SADC Plant Genetic Resources Centre (SPGRC)

Regional Stakeholders' Meeting on Information Exchange of National Strategies on PGRFA, 2013, Lusaka, Zambia

September 2013
Lusaka, Zambia

Acronyms

ABCIC	African Biodiversity Conservation and Innovation Centre
APPSA	Agricultural Productivity Programme for Southern Africa
ARC	Agricultural Research Council, South Africa
ARIPO	African Region Intellectual Property Organization
AVRDC	Asian Vegetable R4esearch & Development Centre (World Vegetable Centre)
BCA	Botswana College of Agriculture
BCN	Biodiversity Community Network, Zambia
BRAHMS	Botanical Research and Herbarium Management System
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
CIAT	International Centre for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Centre
CTDT	Community Technology Development Trust, Zimbabwe
DAR	Department of Agricultural Research
DRC	Democratic Republic of Congo
DST	Department of Science and Technology
EMBRAPA	Brazilian Agricultural Research Corporation
FAO	Food and Agriculture Organisation
GCDT	Global Crop Diversity Trust
GPS	Global Positioning System
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
ICBA	International Centre for Biosaline Agriculture
ICRAF	International Council for Research in Agroforestry
IIA	Instituto de Investigação Agronómica (Agricultural Research Institute), Angola
IIAM	Instituto de Investigação Agrária de Moçambique (Agricultural Research Institute), Mozambique
IKS	Indigenous Knowledge Systems
INERA	Institut National pour l'Etude et la Recherche Agronomique (National Agricultural Research Institute), DRC
IPGRI	International Plant Genetic Resources Institute (now Bioversity)
IRRI	International Rice Research Institute
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
KEW	Royal Botanical Gardens (usually referred to as Kew Gardens), UK
MRS	Malkerns Research Station, Swaziland
MSBP	Millennium Seed Bank Project
NBRI	National Botanical Research Institute, Namibia
NPGRC	National Plant Genetic Resources Centre
NPGRCom	National Plant Genetic Resources Committee
NTSYSpc	Numerical Taxonomy SYStem for personal computer
NUCS	Neglected and Underutilized Crop Species
PCR	Polymerase Chain Reaction
PGR	Plant Genetic Resources
PGRFA	Plant Genetic Resources for Food and Agriculture
SAA	Seychelles Development Agency
SADC	Southern African Development Community
SANBio	Southern African Network for BioSciences
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management
SCCI	Seed Control and Certification Institute, Zambia
SDIS	SPGRC Documentation and Information System
SLU	Swedish University of Agricultural Sciences
SPGRC	SADC Plant Genetic Resources Centre
SPO	Senior Programme Officer, SPGRC
SSR	Simple Sequence Repeat markers
TCP	Technical Cooperation Project
TO	Technical Officer, SPGRC
TPRI	Tropical Pesticides Research Institute, Tanzania
UNCTAD	United Nationas Conference on Trade and Development
UNZA	University of Zambia
ZARI	Zambia Agricultural Research Institute

Contents

1. Objectives

The SPGRC/NPGRCs Regional Stakeholders' meeting was held in Lusaka, Zambia with the objective to:

- Discuss FAO-TCP project activities with regard to developing national PGR conservation strategies in selected SADC countries
- review the implementation of the technical activities for 2012/2013 cropping season;
- evaluate the technical and budgetary plans for the 2013/2014 cropping season; and
- facilitate information sharing on any other technical and networking issues.

In addition to the routine discussions and deliberations on conventional SPGRC network activities, the meeting also discussed the critical financial and administrative implications in the wake of diminishing donor funding.

2. Attendance

There were twenty nine (29) participants from NPGRCs, SPGRC, FAO, and AVRDC. Due to logistical problems, Mauritius, Seychelles and South Africa did not attend the meeting. At least, Seychelles sent in their annual report.

3. Venue

The meeting was held at the Protea Hotel – Cairo Road, Lusaka from 11th to 13th September 2013.

A detailed meeting programme is found in Appendix I.

4. Opening Ceremony

The meeting was called to order by the Session Chair at around 09:30 by welcoming all participants to this year's regional stakeholders' meeting on information exchange of national strategies on PGRFA with emphasis on what had been achieved over the one-year implementation of the FAO-TCP project.

He announced sad news about the demise of a Zimbabwean research officer, Ms Alter Murangi who apssed away in December 2013 after illness. A minute of silence was observed on her remembrance.

In the logistics the Chair by directed where the SPGRC Secretariat was in the Hotel and asked participants to hand in any claim forms for processing.

4.1 Welcome Address by Head of SPGRC

The Head of SPGRC welcomed all participants to the meeting appreciating for the trouble taken to travel to Lusaka from their respective countries. He recognized the presence of Dr George Okech, Zambia FAO Representative, Dr Chikelu Mba, FAO senior officer, Dr Dan Kiambi, Excecutive Director of ABCIC, and Dr Tsvetelina Stoilova, senior scientist at AVRDC in Arusha.

Despite several challenges, the Head outlined notable achievements made during the year. These include implementation of the FAO-TCP project which conducted pre-breeding training for network scuientists, development of national strategies for the partixcipating countries, and for the ongoing upgrading of equipment and facilities for SPGRC and NPGRCs.

The Head informed the June 2013 meeting of the Ministers responsible for Agriculture and Natural Resources approved the regional PGR policy guidelines developed by SPGRC with SANBio financial support. The SANBio funding also sponsored a network scientist for a 1½ years MSc training in Environmental Policy and Planning and the candidate graduated in July 2013. He also reported that SPGRC had finalized a completion report for the 5th Phase of the SPGRC project. It also updated the financial sustainability strategy.

The meeting was informed that SPGRC had established close collaboration with CCARDESA, as a result, Mozambique, Zambia and Malawi are participating in the APPSA.Besides SPGRC re-establishing contacts with AVRDC – Africa Region, it also collaborated with SADC Secretariat in the development of the web-SDIS.

SPGRC senior staff particiapted in collection mission in DRC, conducted backstopping missions in Member States and were also involved in the review of RISDP and RAP.

Challenges still facing SPGRC include financial constraints resulting in little activities being conducted by NPGRCs and there have been no training opportunities at postgraduate levels.

4.2 Welcome Remarks by FAO Representative

The Representative of FAO in Zambia, Dr George Okech expressed his pleasure for being invited to attend the meeting. He emphasized on the fact that FAO considers conservation of PGRFA as very important for global and regional food security and was enlightened that SADC values that imporatnce for which it has even developed policy guidelines.

He recognized the work that has been done and which is going on in implementing the FAO-TCP project in selected countries. He promised that FAO was looking forward to its renewed commitment to the future of conservation.

On resource mobilization, Dr Okech advised SPGRC that in order to be financially sustainable, resource mobilization becomes inevitable and this is usually best achievable through tapping on resource mobilization officers against traditional dependence of technical officers writing proposals in order to attract funding from donors.

4.4 Programme and Logistics Announcements

The Session Chairperson made logistical announcements regarding the filling and submission of registration forms, about the complementary availability of Internet at the hotel, and that before the morning tea break a group photo will be taken at the hotel front.

5. Matters Arising from the Last (2012) Meeting

5.1 Investigations on Using Solar Power for Backups

Last year, with looming power outages in the region, countries were advised to look into possibnility of using solar power as backups for the genebanks. Since Lesotho had pioneered in this initiative, it was asked to share results with the rest of participants.

5.2 Sources of Genebank Equipment, Facilities and Consumables

Last year, paricipants requested SPGRC to provide them with contacts of the suppliers of genebank equipment, facilities and consumables from the region and beyond.

In reponse, the SPO - *Ex-Situ* informed the meeting that suppliers for pollination bags were in Zimbabwe. He also said contactys for suppliers of driers were available (in South Africa) and will be shared. He however cautioned that the available driers were not the same as the ones commonly used in the network.

With regard to aluminium foil bags, it was reported that they are available but do not meet standards. The SPO – *Ex-Situ* mentioned that they have now explored beyond borders and will be sharing the information.

6. NPGRC PROGRESS REPORTS

Angola

A. General

(i) Introduction

Angola is a large country with a very wide variety of biomes, physical and climatic diversity which reflect the diversity of its local varieties of food crops, including maize, common bean, cowpea, groundnut, sorghum, pearl millet and others. These crops contain the genetic resources of local varieties of food crops.

Collecting missions were not carried out during this period although it had been proposed last year that collections were to be made in the remaining districts of Lunda Norte, Lunda Sul and Moxico provinces.

In the period under review the Angolan NPGRC organized a pre-breeding course for agronomists, middle level technicians and final year biology students from Agostinho Neto University Science Faculty. The main aim of the course was to give an overview of the basic methods of agro-morphological and molecular characterisation to be applied in germplasm conservation and utilisation.

(ii) Staffing

There were no changes to staff complement.

(iii) National Plant Genetic Resources Committee (NPGRCom)

In the period under review, the Angolan NPGRCom met twice, on 23rd January and 5th September 2013 to consider an innovative proposal for increasing the benefit sharing in the International Treaty of PGRFA. The meetings also reviewed some changes to the genetic resources bill that is expected to be presented for approval in the coming months.

(iv) Training, Workshops and Meetings

- In February 2013 the NPGRC was visited by a Brazilian delegation, from Santa Catarina University, Florianopolis, to discuss technical aspects of Masters course in Conservation and Utilization of PGR, due to begin at NPGRC in 2014;

- Angolan NPGRC organized a training course in pre-breeding for agronomists, middle-level technicians and final Year Biology students from the Science Faculty from 06-17 of May 2013, with participation of two specialists from the Brazilian EMBRAPA Rice and Bean Research Centre.

- The Angolan NPGRC was invited to participate in the 2015 EXPO in Milan, Italy whose principal theme was Agriculture and Culture: educar para inovar.

- In 2013, Elizabeth Matos participated in two meetings of the *ad hoc* Committee on the Funding Strategy of the ITPGRFA.

(v) Equipment, Supplies and Facilities

There was no change of status of equipment and facilities during the year.

(vii) Requirements

The Centre is in requirement of 500 large, 1,000 medium and 2,000 small size laminated foil bags, as well as 1000 large pollination bags.

(vi) Constraints

A serious constraint on the work of the Angolan NPGRC continues to be the delay in the establishment of the Centre's experimental field at the new University Campus. These delays, mainly caused by financial constraints, have been the main reason for NPGRC being unable to carry out some of its expected field plans for 2012. While waiting for the new experimental field, NPGRC continues its work at the Ministry of Agriculture's Seed Services field at Kikuxi.

The two non-functioning driers that are not working and the shortage of aluminium foil bags created constraints for the collection mission that had been planned for 2013.

At the University Campus site the building of a storage unit for field equipment and a generator house for the Artesian well pump are now expected to be finished by the end of September of 2013. Once these are delivered the Centre will be able to begin planting at this site.

B. Technical Report

(i) *Ex-Situ* Conservation

Conservation
Angola NPGRC is planning to collect in the remaining areas of Lunda Norte, Lunda Sul and Moxico provinces. The collection mission for this period was not organized because of the shortage of aluminium foil bags and little space.

The NPGRC sent to base collection a total of 45 accessions in 2012 that include *Zea mays* – 12, *Phaseouls vulgaris* – 10, *Vigna unguiculata* – 6, *Arachis hypogaea* – 10, and *Cucurbita sp.* 7. It also sent 35 accessions to that base in 2013 that included *Zea mays* – 4, *Phaseouls vulgaris* – 1, *Vigna unguiculata* – 9, *Sorghum bicolor* – 5, *Arachis hypogaea* – 5, *Cucurbita sp.* – 3, and *Pennisetum glaucum* – 8.

Regeneration and Multiplication
During the period under review (2012-2013), the Centre carried out and completed activities of multiplication, characterization, multiplication and regeneration of accessions of common bean, cowpea, maize, pumpkin, tomato, chili pepper, pearl millet, groundnut, sunflower and pea.

