening ceremony

SADC participants (6)		
Country	**Nominee**	**Contact details**
Botswana	Ms Tiny Motlhaodi	Department of Agricultural Research Private Bag 0033 **GABORONE** Botswana Tel: 267 3668100 Cell: 267 71718389 Email: tmotlhaodi@gov.bw
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Seychelles	Mr Keven Nancy	Principal Officer Research and Development Seychelles Agricultural Agency P O Box 166

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SPGRC (1)		
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Guests attending the opening ceremony

- Prof. Edith Vries, Director General DAFF
- Dr Julian Jaftha, Chief Director, Plant Production and Health, DAFF
- Dr Noluthando Netnou-Nkoana, Genetic Resources Director, DAFF
- Mr Schaefer, Minister Counsellor - Head of Operations, European Union delegation to South Africa
- Prof Hammer, Acting Chief Director - Biosystematics and Collections, South Africa Biodiversity Institute (SANBI)
- Dr Shadrack Moephuli, CEO, Agricultural Research Council (ARC)
- Dr Maneshree Jugmohan-Naidu, Director Biotechnology, Department of Science and Technology (DST)
- Ms Tlhagale, Director Strategic partnerships, DST
- Dr K Tshikolomo, Senior Manager - crop production, Provincial Department of Agriculture (PDA)
- Mr Maisela, Senior Manager, PDA
- Mr RR Ramugondo, Senior Manager – Research and Development, PDA Limpopo