The characterization of five accessions of common bean, particularly aimed at supporting "the pre-breeding course for effective use of genetic resources for food crops" coordinated and conducted by CRF-UAN and EMBRAPA Rice and Bean from Brazil, with participation of 22 technicians and graduate students from various agricultural research institutions, contributing to implement new ways of working together and participatory research involving other sectors.

The Centre multiplied 48 accessions (common bean – 10, maize – 12, chili pepper – 5, sunflower – 12, and peas - 9), characterized 75 accessions (common bean – 15, and 10 each of maize, pearl millet, groundnut, pumpkin, tomato and chili pepper) and regenerated 5 accessions (cowpea – 3, and maize – 2).

Some accessions distributed from NPGRC such as common bean, maize, millet, groundnuts and vegetables (pumpkin, tomato and chili pepper) were used for the characterization purpose. This work was done by two final year Biology students from Science Faculty as a thesis for their graduation. The viability of seeds stored in the genebank was tested in the seed laboratory and in field conditions.

Due to lack of funds and technical unavailability of the IIA with whom NPGRC would like to coordinate the execution of joint tasks was not yet been possible to start the project and carry out the characterization and breeding process of 50 accessions of common bean provided for the period 2012-2013 by the experimental stations of IIA. But everything is being done so that as soon as funds are available funds to start the project.

(ii) Field Genebank Maintenance

There are field genebanks in some Ministry of Agriculture Research Stations: Roots and tubers in Malange (Malange Province) and Mazozo (Bengo Province); mango and banana gene bank at the IIA Benguela, Fruit Research Station; and *Robusta* coffee in Huambo and in national coffee research stations in Kwanza Sul and Uige Provinces.

(iii) Utilisation of Plant Genetic Resources

The Genebank distributed 15 accessions of maize (*Zea mays* L.) each containing 50 seeds for the Norwegian University of Life Sciences for research purposes in November of 2012.

It also distributed 58 accessions of different food crops, each containing 200 seeds for training programmes in seed laboratory and experimental field. This material is for the final year Biology students from Science Faculty.

Five accessions of common bean each containing 200 seeds were distributed for the pre-breeding course held last May.

(iv) Germplasm Collection

During the period 2012-2013 the Angola NPGRC did not organise collection missions, the main reason was the lack of aluminium foil bags to store the material in the freezers. The other reason is the lack of space at NPGRC.

(v) Documentation and Information

The SDIS is working very well. The back-up is made very often as soon as new data is added to the system.

Database has been valuable for the work at NPGRC as well as for the support of student's thesis during their studies.

The Genebank would like to have assistance regarding to the addition of names of districts ("municipalities") which are not yet in the SDIS system. Some materials have been collected from these places but not entered in the system for lack of names.

Botswana

A. General

(i) Staffing

Ms Lucia Mchuka, a Technical Assistant retired thus constraining the genebank more on the staff composition.

(ii) National Plant Genetic Resources Committee (NPGRCom)

There was no Committee meeting held in the year. Two committee members left for further training while one was transferred locally. The affected institutions have been requested to nominate replacements.

(iii) Training, Workshops, Courses and Meetings

- Mr C Gwafila attended a National Taxonomy Committee (Museum) workshop in Gaborone;
- Ms M. Molefe attended a Consultative workshop in IK Systems Technical stakeholder workshop, Botswana;
- Mr C. Gwafila and Ms. M. Molefe participated in the National Agricultural Exhibition Show (exhibited conserved accessions) in Gaborone;
- Mr C. Gwafila and Ms. M. Molefe attended a Pre-breeding course (Feb 2013) in Zambia, and attended a National Strategy Consultative workshop (June 2013) in Botswana;
- E. Molaodi pursuing a 2 year (2013 – 2015) Diploma course in Agriculture in Botswana;
- T. Motlhaodi attending PhD training in Sweden/Botswana through Sida/SPGRC sponsorship

(iv) Visits

- Mr B. Kapange and Mr M. Daka (SPGRC) to install SDIS in new computer;
- Mr L. Qhobela (SPGRC) to monitor and evaluate the genebanking processes;
- Dr C. Mba, Dr P. Munyenyembe and Ms T Lupupa to attend national strategy workshop and visit the gene bank;
- Chinese Delegation: Familiarisaion and research collaboration benchmarking;
- South Sudan delegation: Familiarisaion and research collaboration benchmarking;
- BCA students and Secondary schools students: Learn about conservation activities

(v) Equipment, Supplies and Facilities

The NPGRC has maintained two types of storage facilities: 10 upright freezers and a cold room all of which are functioning well. The germinator, seed counter and seed grinder are still in good working condition. The walk-in drier that was reported faulty last year was fixed by a local company and is now working.

(vi) Requirements

The NPGRC expressed need for a standby generator, germination trays, aluminium foil bags, irrigation facilities, and chemicals for molecular characterization.

(vii) Constraints

The NPGRC has continued succumbing to the shortage of qualified staff as well as lack of funds for short and long courses training for genebank staff. It is also constrained by lack of irrigation facilities.

B. Technical Report

(i) Conservation

The NPGRC reported of having 4,611 accessions in conservation out of which, 3,561 are cultivated crop species and 1,050 are wild plant species. Seed samples are conserved in the freezers at -20^{o}C and cold room at-5^{o}C

The NPGRC duplicated 284 accessions to SPGRC in 2012/2013. These included 165 cowpea, 86 sorghum, 2 maize, 8 bambara nuts, 5 groundnut, 15 mung bean, and 3 pearl millet species.

During the year, 10 accessions were collected which included 2 cowpea accessions, 2 wild cowpea accessions and one accession each for wild cowpea, maize, marama bean, water melon, sweet potato, *Grewia avallana*, and *Cleome gynandra*.

(ii) Regeneration/Multiplication

A total of 230 accessions were planted in December 2012 for rejuvenation of the ageing seed materials. Out of the 15 planted sorgum accessions, only 7 were harvested. Out of 100 accessions each planted for bambara and cowpea, only 77 and 64 accessions were respectively harvested; and all the 15 planted melon secies were successfully harvested.

(iii) Utilization of Plant Genetic Resources

The rising trend for demand of germplasm persisted in the year in response to which NPGRC distributed 228 accessions to the Department of Agricultural Research, Botswana College of Agriculture (BCA), PhD students for screening, evaluation, nutritional analysis, and for assessment of genetic diversity and mapping of QTLs associated with drought tolerance based on SSR markers

(iv) *In-situ*/On-farm Conservation

The Centre intended to explore the possibility of holding a Seed Fair in an area/district which is well known for diverse crops. However, this activity was deferred until completion of the FAO TCP activities.

(v) Documentation and Information

There were problems regarding the use of SDIS, however, the desktop with the database is phased out of the government system and it is no longer under IT service. Loading information is risky as it may crash anytime.

A new desktop was procured and was installed with SDIS and the non-functioning EDIT function enabled. Data entry will now resume.

(vi) Conclusion and Recommendations

Yield was severely affected by drought which affected the quality and quantity of seed for crops under multiplication.

Data for bambara nut under characterization was incomplete due to drought (poor seed setting, failure to reach maturity and shrivelled seed). The trial will therefore be implemented again in 2013/14 season.

Democratic Republic of Congo (DRC)

A. General

(i) Introduction

The National Plant Genetic Resources is cross-cutting programme that deals with all species and thematic programmes in DR Congo. Genetic resources are *in-situ* and *ex-situ* species collected or developed by thematic programmes. The bottleneck remains

on conservation of these genetic resources and availability of adequate facilities and equipment.

INERA which is an apex institution, under which NPGRC is housed, operates in 32 Centers and Stations where potentially, PGR activities could be handled under the direction of the NPGRC.

(ii) National Plant Genetic Resources Committee (NPGRCom)

The NPGRCom was institutionalized in 2008 with committee members approved from ministries, universities and other institutions involved in genetic resources activities. However, the committee did not hold any meeting during the reporting period.

(iii) Staffing

The NPGRC in DRC staffing for the newly established NPGRC as Professor Mbikayi Nkonko – Director Scientific Research at INERA, Mr Ramazani Lumbe – Head of Division Management of Genetic Resources, and Program Chiefs at respective Research Centres across the country.

(iv) Facilities and Equipment

The established NPGRC for DRC reported of having an office and a faulty desktop computer at INERA in Kinshasa. As a result of joining the network late, DRC has not received any kind of equipment support and was therefore asking for SPGRC to enable it start up activities.

(v) Constraints

DRC reported to have identified a building to house the genebank (a small store room which needs renovations). In the mean time, NPGRC proposes for SPGRC assistance in funding. It is in dire need for a laptop, desktop computer and database to document conserved germplasm.

B. Technical Report

(vii) Germplasm Conservation and Collection

DRC reported that it has in conservation over 9,641 species of germaplasm at Yangambi Research Centre. These include cocoa, coffee, forest trees, oil palm, cassava, maize groundnuts, cowpea, soya, agrostological species, wild fruits, banana and hevea/para rubber species. It also reported another 723 species in conservation at M'Vuazi Research Centre most of which include cassava, groundnut, cowpea, soya, common beans, banana, forest species, rice, maize, mango, citrus, pawpaw, avocado, agrostological species, lansium, pigeon pea and taro species.

Due to financial and functional difficulties, INERA was obliged to restructure and to reduce the number of Centers and Station a network from 32 to 5 Centers and 4 functional active stations. As a result, INERA created 4 regional branches following ecological conditions in DRC:

- M'vuazi (Lower-Congo/from coast to Kinshasa and the regions around.
- Yangambi (in the centers/equatorial zone)
- Mulungu (mountain region/temperate zone)
- Gandajika (Savannah'region / Tropicales Zones)

Unfortunately, in the abandoned 23 active stations there were active and some neglected or non-evaluated germplasm materials. It implies that from these there is a problem to evaluate and to transfer to safety collections of food producing and

industrial crops (palm oil, cotton, coffee, tea, cocoa, rubber, quinine, medicinal plant, jatropha, *etc*.).

Lesotho

A. General

(i) NPGRC Staff

The staffing situation remained unchanged from what was reported last year. The position of the resigned in-situ remain unfilled.

(ii) National Plant Genetic Resources Committee (NPGRCom)

The Lesotho NPGR committee composition changed again after two members representing the Forestry Department and NGOs retired and their positions have remained vacant. The Committee held three meetings during the year to deliberate on issues affecting PGR conservation and utilization in the country.

(iii) Training, Workshops, Meetings

The NPGRC staff attended the following workshops and meetings:

- Regional Forum on Transforming African agriculture to support smallholder farmers in Southern African countries from 2 -3 October 2012, Johannesburg, South Africa
- Regional workshop on the African Region Intellectual Property Organization (ARIPO) legal framework for the protection of new varieties of plants held at Ufulu Garden, 22 – 25 July 2013, Lilongwe, Malawi.
- A one-day workshop on Guidelines for Policy Framework Development on Traditional Knowledge & Use of Plant Genetic Resources
- All staff attended a two-day stakeholder workshop at 'Melesi Lodge' on the presentation of the draft National Strategy on Plant Genetic Resources
- All staff participated in several meetings locally on climate change related issues facilitated by among others GEF
- Pre-breeding and evaluation course of PGR material for addressing challenges of climate change in Lusaka, Zambia on 25th March - 7th April 2013

Visitors

Dr. Munyenyembe- Head SPGRC, Dr. Chikelu Mba (FAO), Dr. Joyce Mulila-Mitti (FAO), Mrs Thandie Lupupa, Dr. Dan Kiambi – Consultant (ABCIC): A technical support mission participating in the Plant Genetic Resources for Food and Agriculture National Strategy Stakeholders Workshop held at Mmelesi Lodge, Thaba Bosiu, Maseru, Lesotho, in May 2013.

(iv) Equipment and Facilities

With the exception of the faulty photocopier, label printer, and a seed drying cabinet, most of the equipment are in good condition.

B. Technical Report

(i) *Ex-situ* Conservation

It was reported that the active collection holds 1,519 accessions. Out of a total of 17 fridges, 9 freezers hold active material largely comprising cereal and leguminous crops.

Upon monitoring of the germplasm materials, the following were the germination results for the tested crops: Maize ranges between 89% and 93%, beans 63% - 87%, wheat is about 98% and barley 97%.

(ii) **Multiplication and Characterization:**

None of them conducted during the reporting period.

(iii) **Field Gene Bank Maintenance**

Maintains 64 different species of the indigenous medicinal plants and species of socio-economic importance

(iv) **Germplasm Collection**

About 44 plant species were collected for the field gene bank of which only two are new species of *Pentanisia prunelloids*. The rest are for replacement or to increase the number of plants per plot.

5. Documentation/SDIS :

(i) Documentation and Information

About 330 records were entered in the SDIS modules including Germplasm Collection Information System. The entries were 44 in collection module and 286 in active collection module.

Internet access and Linux server are connected through the Department of Communications which also houses the department's main server.

(ii) **Utilization of plant genetic resources**

Researchers and students were distributed with 29 accessions which they requested for research purposes.

For purposes of distribution, exchange and sharing, a material transfer agreement is drafted awaiting the inputs Chief Legal Officer for the Ministry of Agriculture

(iii) General Constraints

- Limited recurrent budget
- Minimal utilization of material in the gene bank
- Inconsistent power supply
- Gaps between the collected material and active as well between base and active collections
- Lack of local expertise in PGR conservation
- Inadequate equipment e.g. color chart, seed counter *etc*. (except for those that are covered under SPGRC FAO TCP project)
- Lack of irrigation facilities at research stations where multiplication and characterization activities are undertaken.

6. Requirements

The NPGRC requests for a germinator, a laptop, colour chart, seed counter, moisture analyzer, aluminium foil bags (large, medium, small), and carton boxes. It also needs a laptop, and a video camera.

The genebank is also in need of a computer dedicated for SDIS.

Malawi

A. General

Since its inception, the Centre has collected about 4,613 accessions, of which 4,097 are seed samples, and 516 vegetative samples. Samples were collected from 1,001 plant species (32 crop and 969 tree species).

(i) Staffing

During the reporting period, the Malawian NPGRC Curator, Mr Lawrent Pungulani continued with PhD study programme in New Zealand. At the same time two other scientists continued with thier studies. Mr Kingsley Kapila left the genebank after his term of service expired.

The genebank has four technicians, five research attendants, and 5 part time labourers

(ii) Equipment and Facilities

The Centre requested for pollination bags, carton boxes, and aluminium foil bags (medium and large sizes).

B. Technical Report

(i) Characterization, Multiplication and Rejuvenation

This entails a process of establishing characters of a particular accession, increasing seed quantity and improving viability levels.

The main objectives were to establish and document traits associated with different crops, increase seed quantity, and increase viability/germination capacity of seed.

This resulted into characterising about 19 accessions of cowpeas and also multiplication and rejuvenation of 23 accessions of different crops.

(ii) Seed Packaging, Processing and Storage

This activity aims at reducing rate of deterioration, improving on storability of the samples, and documenting, and retrieval of all the information associated with the germplasm.

The processing is going on and results will be reported later on.

(iii) Distribution and Sustainable Utilisation of PGRFA

The genebank has so far distributed more than 1,380 samples to 459 beneficiaries of which 122 are female farmers (26.6%), 274 male farmers (59.7%), 7 BSc students (1.5%), and 56 Scientists (12.2%).

It has duplicated about 1,389 crop samples at SPGRC; and all tree samples under the Millennium Seed Bank Project have duplicates sent to Royal Botanical Gardens (KEW).

Additionally, 70 wild rice samples were sent to IRRI.

Some promising sceintific results from distributed germplasm materials include:

- Pigeon peas drought screening, evaluation for agronomic traits – research underway;

- Cowpeas drought tolerance screening, evaluation for agronomic traits – research underway;
- Groundnut resistance to rosette - 3 accessions identified as resistant;
- Maize resistance to larger grain borer – research underway;
- Breeding for drought tolerance (earliness) - released some sorghum varieties

It can be said that success of the gene bank has improved as indicated by the number of users and samples distributed.

(iv) Documentation and Information

The new machine dedicated to hosting SDIS was installed with the database and staffs are able to input data.

(v) *In-situ*/On-Farm Conservation of Landraces

- Conservation of bambara nut in Ntchisi and Mzimba under DARS up scaling programme and McKnight funded project.

- Conservation of yams, sorghum, pearl and finger millets and cowpeas under PR 219 project.

(vi) Donor-Funded Projects

FAO funded project PR219

Project title: Improving livelihoods of local communities in semi-arid zones of Malawi through on farm conservation and exploitation the genetic potential and seed production of yams, sorghum, pearl millet, finger millet and cowpeas germplasm mitigating climate change

Mc Knight funded Bambara Project

Project title: Development and Promotion of Bambara Nuts for Improved Human Nutrition in Malawi, Mozambique, and Tanzania

Activities

- Sensitization meetings
- Baseline survey on socio economic status of farmers and production of target crops in all project sites.
- Gap filling collection
- Public awareness on the role of plant genetic resources
- Strengthening the community seed systems
- Eco-geographical survey
- Mounting of demonstrations and conducting field days
- Developing, finalising and owning of the national strategy on PGRFA

Project Underway

World Bank funded project

Title: Maize germplasm collection and characterisation for climate change adaptation to CCARDESA under APPSA with a project budget support of USD 200,000.

Project duration: 3years

(vii) Management of Field Genebanks

Malawi PGRC has established 4 field genebanks for:

- Cassava (197 accessions) and coco yams at Chitedze
- Sweet potato (110 accessions) at Chitedze
- Banana (70 accessions) at Bvumbwe
- Sugarcane (98 accessions) at Kasinthula

It was reported that Malawi lost three field genebanks (sweet potato, cassava and banana) due to diseases. However, it is planning to restore sweet potato and cassava field genebanks.

Challenges

- Power cut offs
- Break down of deep freezers and other equipment.
- In adequate cotton bags for seed drying

Mozambique

A. General

(i) Staffing

In terms of staff complement, there were no changes during the reporting period. A research officer, Mr Abilio Virissimo Afonso, successfully completed his MSc degree programme at the Swedish Agricultural University and returned home to serve at the NPGRC.

(ii) NPGRCom

No meeting was held since last year, and there was no change on the Committee composition.

(iii) Training, Workshops and Meetings

- Mr. Abilio Virissimo Afonso completed his studies at MSc. course in Sweden.
- Workshop: Development of national strategy on plant genetic resource for food and agriculture on 27 June 2013, Maputo, Mozambique.
- Mr Francisco Reis is pursuing his studies at BSc. Hons level (Agronomy) at the Polytechnic Institute in Maputo
- Mr. Francisco Reis and Ms. Carla do Vale attended a two weeks short training course on Pre-breeding and Molecular Characterization of Plant Genetic Resources at the University of Zambia, during last February, 2013.
- Mr Francisco Reis attended a 3 weeks training course on vegetable production, at Embrapa, Brazil, during last September, 2013.
- Ms. Carla do Vale, attended a 3 weeks training course on contemporary approaches to genetic resources conservation and use at the University of Wageningen, Holland in April- May, 2013.
- Dr. Paulino Munisse attended the Africa Regional Capacity Building Workshop on Nagoya Protocol on Access and Benefit Sharing (ABS), Traditional Knowledge (TK) and Nagoya Kuala Lumpur Supplementary Protocol on Liability and Redress of Biosafety (NKLSP), held in India.

(iv) Visitors

- Ms Thandie Lupupa, Dr Munyenyembe from SPGRC and Dr. D. Kiambi of ABCIC visited the Mozambique NPGRC in a technical mission to assist

development of national PGR strategy for conservation and sustainable utilization;

(v) Equipment and Facilities

The Mozambican NPGRC is currently in possession of 9 functional deep freezers, one functional precision weighing balance and 2 aluminium sealing machines. It also possesses a moisture analyzer, seed grinder, 2 desktop computers, 2 printers, 2 UPS. In addition, it has 3 air conditioners and 3 sets of camping equipment.

(vi) Requirements

The NPGRC is in need of the following items: 1 PCR, nanodrop, laboratory room, 1 germination cabinet, 1 seed drier, and pollination bags.

(vi) Constraints

The transportation to the field plots or collection target sites is still a challenge to the NPGRC due to lack of reliable transport.

B. Technical Report

(i) Germplasm Conservation

Currently, the NPGRC holds a total number of 2,823 accessions.

(ii) Regeneration and Multiplication/Characterization

During the period under review, no regeneration and multiplication/characterization activities were conducted at the NPGRC. The transportation to the field plots/collection sites is still a challenge to the NPGRC. There is an urgent need to acquire a new vehicle.

The Umbeluzi Research station where very often the multiplication and characterization activities are conducted is facing some infrastructure problems, i.e. water supply, old machinery and personnel. The Chokwe Research station was heavily affected by the recent floods this year.

(iii) **Field Gene bank maintenance**

Currently, the NPGRC does not have a field genebank.

(iv) *In-situ*/On-Farm

Nothing to report.

Germplasm collection

Nothing to report.

(v) Documentation and Information

The NPGRC has entered data for *Abelmochus esculentus* (21 acessions), *Arachis hypogea* (41), *Cajanus cajan* (19), *Capsicum* sp. (1), *Carya* sp.(14), *Citrullus lanatus* (130), *Cucumis sativus* (10), *Cucurbita maxima* (27), *Discorea* sp. (2), *Eleusine coracana* (12), *Glycine max* (72), *Helianthus annus* (21), *Lablab purpureus* (15), *Leersia hexandria* (5), *Mucuna purpuriens* (19), *Oryza longistaminata* (26), *Oryza sativa* (344)

It also has Oryza sp. (4), *Pennisetum glaucum* (29), *Phaseoulus vulgaris* (234), *Sesamum* sp (9), *Sorghum bicolor* (281), *Vicia faba* (1), *Vigna radiate* (14), *Vigna* sp. (1),

Vigna subterranean (106), *Vigna unguiculata* (144), *Zea mays* (334). This makes a total of 2,074 acessions stored in the active collection.

Namibia

A. General

The fundamental nature of conservation is for some forms of life to remain in existence in their natural state, to continue to evolve, as have their ancestors throughout evolutionary time. However, genebanks complement nature as it is used to preserve genetic resources for their immediate or potential usefulness to humans, in breeding or in some other form of research or development. Consequently, collections in Genebanks are the best option for progress as the climate continues to change and food prices are escalating. In addition, genetic diversity of plant species are threatened by genetic erosion. Many traditional landraces of crop species would have been lost had they not been collected and stored in the Genebanks. Therefore, safeguarding of genetic diversity in a Genebank is a matter of great importance.

As mandated by SADC Plant Genetic Resources (SPGRC), the Namibian National Plant Genetic Resources (NPGRC) has been conserving the genetic materials as per prescribed standards.

(i) Staffing

The National Plant Genetic Resources Centre form part of the National Botanical Research Institute, residing under the Directorate of Agricultural Research and Training of the Ministry of Agriculture, Water and Forestry.

The staff of the NPGRC are as follows:

- Ms S. Loots - Senior Agricultural Researcher is the curator of the Genebank and the *in situ* officer. She is currently doing her PhD in Sweden.
- Ms R. Moses - Agricultural Researcher.
- Ms K. C. Sikute - Agricultural Research Technician mainly responsible for supporting research activities and manage the technical aspects of the genebank
- Mr E. Lucas - Senior Technical Assistant

(ii) National Plant Genetic Resources Committee (NPGRCom)

There were no reported changes in the NPGR committee, but the committee has been dormant for many years. The NPGRC will have to review the members and only select people capable of serving on this committee.

(iii) Training, Workshops and Meetings

- Ms S. Loots is still on study leave pursuing her PhD in Sweden. Her research forms part of the *in situ* conservation of the genus *Lithops* in Namibia.

- Ms R. Moses completed her Honours Degree in Plant Sciences in 2012. She also attended a workshop on Disaster Planning and Management for Namibian Museums in August 2013.

- Mr Qhobela visited the Namibian NPGRC from 26-29 June 2013.

- Mr M. Daka the IT officer from SPGRC visited the NPGRC and managed to rescue the SDIS from the collapsing computer.

- Ms K. C. Sikute attended a two-day course on Biodiversity, Traditional Knowledge and Intellectual Property, organised by South Africa, the GIZ, the Department of Science and Technology (DST) of the Republic of South Africa and United Nations Conference on Trade and Development (UNCTAD).

(iv) Equipment, Supplies and Facilities

The NPGRC possesses two 4x4 vehicles running vehicles. There are a total of 48 upright freezers in the NPGRC of which 21 are filled. The NPGRC has four computers one of which is faulty and one printer in working order. It has two working dehumidifiers. NPGRC is currently featuring its own web page in the website of the National Botanical Research Institute at the following address: www.nbri.org.na. The website has links to the SPGRC website as well as that of the ITPGRFA.

The NPGRC has two sealers, two grinders, two growth chambers (germination cabinets), 4 electronic scales, two moisture content analysers, an autoclave and a laminar flow cabinet, all in working condition.

(v) Constraints

The lack of pollination bags (brown and white) is the major constraint at the NPGRC.

(vi) Awareness seminars

During this year, the NPGRC was visited by different schools, several tertiary institutions from Namibia and delegates from Argentina.

B. Technical Report

(i) *Ex situ* conservation

Germplasm Conservation

The NPGRC added 66 new accession of a wild species to the collection, accredited to the Millennium Seed Bank Project. The number of accessions in the national collection has increased from 3,917 to 3,983 and the number of batches increased to 5,008.

The total accessions in the Genebank consist of 50.5% crops and the rest are wild species, which will not be multiplied or characterised in the near future.

Germplasm Multiplication

Multiplication and characterization of Pennisetum glaucum

Due to lack of material needed to carry out multiplication and characterization of the *Pennisetum glaucum* accessions, this activity has been put on hold.

There are 1,450 *P. glaucum* accessions in the genebank of which only 668 accessions has been characterised to date. There is a need to characterize the reminder of the accessions.

Multiplication and characterization of Citrullus lanatus

The NPGRC planned to multiply 5 accessions end of 2012, but did not carry out this activity. The area allocated at Sandveld Research Station was not properly fenced off to keep rodents and all other animals away, hence the postponement of this activity.

Distribution of requested germplasm

Most of the species requested in 2012/2013 were from the wild plants *(Acacia, Sesbania, Sesamum, Acanthosicyos, Sclerocarya* and *Ziziphus*) and some crop species (*Vigna* and *Pennisetum*).

Approximately 50 accessions were distributed in 2012/13 for scientific annd research work, as well as crop restorations.

(ii) *In situ*/On-farm

In-situ

These activities were carried out by Ms Sonja Loots as part of her PhD work. Her focus is on *Lithop* species in Namibia. As a result, an ecological fieldwork is carried out on selected *Lithops* populations. Seedlings of *Lithop* species collected from 38 wild populations are raised and the DNA from these seedlings was extracted at the Swedish University of Agricultural Sciences. Work on molecular marker were conducted at an institute in Germany.

On-farm conservation

No activities were carried out in 2012

(iii) Germplasm collection

The NPGRC did not carry out any seed collection under the year reviewed. However the Millennium Seed Bank Project has added 66 accessions to our collections.

(iv) Other Implemented activities

Germination tests

The NPGRC managed to carry out germination test of 86 *P. glaucum* accessions from the Genebank of which 30 accession scored below 85%. Further tests will be carried out to verify these results.

The NPGRC also collaborated with the Division of Plant Production Research, Section Agronomy and Horticulture by assisting them with germination of breeder's material.

(iv) Documentation and Information

SDIS

Achievements

- The country profile is up to date.
- The manual register contains 3,983 accessions.
- Both the registration and active module stands at accession 3,917.
- Entered characterisation data of 120 accessions on SDIS from field books of 2002/2003 and 2006/2007 main season.
- SDIS germplasm collecting module stands at accession 3,781
- SDIS were backed up as new data were registered

Challenges

- The NPGRC could not use SDIS for about four months as the old computer had given up.
- The Germplasm Collection Information System is still behind.
- Most characterisation data still need to be re-entered into the SDIS Characterisation module

Internet Access

The NPGRC has internet facility.

Seychelles

A. General

(i) Introduction

It has been 5 years since Seychelles rejoined SPGRC network and during this time, several efforts have been put togther to revive the NPGRC.

(ii) Staffing

There were no new recruit for the PGR unit during 2011-2012 period. New recruitment is schedule for next year with the establishment of the NPGRC. The current staffing of the PGR Unit includes the Acting Curator and Acting Documentation Officer.

(iii)National Plant Genetic Resources Committee (NPGRCom)

The composition of the NPGRCom was been finalized and approved by the responsible authorities.

The Terms of Reference for the committee members were drafted and endorsed by the CEO (SAA). It is expected that soon the NPGRCom will commence its work.

The Committee is composed of:
- Chairperson (SPGRC Board member) (CEO SAA)
- Principal Officer – Research & Development, SAA
- Acting Curator NPGRC
- Policy Analyst, Ministry of Natural Resources
- Mr. Jose Lausteau Lalanne
- Rolline Oreddy, Acting Documentation Officer (NPGRC)
- Representative of the Attorney General's Office
- Representative, Ministry of Environment

(iv) Training Workshops, Meetings

- The Acting Curator attended the Bio-saline Agriculture technology training in Dubai from the 9th to the 20th of October 2011, organized by ICBA (International Centre for Bio Saline Agriculture) and funded by BADEA.
- The Acting Curator attended the Ex-Act Training, focusing on the use of the Ex-Act Software to calculate carbon footprint as a result of land uses changes. The training was funded by FAO and carried out in Mauritius.

B. Technical Report

(i) Ex-situ

The NPGRC has now secured a new location where the Soil Laboratory was before moving to its new location too. The new genebank is due for renovation and furnishing.

Besides the genebank room itself, it also has two offices for the officers.

(ii) In-situ

The only in-situ activity conducted was with Val D'Endor Farmers' Association which, with the Plant Conservation Action Group (PCA) undertook visits to identify areas to where some selected crops were found for in-situ conservation.

The selected crops include spanish tamarind, bilimbelle, Indian plum, aerial yam, Surinam cherry, patcholi, cassava, banana, coffee, jambrossa, tomato, yam, and sweet potato.

The NPGRC will keep SPGRC and the network updated on the work of the NGO and share all experiences, challenges and successes on this regard.

(iii) Documentation and SDIS

There was no progress made with regard to SDIS. This is because there is yet no formal genebanking activities taking place to have SDIS working.

However, it must be noted that there is a server at SAA and it has been proposed to have a space for use by SDIS. Staff will need re-training in SDIS so as to be able to manage and use the database.

(iv) Equipment, Supplies and Facilities

The seed testing laboratory which is adjacent to the NPGRC has received a set of analytical equipment for viability analysis which includes:

- Automatic moisture analyzer
- Automatic seed counter
- Oven with timer
- Seed germinator
- Seed separator
- EC meter
- Microscope
- Glassware
- Lamina flow cabinet

Procurement of the genebank equipment and facilities is scheduled to take place next year provided that the allocation for the genebank gets the necessary approval.

Swaziland

A. General

1. Introduction

The continued crop failure in dryland crop production due to changing weather patterns is Swaziland's major challenge. This challenge threatens food and nutrition

security particularly as population growth also increases. This necessitates the continued exploration of adapted and sustainable agricultural practices and food production technologies that can enable the country to address challenges confronting its people so as to sustain and increase food production and productivity.

A. General Progress

(i) Staffing

The has been no changes in staffing in the NPGRC as it is still manned by the Curator and Technician.

(ii) Membership and Strengthening of NPGRCom

Mr. Sipho Simelane who was Vice chairperson of the NPGR Committee retired in Novermber 2012. There were no meetings held during the current season.

(iii) Meetings, Trainings and Workshops

The following trainings and workshops were attended during the season under review.

- Workshop on techniques of tissue culture and healthy seedlings propagation Taipei, Taiwan, 9 – 19 April 2013

- MSc. training at Swedish University of Agricultural Sciences (SLU) by Ms. Busie Nsibande between 2011 and 2012.

- Workshop for Parliamentary Portfolio Committees Chairpersons on Conventions and Treaties, Ezulwini, Swaziland in October 2012, including a questions and answers joint seating of Parliamentary debate on the Treaties.

- National biodiversity strategy and action plan stalk-taking report workshop at Ezulwini, Swaziland, March 2013.

(iv) Equipment, Supplies and Facilities

It was reported that most of the genebank's equipment was working except for continuous ice accumulation on outside pipes on the freeze drier. The grinder is faulty and the standby electric generattor has a battery carging problem and thus both need attention.

(v) Facilitated accession to the ITPGRFA

Following the King's pronouncement that Parliament engage itself in debates for international conventions/treaties, in September 2012, a follow-up workshop for Ministers responsible and Portfolio committee Chairpersons was held for all Ministries that had conventions that needed Parliament's approval. The ITPGRFA was first to be tabled and approved by Parliament. An Instrument of Accession was deposited to FAO headquarters in November 2012. Hence **Swaziland is now a Contracting Party to the Treaty.** However, work on initiation of the Treaty domestication process has not yet been initiated.

B. Technical Report

The NPGRC, during the 2012/2013 cropping season, accomplished the following activities:

(vi) *Ex-Situ* Conservation

Germplasm Conservation

The Curator collected and deposited 5 wild cotton samples from Lower Usuthu Downstream Development Area. Also, 8 different crop samples were collected from sub-regional agricultural shows. This has brought the total number of accessions conserved by the NPGRC to 985 accessions. The NPGRC also continued with maintenance of vegetatively propagated crops and edible aloe germplasm in field genebank.

Germplasm Multiplication

While five beans accessions were multiplied for preliminary evaluation; six cowpea and one pigeonpea accessions were multiplied to increase quantities to meet requests. One each of lablab and mucuna accessions were also multiplied for use CA research trials.

Maintenance of germplasm in Field Genebanks

The NPGRC continued with monitoring and vegetatively propagated crop germplasm of cassava and sweet potato at the MRS field genebank. Edible aloe germplasm was also re-transplanted from light sandy loam to loam soil as they were not performing well in the former.

Distribution of requested germplasm

One pigeon pea accession was distributed to University of Swaziland lecturer for research purposes.

(i) *In-situ*/On-Farm conservation

There were no *in situ/on-farm* activities implemented during the 2012/2013 cropping season in Swaziland partly due to a combination of factors which include inadequate staffing and transport challenges.

(ii) Analysis of genetic diversity on Maize Trial, and Inbred line development

Forty maize accessions were selected and planted for analysis of genetic diversity as well as inbred line development under rainfed conditions. Unfortunately, emergence was very poor. As a result, genetic diversity analysis became impossible. Hence it was decided that the trial would then be maintained only for inbred line development. Consequently, a total of 37 maize inbred lines(S1) were successfully developed and is now processed and kept to be advanced to the next stage (S2) of inbred line development.

(iii) Documentation and Information

SDIS

There was no work accomplished on the SADC Documentation and Information System (SDIS) due to the continued staffing challenges.

Information dissemination

A groundnut accessions research paper on characterization of 18 accessions through joint collaboration between the University of Swaziland, Faculty of Agriculture and the NPGRC in 2011-2012 season was submitted to the Journal of Crop Science and is still pending publication. The paper is entitled 'Multivariate Analysis of Genetic Diversity of Groundnuts and Implications for Breeding'

Internet Access

The NPGRC Internet is functional except on certain occasions especially in the afternoon when it becomes very slow or connection suddenly ceases.

(iv) Challenges

The continued shortage of staff is the major challenge. The National PGR Conservation programme has been adversely affected as the officers are also involved in research programmes such as Conservation Agriculture. Transport is still a challenge in the Ministry of agriculture due inadequate funds.

Tanzania

A. General

(i) Staffing

There was a slight change in the staff status at the NPGRC. Mr. Shedrack Solomon was transferred from NPGRC to TPRI for other official activities.

In the centre are five research scientist, two field officers and two supporting staffs.

(ii) Meetings, Workshops, Trainings

- A workshop in Nairobi on the preparation for a project "collection of landraces and wild species of *Oryza* in Kenya, Tanzania and Uganda" , attended by Dr. M. Mollel, Mr. W. Hamisy, Mr. M. S. Kabululu and Mr. E. Mausa

- An African Regional Workshop on Plant Conservation in Cape Town, South Africa attended by Mr. L. N. D. Mapunda

- Three scientist attended inception workshop on "varietal diversification to manage climate risk in east Africa" organized by ABCIC and Bioversity international, Nairobi – Kenya

- Dr. Margaret Mollel attended "Access and Benefit sharing course" in Gaborone, Botswana from 4th to 8th February 2013

Trainings/Short courses

- One staff attending an M.Sc. training in Molecular Biology and Biotechnology at Sokoine University of Agriculture in Morogoro, Tanzania

- Short course on pre-breeding and Molecular characterization at University of Zambia attend by Mr. M. S. Kabululu and Miss. G. Kanyairita

(iii) National Plant Genetic Resources Committee (NPGRCom)

Due to lack of funds, no NPGRCom or Crop working Groups meetings was held during the period under review.

(iv) Constraints and Material Requirements

The Centre is constrained by lack of enough space that can accommodate additional freezers and office for staffs.

At the same time, it must be noted that the available motor vehicles which the centre has are too old for field activities. The screen and green houses have passed their life time, hence a need for renovation

(v) Major Achievements

- The Centre managed to collect and conserve 586 seed samples of rice landraces
- The centre has carried out regeneration and characterization of 142 seed accessions from 4 crop species.
- The centre managed to acquire an old car from the Ministry of Agriculture and Food Security.
- The center distributed a total 360 different seed accessions to researchers

B. Technical Report

(i) Exploration and Colletion

During the year under review, the NPGRC undertook 4 germplasm collection missions, 4 of which were targeted on rice under Gatsby funding. A total of 569 rice accessions were collected during the mission covering Southern, Northern, Coastal and Central Agricultural Zones. The remaining mission was in collaboration with KEW- Botanical Garden, UK targeting wild seed germplasm around Mount Kilimanjaro.

(ii) Multiplication, Regeneration and Characterization

A total of 142 accessions were multiplied**,** regenerated and characterized. These included 71 maize, 9 soybean, 20 pigeon peas and 42 peas' accessions.

(iii) Germplasm Distribution

In the effort to step up sustainable utilization, the NPGRC distributed 5 Amaranth, 7 Crotalaria, 2 Corchorus, 10 pumpkin, 1 Lagenaria, and 3 Cowpea to AVRDC. It also distributed 2 wild rice, and 4 Crotalaria accessions to a Nelson Mandela University student.

On the same vein, 8 cowpea, 7 Lablab, 8 pigeon peas, 1 Dolichos, 1 *Glycine max*, 1 Mucuna, 9 Crotalaria accessions were distributed to ECKO Company; whereas, 80 pigeon peas, 124 sorghum, 68 cowpea accessions were distributed to partners of ABCIC Project; and 15 maize accessions were distributed to a Norwegian University student.

(iv) *In-situ*/On-farm Conservation

The ongoing 3 years project, titled: "Strengthening On – farm conservation of selected neglected and underutilized crop species - NUCS (cucurbits, finger millets, yam) in Tanzania" continued with funding from the government through the Commission for Science and Technology.

It objectives is to generate baseline information on useful traits (drought, insect, and diseases resistance) of the selected NUCS, generate information on traditional cultural practices on crop management and utilization and to generate information on the rate of genetic erosion. It also aims at evaluating and identifying the best traditional management practices for NUCS conservation and sustainable utilization.

(v) Documentation and Information

A total of 5,274 accessions have been registered in the system so far while a lot more information is still to be electronically entered. However, the database continues to be regularly updated.

The SPGRC Senior Documentation Officer (Mr. B. Kapange) visited the centre in June, 2013 for database update when he, among other things, conducted training on data entry in characterization module.

(vi) Genetic Enhancement

In order to enhance genetic diversity in the country, studies were conducted on assessing the genetic diversity of rice landraces and its wild relatives conserved at NPGRC-Tanzania, using SSR markers. In this study, 79 rice accessions from the genebank were assessed with view to determine their morphological diversity and estimate genetic relatedness of rice accessions conserved at the genebank using SSR markers. Results in cluster analysis and principle component analysis were made.

Zambia

A. General

Institutional Framework

The National Plant Genetic Resources Centre (NPGRC) is a section in the Crop Improvement and Agronomy Division within the Zambia Agriculture Research Institute (ZARI), a department within the Ministry of Agriculture and Livestock (MAL). The NPGRC has a wide national mandate of conservation of and facilitating access to and promoting sustainable utilization of plant genetic resources for food and agriculture.

In its implementation of the activities, the NPGRC is working in close collaboration with the SPGRC within the framework of SADC PGR Networking. The national programme is collaborating with a number of national and international partners in the implementation of its plant genetic resources conservation activities. During the period under review the programme undertook some of its activities mainly with funding from the government.

(i) Staff Position

During the period under review the staff position at the NPGRC remained unchanged both at professional and technical levels. There are three (3) professional officers, one (1) Technical Research Assistants and two support staff. One of the support staff attained his retirement age.

(ii) Training, workshops and Meetings

During the period under review, three NPGRC members of staff participated in the SADC regional training workshops. Womba Peggy Kamusaki and Edwin Ng'ona participated in the SADC Regional training course on Pre-breeding and molecular characterization of PGRFA that was held in Lusaka, Zambia from 25th February to 7th March 2013.

Mr Graybill Munkombwe, participated in a two days training workshop on Biodiversity, Traditional Knowledge and Intellectual Property for Sub-Saharan African countries in South Africa between 9-10 September 2013.

(iii) Facilities and Equipment

The NPGRC has one running vehicle which is old and now has very high maintenance costs.

During the period under review, the seed dryer developed a fault and worked on by a Lusaka company known as Electro air. It is now in its working condition. However, there is need for regular servicing and frequent changing of filters. SPGRC is being requested to avail reference manuals as guidelines for servicing this equipment.

The 30 KVA genset that was procured in 2007 with support through the SPGRC Project is still functioning well.

The number of deep freezers has remained at 28. However, there is need for additional number of freezers considering that there anticipated increase in the number of accessions and batches arising from collecting and regeneration activities respectively that were undertaken during the period under review.

There are challenges of germination testing of the conserved germplasm accessions at the NPGRC. The NPGRC does not have a seed germination facility of its own to undertake germination testing. In the past, the NPGRC has relied on facilities at the Seed Control and Certification Institute (SCCI) for viability testing. However, SCCI gives priority to seed samples from Seed companies, which leads to delays. This has adversely affected work of monitoring viability of conserved germplasm accessions in the genebank.

Currently, the NPGRC has just acquired a seed moisture analyzer from the USA. The equipment will enable efficient determination of seed moisture content prior to storage.

The NPGRC has two (2) functional desktop computers and two functional printers, a LaseJet M1132 MFP and HP LaserJet P1005. Two other printers, HP LaserJet 4200 PS, a and Sharp model AL-1556, AL-1566 are not functional and require repair. There is a challenge of sourcing some spares for the sharp printer locally.

(iv) Collaborating Institutions

The NPGRC is collaborating with both national and international institutions in the implementation of the plant genetic resources conservation activities. Some of the national collaborating institutions are Community Technology Development Trust (CTDT), Biodiversity Community Network (BCN), National Remote Sensing Centre (NRSC), University of Zambia (UNZA), Seed Control and Certification Institute (SCCI). At international level, the NPGRC is collaborating with the Food and Agriculture Organization (FAO), Bioversity International and ENZA ZADEN.

B. Technical Report

(i) PGR Conservation and Distribution

The active collection at the NPGRC is still undergoing realignment so that the germplasm accessions conserved correctly match with the record on the SDIS. Currently, the number of accessions held in the genebank stands at 6,500 without taking into account the recently collected plant genetic resources. The centre is also maintaining a living collection of 100 accessions of cassava in the field gene bank.

As part of its mandate, the NPGRC is charged with the responsibility of facilitating access to conserved plant genetic resources for purposes of research and development.

The NPGRC implemented four major field technical activities during the course of the 2012/13 growing season. These field activities involved regeneration and

characterization of germplasm accessions; germplasm collecting targeting traditional leafy vegetables in Nyimba district; on-farm conservation of crop genetic diversity and characterization and maintenance of cassava germplasm in the field genebank at Mount Makulu Research Station. In addition, the NPGRC implemented three planned activities under the FAO/SPGRC Technical Co-operation programme. The NPGRC plans to continue with some of these activities and also plan to implement new activities during the 2013/14 growing season.

(ii) Distribution of Germplasm

During the period under review, a total of 76 germplasm accessions of various crop species were distributed to users. A total of 18 accessions of sorghum, cowpea (9 accessions) and 3 accessions of pearl millet were distributed to Biodiversity Community Network, a local NGO, for participatory seed multiplication and distribution to farmers in project sites of Southern and Western Provinces. The University of Zambia, School of Agricultural Sciences through its MSc student requested for 31 accessions of paddy rice. The Norweagian University of Life Sciences requested for 7 accessions of maize and 8 accessions of sorghum for research and development.

(iii) Multiplication and Characterization of Germplasm Accessions

These were done to increase seed quantity of accessions in order to duplicate the accessions to the base collection and be able to respond to requests for seed samples by users of PGRFA, and characterize the conserved germplasm accessions.

A total of 202 germplasm accessions of maize, rice, cucurbits and sesame were planted during the 2012/13 season. Of these, one hundred and eighty eight (188) accessions were finally harvested. All the four wild rice accessions (ZMB5012, ZMB5013, ZMB5014 and ZMB5015) did not germinate. Six of the cultivated rice accessions flowered but aborted resulting in failed grain formation.

Characterization of rice germplasm

Fourty five (45) rice accessions were planted in the paddy plots at Mount Makulu Research Station during the last planting season. Data on a total of eight (8) agromorphological traits was measured and observed at the vegetative and reproductive growth stages of the crop. The collected data on the vegetative and reproductive traits was subjected to multivariate analysis using the Unweighted Pair Group Method with Arithmetic mean (UPGMA) (NTSYS pc 2.1).

Cluster analysis of the data yielded a dendrogram that placed a total of 40 accessions in one cluster. The analysis indicated that one accession, ZMB2875, was dissimilar from the rest of the rice accessions involved. Within the fourty accessions that formed one cluster showed to be dissimilar from one another at various levels of similarity coefficient.

The Unweighted Pair group method with Arithmetic Mean clustering of 45 rice accessions based on similarity matrix were made; and the matrix plot projecting rice accessions (OTUs) with the eight traits (vectors) in graphics module of NTSYSpc yielded a plot pattern where traits Culm habit, panicle number per plant and culm number were responsible for the grouping together of accessions.

In conclusion, it was evident enough that there is a good deal of genetic diversity among the rice germplasm accessions involved in the characterization. Notably, the germplasm accessions showed great variation on time period to heading and maturity. In addition, there was variation among accessions for plant height and panicle length.

Characterization of maize germplasm

Fifty (50) accessions of maize grown in unreplicated plots were characterized in the field at Mount Makulu Research Station. Eleven traits were measured and observed during the field activity. Characterization data obtained from agromorphological characterization of 50 germplasm accessions of maize were subjected to multivariate analysis using NTSYSpc 2.21.

Cluster analysis based on 11 traits based on UPGMA with arithmetic mean clustering method yielded a dendrogram with several dissimilar clusters were done. Notable among them is the cluster grouping ZMB7002 and ZMB6967 exhibited the characteristic of dissimilarity from other maize accessions.

The matrix plot projecting maize accessions (OTUs) with the eleven traits (vectors) in graphics module of NTSYSpc yielded a plot pattern where traits Culm habit, panicle number per plant and culm number were responsible for the grouping together of accessions.

It can be concluded that significant variation was observed among the maize accessions that were included in the field. Maize accessions showed some similarity and dissimilarity based on ear and plant heights as well as days to tasseling and days to silking.

Characterization and evaluation of cassava germplasm collections

The NPGRC is maintaining cassava germplasm as living collection in the field gene bank at Mount Makulu Research Station. These local germplasm materials were collected from Luapula, Northern and Northwestern provinces of Zambia. These cassava germplasm collections exhibit a wide genetic variability in terms of the agro-morphological traits and quality attributes. Utilization of these collections has to a larger extent been limited because little or none is known about their agromorphological characteristics.

During the period under review, cuttings of the cassava collections were planted out in the field in unreplicated design with specific objectives of rejuvenating the cassava collection, characterizing and evaluate the cassava germplasm collection, and maintenance of the cassava as a living collection.

One hundred (100) cassava accessions were planted at the start of 2012/13 season. The accessions were planted at the intrarow spacing of 1.5 m and interrow spacing of 2.0 m to allow the scoring of individual plots and avoid mixing by lodging.

Agromorphological data was recorded using descriptors developed by Fukuda *et al.*, 2010. The data collected is based on descriptors used by both CIAT (Colombia) and EMBRAPA (Brazil), which encompass the world's cassava collections. Scoring of descriptors was staggered at three, six and nine months' intervals. Other descriptors would be scored at harvest during the second growing season. This far, data has been collected at three and six months from planting. More data is to be collected at nine months from planting and at harvest stages.

The field data collection is ongoing and will continue during 2013/14 season. Therefore, there are no results to be reported at this stage.

iv. Targeted gap filling germplasm collection mission

The main objective of the germplasm collection mission was to fill the existing collection gaps with respect to geographic and species coverage targeting areas in Nyimba district and species in Family Cucurbitaceae, respectively.

The collection mission was undertaken by the NPGRC in collaboration with SPGRC and Department of Agriculture (DoA). Consequently, the collection team was

composed of staff members from the stated institutions. Lead farmers in particular collection areas were also important resource persons that were substantially involved in reaching out to the farmers during the mission.

During the undertaken mission, a total of 87 samples of germplasm were collected covering about five crop species. Considering that the mission was undertaken after harvest, most of the samples collected were in form of fruits and in rare cases were seed samples collected. Of the 87 samples collected, 36 were *Cucumis* spp, 39 were *Cucurbita* spp, 2 were *Lagenaria sinceraria*, 7 were *Lycopersicon* spp and 1 sample was *Solanum* spp. In most cases, the samples were collected from female farmers.

Genetic diversity, indigenous knowledge and Genetic erosion
Comparatively, there was high variation with respect to *Cucurbita* spp. Generally, very few farmers in the areas reached were maintaining genetic resources of traditional vegetable species. As a result only a few households were able to provide germplasm samples of the target crop species. Notably, the mission did not come across any of the farmers growing Ethiopian mustard, *Brassica carinata*. In most cases, the indigenous knowledge was not passed on to the younger generation. A number of factors were mentioned as causes of genetic erosion. Largely, there was preference for cultivation of high value crops that could be marketed to realize some income for the farm family.

Conservation and utilization of PGRFA
The collected plant genetic resources during the collection mission are part of those listed in Annex I of the Treaty and as such are in the public domain under the Multilateral System and could be accessed by users such as planr breeders and other researchers at national, regional and international levels for purposes of research, training and development. These germplasm material will be made available to users through the use of the Standard Material Transfer Agreement (SMTA) of the ITPGRFA.

v. On-farm conservation of genetic diversity

Participatory evaluation and selection of varieties of crops selected by the farmers
The NPGRC continued with on farm activities in Rufunsa, Situmbeko and Chikankata. During the period under review, activities centred on the planning phase to prepare farmers in the three areas for participatory evaluation and selection of varieties of crops selected by the farmers. The proposed activities on farm will be implemented with support under Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL), an initiative of the German Federal Ministry of Education and Research (BMBF) in co-operation with Angola, Botswana, Namibia, South Africa and Zambia with focus on water, climate, forestry, biodiversity and agriculture.

The specific objectives of the preparatory meetings undertaken during the period under review in the three areas were to identify and document the traditional custodian farmers in the three areas, select and prioritise crops to be involved in participatory variety evaluation and selection, and identify lead farmers that will host participatory variety field trials.

Food security crops in the target areas
The crop identification process was carried out by local farmers. In the three areas visited, there was commonality in the crops that constituted food security crops as identified by farmers in Rufunsa, Chikankata and Situmbeko. Specific food security crops were identified as sorghum, maize, groundnuts, Bambara groundnuts, cowpea and sweet potato.

Selection of crops for participatory variety evaluation and selection
When it came to selection of crops whose varieties will be involved in participatory evaluation and selection, there were not significant differences between areas. The

common crops that were selected for on farm evaluation of their varieties were maize and cowpea.

Design of the participatory evaluation trial
For each site, three farmers were selected to host each of the crop. Therefore, each farmer would be a replicate for each crop. This meant that for each site and the two selected crops involved, there will be six farmers participating in the field evaluation. The farmers hosting the field trial will manage the field and will be involved in the collection of data. The field will at an appropriate time period host field days during which time group evaluation and selection of the varieties will be undertaken. The crop varieties that will identified to be suited to the area will be passed on to other farmers to enable them grow them during the following rainy season.

Assessment of In-situ/On-farm conservation, Determination of Crop Diversity Hotspots
This study embarked to assess the status of *in-situ*/on farm conservation of PGRFA and determination of the genetic diversity hotspots for the project priority crop species in Zambia.

Status of in-situ/on-farm conservation
In situ and on-farm conservation of PGRs is considered as complementary strategies for the management of PGRFA. In general, *in situ* and on farm conservation is not well developed compared to *ex situ* conservation, due to a number of factors. Although there are limited deliberate efforts to promote on farm conservation of farmers' or local traditional crop varieties, the role of farmers and farming communities in the development and conservation of their own local traditional varieties is recognized and can be a useful starting point for further promotion and enhancement of on farm conservation of these resources.

Though on a small scale, deliberate efforts are being made to promote crop genetic diversity conservation through the involvement of farmers and communities by the NPGRC in collaboration with a number of other organizations including NGOs. Some pilot activities in this regard have been carried out since 1999 in Rufunsa area as part of the regional initiative involving Malawi, Zambia and Zimbabwe. Some of the activities undertaken in Rufunsa include participatory multiplication and distribution of farmer preferred local crop varieties, which included groundnuts and sorghum, conducting seed fairs and field days.

This work has been extended to a few other areas, which include Situmbeko, Simutwe and Mamvule in Mumbwa district and Nadezwe and Simutwe in Chikankata district.

There are a number of National parks and forestry reserves where crop wild relatives of certain crops such as cowpea are found. Though not specifically designed as conservation sites for these wild crop relatives these to some extent do serve as in situ conservation areas for the plant species occurring in these areas.

Community Mechanisms for Management of Crop genetic resources
Most small scale farmers or smallholder households source genetic resources of crops, as seed, mainly from their own farm saved seed and sometimes from neighbours either through exchange or gifts. Seeds are also sourced from relatives, friends in other communities especially in disaster situations such as crop failure or poor harvest due to drought, floods and crop damage due to outbreak of pest and disease epidemics. Disasters such as prolonged drought, crop diseases have adverse effect on the perpetuation of certain crop varieties.

Seeds of improved crop varieties are in most cases externally sourced through commercial retail outlets supplied by Seed Companies. The availability and accessibility is determined by market forces of supply and demand. In a number of

instances farmers have recycled seed of improved varieties mainly on account of not having adequate cash to purchase fresh seed.

The predominant pattern of exchange of seed of local crop varieties among the small scale within the traditional farming communities is free exchange among friends and neighbours within the same community. There is, however, a growing shift in the pattern of exchange with more incidences of selling for cash or barter being observed. Generally, there is free access to crop genetic resources by close relatives and friends within and around neighbouring communities. It is relatively easy for local farmers residing outside a particular area or district to access crop genetic resources.

There are certain individuals within the traditional farming communities of small scale farmers who were considered owners of particular varieties.

There is no system that allows benefits arising from utilisation of genetic resources accessed from a particular community to accrue directly to that community. Benefits, which are normally in monetary form, arise from transactions during the exchange of seeds and these mainly benefit the households that are directly involved or own them. This, therefore, means that households that are holding seed usually benefit more than those with little or nothing to offer.

Determination of Crop Diversity Hotspots
The crop genetic resources found in Zambia consist of mainly traditional varieties that have evolved over a number of generations through both human and natural influences. Zambia has also benefited from exotic genetic resources, which has enhanced the local germplasm and facilitated the development of higher performing varieties that are also widely adapted.

Cultivation of these crop species over time has led to the generation of unique and valuable crop genetic diversity that has played and continues to play an important role in contributing to household food security. There are also wild crop relatives occurring in Zambia. These include wild relatives of rice, cowpea, sorghum and a range of Cucumis species. A wide range of indigenous vegetable species which may be semi-cultivated or gathered from the wild also occur throughout the country.

Methodology for determination of the hotspots
The determination of possible genetic diversity hotspots for priority crops including sorghum, pearl millet, groundnut, bean, cowpea and cassava was based on germplasm collection data or passport data of accessions maintained at the national gene bank. Between 1992 to date, a total of 1,682 crop germplasm accessions have been collected mainly from farmers' fields throughout the country. Collection site data, which include province, district and village from which each of these priority crops were collected from was obtained from the “Collection Information Database” of the SDIS being used. It is assumed that the number of collections for a particular crop in a given place indicates genetic diversity richness and is therefore assessed as possible diversity hotspot for the respective crops. Given the data available it was found practical to base the determination of diversity hotspot at the district level.

Findings on the national crop genetic diversity hotspots
Sorghum is grown in almost all parts of the country to varying extents. However, sorghum cultivation is considered to be more prevalent in the Zambezi-Gwembe valley areas of Southern province, southern and central parts of Luangwa valley in Lusaka province, parts of North-Western, Central and Copperbelt provinces. It is a major staple food crop in the valley areas of Southern and Central provinces as well as semi arid regions of Muchinga and Eastern provinces. Variation in traditional cultivars is found in panicle, glume and grain characteristics. Local cultivars are still widely grown though gradually cultivation of improved varieties that are early maturing and higher yielding is being adopted. Apart from the valley areas of Southern province, hectarage under sorghum has been reducing due to farmers more and more shifting from

sorghum to maize cultivation. This is true for areas in Copperbelt rural once considered to be predominantly sorghum growing areas and parts of Lusaka province such as Luangwa and Rufunsa districts. Wild and weedy forms of sorghum also occur in some parts of the country.

Pearl millet is grown as a rainfed crop in parts of Western province and valley areas of Southern province. The crop performs relatively well in low rainfall areas and on poor sandy soils, where other cereal crops may not do well. Pearl millet in Zambia, however, does not seem to have much variability. A number of improved varieties has been developed and released by the Sorghum & Millet Improvement Team of ZARI over the past 20 years or so. These have been taken up for cultivation by some farmers in Western province and are expanding the varietal diversity available for pear millet.

Cowpea in Zambia is mainly grown by traditional subsistence farmers almost throughout the country. Variation between cultivars can be found in growth habit, maturity, pod length, pod colour, seed size and colour. Mehra (1981) reports the occurrence of more variation in agro-morphological characters, seed colour and seed coat patterns in Southern and Western provinces. A lot of germplasm has over the years been introduced from outside the country through crop improvement programmes. A number of improved varieties have been developed and released by the Food Legume Improvement Programme of ZARI over the past 20 years or so. These are short maturing and more erect in terms of growth habit compared to the traditional varieties. A few farmers are taking up cultivation of these varieties especially in Southern province.

Common bean is grown in almost every part of the country though more prevalent in Northern, Muchinga, North-Western, Luapula and Central provinces. Wide variability is found in Eastern, Northern and Muchinga provinces. Both bushy and viny types occur with the widest variation being in seed colour, size and shape. Crop improvement efforts for beans have over years resulted in the introduction of a lot of germplasm from outside the country mainly from the International Centre for Tropical Agriculture (CIAT), leading to the development and release of over 10 improved varieties. The adoption and uptake of these improved varieties by farmers is however limited partly due to inadequate promotion and seed availability.

Groundnut is grown in all provinces of the country, though Eastern province leads in terms of area cultivated and quantities produced. Central, Northern and Muchinga provinces are also important groundnut production areas. The common types grown in Eastern province are Chalimbana, with a spreading habit. There has been an increase in farmers growing improved varieties, including *MGV4*, *MGV5* and *Chishango* which have been developed by the Food Legume Improvement Programme of ZARI. Cultivars grown in Southern province are generally small seeded such as Natal common. Variation in groundnuts is rather limited compared to common bean for instance.

Only 15 records relating to passport data for cassava were found in the database, and all the collections came from Kaoma district in Western province. Cassava is however widely grown in Northern, Muchinga, Luapula, North-Western and parts of Central provinces. There is therefore likelihood of there being a number of hotspots for cassava germplasm diversity in many of the districts found in these provinces.

Cassava has generally been associated with finger millet, groundnut and bean cultivation. The local cultivars are tall, late maturing, with a lot of variation in tuber shape, size and sweetness. Considerable variation exists and mostly found in Northern, Muchinga, Luapula North-Western and parts of Western provinces.

Conclusions

The assessment of possible areas of genetic diversity hotspots based on relative numbers of germplasm accessions collected has its own limitations. The number of

samples collected per district for a particular crop may depend on the intensity of sampling, which may vary from one district to another. It may also depend on the area sampled. Some districts may for instance have been sparingly collected, while others were widely surveyed and collected. Cowpea and groundnuts are likely crops that may be affected by these factors.

Since most collections were undertaken years back it may also be tricky to assess hotspots on the basis of collection information as significant changes may have taken place in the cropping systems of particular areas. There has been a shift in the type of crops grown for a number of areas, although there are a number of areas that have remained relatively stable. Determination of possible crop diversity hotspots may also require a review of the status and extent of cultivation of the target crop species.

In view of the forgoing observations and limitations regarding the determination of crop diversity hotspots, including changes that have taken place affecting farming and cropping systems, further verification work will need to be undertaken to pin point diversity hotspots for the respective crops. Such verification work should include the identification of 'custodian farmers'- farmers who maintain crop genetic diversity in the farming communities as part of strategy to promote on-farm conservation. The districts that are indicated as rich in genetic diversity based on collection information could be starting points for such verification works. This will require conducting field visits and interviewing key knowledgeable individuals, such as district extension officers and NGOs working in some of these areas as well as farmers.

vi. Assessment of the Conservation status, use and threats to PGRFA in Zambia

Status of human capacity at the PGRFA programme

The staff establishment of the National Plant Genetic Resources Programme as approved by Personnel Staff Management Division (PSMD) at the Cabinet Office has a total of ten (10) positions. These are 5 positions each at professional and technical research assistant levels. However, the current staffing levels at the programme are such that there are three professional staff and one staff member at technical research assistant level.

A good number of staff members has been trained at even MSc and PhD levels through capacity building provided through the SPGRC project. However, the programme has over the years experienced serious retrition rates as a result of resignations, retirement and deaths. The programme has not been able to retain its trained staff members mainly because of poor conditions of service. This has led to highly trained staff leaving the programme for better paying job opportunities either at national, regional or international levels. Currently, the staff position especially at both professional and technical research assistant levels at the national PGRFA programme is not adequate enough to fulfill all the routine responsibilities of ensuring that the genebank could acquire, conserve, document information and distribute germplasm according to the international standards.

Infrastructure and facilities for the conservation of PGRFA

The genebank building is currently fully housed in a new building located at Mount Makulu Research Station. This building was built through funding from the Government of the Republic of Zambia (GRZ) and the SPGRC project. The building has adequate space for office accommodation, seed packaging laboratory, seed drying, seed storage and documentation room.

Trend of plant genetic resources vulnerability and erosion

There has not been serious loss of genetic diversity of the collected and conserved seed samples at the genebank. However, the situation may have not been the same for germplasm collections that are vegetatively propagated such as cassava (*Manihot esculentus*), livingstone potato (*Plectranthus esculentus*) and sweet potato (*Ipomoea*

batatas). Presently, the vegetatively propagated germplasm are only conserved as living collections in the field genebank. Unlike cassava, livingstone potato and sweet potato germplasm collections cannot easily be maintained as living collections in the field genebank. A number of factors such as pests and diseases, prolonged dry spells and incidences of drought have contributed to loss of livingstone potato and sweet potato in the field. Although germplasm accessions of livingstone potato and sweet potato were collected and established in as living collections virtually none of these collections currently exist in the field genebank.

At farmers' fields level, crop diversity faces threats of genetic loss and erosion due to natural disasters arising from climate change and human driven factors. Key among the human driven factors are policy related such as promotion of improved crop varieties through the Farmer Input Support Programme, a government programme intended to subsidize crop production of a selected crop species such as maize and more recently cotton, sorghum and rice.

Status of PGRFA acquisition and species coverage
Since its inception in 1989, the national plant genetic resources programme has undertaken a number of collection missions covering most parts of the country. The collection missions have in most cases been of multi-crop nature where many crop species have been targeted for collection. These havelargely been seed samples of orthodox crop species. Only in a few cases has collection mission been undertaken targeting vegetatively propagated crop species such as cassava or sweet potato. According to the information on the documentation system, the NPGRC has acquired and registered a total of 6511 seed crop accessions.

Status of ex - situ germplasm conservation and safety duplication
The PGRFA conservation priorities have been in line with the priority species set for the SADC region, which mainly focused on major traditional food crop species. In general, however, the indigenous and adapted crops have received high priority. The priorities have also been influenced by the existing conservation facilities for PGRFA. This perhaps explains the initial bias towards orthodox seeded crops as opposed to root and tuber and fruit tree and plantation crops, which are vegetatively propagated. Some limited work has been done to undertake the conservation of vegetatively propagated crops, mainly cassava as living collections in field genebanks.

Currently, the NPGRC is holding about 6,500 accessions of different crop species in form of seeds samples, maintained in deep freezers at -20°C as an active collection under long term storage conditions. The NPGRC also maintains 100 germplasm collection of cassava maintained as living collectins in the field gene bank. The NPGRC has duplicated a proportion of its germplasm collection of orthodox seed material to the Base collection at SPGRC and Safety collection under permafrost conditions at the Svalbald global seed vault in Norway.

The NPGRC also participated in a regional project for the regeneration of threatened germplasm accessions with support from the Global Crop Diversity Trust (GCDT) which culminated into the regeneration of 865 germplasm accessions of maize, sorghum, cowpea and beans that were identified threatened due to low viability and/or having fewer seeds. Through this project initiative, the NPGRC has managed to safety duplicate 171 accessions of maize to CIMMYT in Mexico, 96 accessions of cowpea to IITA in Nigeria and 400 germplasm accessions of sorghum to ICRISAT in India as well as passport data associated with these accessions.

Data and information generated on the conserved plant genetic resources is valuable and require to be safely stored in the manner that provides for easy retrieval, updating, accessing and interpretation by both the PGRFA staff and the users of the conserved germplasm material. For these reasons, like other NPGRCs in the SADC region, the Zambian NPGRC has in place a computer based information system known as SDIS that has been developed through SPGRC project. the information system

holds information related to accession registration, active collection data, monitoring the accession viability and germplasm distribution through its genebank management module. The system also has the germplasm collecting information module that permits entry and editing of passport data associated with the collected germplasm.

Status of PGRFA characterization and evaluation
The ultimate objective of plant genetic resources mobilisation and conservation is to make them available for use in crop improvement and research both in the formal and informal sectors. As part of its responsibility, the NPGRC undertakes genetic characterisation and preliminary evaluation of the conserved genetic resources in order to add value and enhance utilisation of these resources. Although there are several methods that can be used in characterisation, the NPGRC has only used morphological and agronomic data generated by growing the accessions in field plots.

Of all the germplasm collections held in the genebank, about 40% have been characterized in the field using morphological and agronomic data based on descriptor lists developed by the International Plant Genetic Resources Institute (IPGRI), now Bioversity International. Crops that have been characterised include sorghum, maize, cowpea, beans, pigeon pea and pearl millet. Apart from making information on the genetic makeup and some agronomic attributes of the accessions available, the data generated could be used to assist in the identification of duplicate accessions within the collection. It should also be noted that morphological characterisation has only targeted major crops with the bulk of the minor crops still untouched. This bias has partly been dictated by the active research programmes in these crops for which adequate descriptors exist.

Morphological data alone may not be adequate enough to facilitate rational conservation and efficient utilization, including creation of core collections. There is need to explore the use of molecular characterization as complementary methods. The technical and scientific capacities need to be developed and adequately supported for undertaking molecular characterization of conserved germplasm collections.

PGRFA distribution and utilization
Since its inception, the NPGRC has distributed a total of 1,738 germplasm accessions to users within the country and internationally. A total of 47 germplasm accessions have been requested by local small scale farmers for seed multiplication and restoration of their farming systems. The rest of the germplasm accessions has been requested by breeders and researchers at national and international levels for use in the research and development. The NPGRC has received requests for such crop species as maize, sorghum and finger millet. Other crop species for which PGRFA has been distributed to the users are beans, cowpea, bambara nuts, cleome, amaranths and cucurbits.

At national level, maize germplasm accessions have been distributed to Maize Improvement Programme, Seed Control and Certification Institute (SCCI) and the University of Zambia (UNZA). The Maize Improvement Programme requested for maize germplasm for field evaluation on traits such as grain quality, drought tolerance and earliness. The Sorghum and Millet Improvement Programme have mainly requested for the sorghum and millet accessions for development of breeding lines and cultivar development. Golden Valley Agricultural Research Trust (GART) requested for germplasm of African leafy vegetables such as cleome, amaranths, corchorus and Hibiscus for multiplication and distribution to farmers. Some germplasm accessions of food legume crops such as cowpea and beans have been distributed to the Food Legume programme and Food Legume Diversification Project for cultivar improvement and entomological research.

Internationally, many institutions have accessed germaplsm collections from the national gene bank. These include among others the University of Swaziland who requested for germplasm accessions of Bambara groundnuts and African leafy

vegetables (cleome, amaranths, okra, cucurbits) for purposes of research and training. Germplasm accessions of Bambara groundnut and cowpea were distributed to the National Botanical Research Institute of Namibia. Masuku (*Uapaca kirkiana*) provenances were distributed to Tanzania, Malawi, Zimbabwe and Mozambique as part of germplasm exchange programme under the International Council for Research in Agroforestry (ICRAF) wild fruit domestication programme. Several accessions of African leafy vegetables were distributed to the African vegetables Research development Centre (AVRDC) for multiplication, conservation and utilisation in cultivar development. Seed samples of wild rice species collected from Zambia were sent to the International Rice Research Institute (IRRI) for conservation and seed multiplication. Other international institutions that have benefited from the plant genetic resources conserved at the gene bank are the Norwegian University of Life Sciences and ENZA Zaden of the Netherlands.

Zimbabwe

A. General

(i) Staffing

Ms Seka joined our institute from the Ministry of Education, Ms Kudzunga and Mr Mandeya (laboratory hands) transferred from within the department. Two staff members transferred to other institutes within the department; Mr P. Mavindidze was elevated to a research officer post at the Crop Breeding Institute. Mr L. Jack, one of laboratory hands was transferred to Chemistry and Soil Research Institute.

Orbituary

The Institute lost one of the long time serving member, Ms. Alter Murangi who was on study leave for her Msc in the Netherlands. Ms A. Murangi died on December 21, 2012. She left behind a daughter. She will always be remembered for her hard working spirit.

Staff Development

- Mr K. Kusena – Doing PhD at the University of Zimbabwe (completion: 2016)
- Mr O. Chipfunde – MSc Environmental Policy & Planning at University of Zimbabwe (completed July 2013)
- Mrs R. Musango – Distance MSc in Biosafety at Italian University (completion: 2014)
- Ms F Chinosengwa – BSc in Agronomy at Midlands State University of Zimbabwe (completion: 2014)

(ii) National Genetic Resources Committee

The NPGRCom held one meeting on the 27th of March 2013. The meeting was mainly to prepare for the Fifth Governing Body meeting of the ITPGRFA to be held in Muscat, Oman from the 24th to the 28th of September 2013.

The Committee was beefed up with new members from Agritex (Livestock and Crops), Animal Division (DRSS), Attorney General's Office, Zimbabwe Farmers' Union, and Unkiversity of Zimbabwe – Crop Science

(iii) Equipment, Supplies and Facilities

The genebank has 27 freezers, 4 of which are faulty – compressors breaking down and replacement parts cannot be sourced locally. It also has faulty drier whose cooling fans are broken making temperatures fall below zero. The Centre has 5 desktop computers, two of which are very slow and other 3 were recently acquired. It has 4 printers, two of which are faulty and others require ink cartridges.

There is a working dehumidifier, a fax-scanner-printer-photocopier machine that is functional but need replacement ink cartridges.

The Centre has 4 heat sealing machines, and 4 functional grinders. It also has two vehicles one of which is faulty and needs servicing..

The genebank has just acquired a grinder, 3 desktop computers, drum cartridge for the Sharp 3 in one fax scanner, copier and printer, and an assortment of working glasses. It however, needs weight scale and a hand-held GPS.

B. Technical Report

(i) Witchweed Germplasm Collection

Striga species are very important economic weeds worldwide, in Africa alone this weed accounts for more than USD 7 billion affecting more than 100 million people (Welsh & Mohamed, 2011), (Badu-Apraku, Fakorede, & Fortem lum, 2008). The weed causes most of the economic damage during its vegetative phase underground, i.e. before it emerges for reproduction and can be seen by farmers. *Striga*. is robust and versatile as it can attain 50% germination under moisture regime described as the permanent wilting point for its host and it can tolerate wide ranges of day/light temperatures making it a successful parasite throughout its host range (Welsh & Mohamed, 2011). *Striga* obtains nutrients and carbohydrates from the host plant (Lendzemo, Kuyper, & Vierheilig, 2009), thereby impairing the photosynthetic efficiency of the host. Subsequently, the major yield loss is caused by the parasite's potent phyto-toxic effect (Badu-Apraku, Fakorede, & Fortem lum, 2008). Characteristics of an infected plant include biomass loss by wilting, stunted growth, shriveling, and plant death and lack of grain or fruit production. Yield loses are estimated to be 40% in cereals (Oliver, Glaszmann, Lanaud, & Leroux, 1998), (Welsh & Mohamed, 2011).

The biology and behavior of witch weed has made it difficult to develop effective control methods. *Striga* plant is capable of producing thousands of tiny seeds which remain viable in the soil for more than 20 years and have an intimate physiological interaction with its hosts, thus making it difficult to develop control measures that are compatible with the farming systems and socioeconomic conditions of the resource-poor farmers in regions with similar economic structures (Badu-Apraku, Fakorede, & Fortem lum, 2008). The weed thrives well in conditions that are of poor soil fertility especially on dry sand soils, with shortened fallow and crop rotation periods and production in marginal lands with little use of fertilizers (Badu-Apraku, Fakorede, & Fortem lum, 2008). The distribution of witch weed throughout Africa as well as other parts of the world shows that rapid movement and gene flow is characteristic to the genus (Mohamed, Bolin, Musselman, & Peterson, 2007). Striga seed is spread through wind, water, contaminated seed, livestock and farm implement movement (Mohamed, Bolin, Musselman, & Peterson, 2007).

(ii) Study on Distribution of Striga in Zimbabwe

There is very little literature on the geographic distribution. The available literature is found in Flora data bases worldwide and constraints presence only information. However there is evidence that Striga is found in all parts of the country. Musimwa,

2006 conducted a collection mission around the country collecting representatives' samples.

A collection mission was conducted in April 2013 when the maize crop had just reached physiological maturity. Collection was done in collaboration with the Weed Research Team in the Department which is under the Agronomy Research Institute. About 4 districts were visited and about 12 samples were collected from striga infested fields. The sizes of the samples differed according to extent of Infestation. The largest samples were collected in Rushinga District which is found Mashonaland West province. This District is known to be a Striga hot spot were famers have abandoned some of their fields because heavy Striga Infestation.

The Striga plants were harvested by hand pulling carefully to prevent loss of seed in the field. Whole plants were harvegsted and then processed to extract the seed. Due to the extreme small size of the Striga seed, the seeds were extracted by first drying the plants and then passing the plants through sieves to collect the seed.

The collected Striga asiatica plants were from (with numbers in brackets): Chiweshe near Bindura town (2), Rushinga near Mount Darwin town (3), Bindura near Bindura town (3), and Norton near Chegutu town (4).

(iii) Regeneration and Characterisation

Cowpea Characterisation

The regeneration project was carried out at the Crop Breeding Institute plots which are situated at the Department of Research and Specialist Services. 40 cowpea accessions were regenerated and multiplied, of these 28 were morphologically characterized.

The crop was first harvested on 30/04/2013 and then the second harvesting was on 03/05/2013.During harvesting 10 plants from each plot were harvested separately for characterization. Plants were harvested at physiological maturity. The crop was shelled for characterization on the 4th of May and characterization commenced on the 5th to the 7th of May. Shelling of the rest of the harvested crop was done on the 13th of May.

Water Melon Mophorlogical and Molecular Characterisation

A total of 14 watermelon accessions which originated from various parts of Zimbabwe were obtained from the National Gene Bank of Zimbabwe, in the Department of Research and Specialist Services (DR&SS). Each accession was allocated a treatment number, and 12 of the 14 accessions were subjected to a germination test.

The Trial was set up in an open field at Gwebi, Varietal Trial Centre (VTC) about 30 km from the NPGRC. The watermelon plants were grown without fertilisers or any soil nutrient supplementing, and supplementary irrigation was applied during dry spells only.

A descriptor list (UPOV, 2006) was used to score the morphological characters of the 12 accessions which germinated of the 14 accessions (in the Appendices).

The data was first sorted in excel and exported to Numerical Taxonomy System (NT Sys) and saved as a CSV file. The data was then transformed into a normal distribution by dividing y bar (the deviation of x from the minimum value) by the standard deviation of the data. Dissimilarity and Similarity module, cluster analysis, Eigen, SAHN and matrix plot to be generated in the NTSys Cluster analysis or clustering is the assignment of a set of observations into subsets (called clusters) so that observations in the same cluster are similar in some sense.

7. NPGRC PLANNED ACTIVITIES FOR THE YEAR 2012/2013

Angola

(i) Multiplication, Regeneration and Characterisation of some accessions in the genebank

The proposed activities include characterization of 70 and 20 accessions of common beans and cowpea respectively. The NPGRC will also multiply 20 accessions each of cowpea and maize, 11 accessions of lossaka, 12 accessions of chilli pepper and 10 accessions of okra.

All the above will be conducted at the Experimental field of the NPGRC.

(ii) Regeneration of Genebank Germplasm Materials

The Centre intends to multiply and regenerate materials from the Genebank. These will include maize (325), common bean (158), sorghum (99), cowpea (63), groundnut (61), pearl millet (42), bambara (11), pumpkin (42), pea and sesame (9 each), rice (8) and soya (3) accessions. That makes a total of 816 accessions.

(iii) In-situ / On-farm

There is a project on *on farm* conservation which is going to be implemented in two provinces: Huambo and Huíla. The objectives are as follow:

- to sensitise the farmers and the agricultural institutions to organise and promote local varieties of maize seed fairs in order to reintegrate, increase the lost agricultural diversity, and to contribute for the conservation of agro diversity in the farmers´ property.
- to strength the traditional system of seeds in the distribution of seeds through exchanges, and trading between farmers
- to create mechanisms such as the establishment of community seed banks which facilitate the immediate access of seeds.

Botswana

(i) Characterisation of Sorghum, Maize and Pearl millet accessions 2013/14

The main objectives for this activity include characterisation and preliminary evaluations on sorghum accessions, maize and pearl millet, regenerate accessions of sorghum with low seed viability. It will also attempt to salvage characterisation data for sorghum and pearl millet and increase number of seeds per accession (for bridging the gap between NPGRC and SPGRC).

(ii) Germplasm Collection

Eight field trips have been planned as indicated in the workplan below; the targeted plant species, their locality and proposed dates are indicated.
The duration of the trips will be ranging from a day to 12 days depending on the situation. The activity will funded by DAR.

Democratic Republic of Congo

(i) Updating the status of the gene bank accessions in the four main research centers of the DRC

Justification

The Democratic Republic of Congo has been member of the PGRC network since then; however, its critical political situation of the wars did not give opportunity to DRC to be on board.

The food security and alleviation of poverty have been the bottleneck of the world's effort to sustain actions towards agriculture development.

The importance of the genebank for agriculture development has been known as an important strategy for the breeders and other research officers to accomplish the world's goal mentioned above.

The purpose of this proposal is to get the real figures on the status of the species accessions that are available and sustain actions for their maintenance for their used in the process of breeding work.

Objectives

- To conduct an inventory of the species accessions and to reorganize them in database of accessions.
- To maintain the database of these accessions so that scientists can request and use them in their breeding programme and being shared in the region.
- To ascertain the staffing status that has to sustain the genebank maintenance, and establish actual potential of DRC's germplasm

Results

- The number of accessions per species in each research Center is known.
- Rejuvenation and maintenance of accessions accomplished
- Technicians are trained on the data entry and database maintenance
- Database of accessions is developed

Work Programme

January 2014-June 2014: Preparation of inventory in each research centres and station.

July 2014- August 2014: Going through results and elaboration of report

Estimated Budget

We would like to propose the same budget presented last year for inventory (US$ 20,500) with the inclusion of characterization (US$ 5,000) of new samples found during the collection mission at Kipopo and Mvuazi Stations.

Lesotho

(i) Multiplication and characterization proposal -2012/13

The NPGRC proposes to multiply and characterize 110 accessions of sorghum, 100 accessions of maize, and 40 accessions of beans. Activities will be undertaken at Thaba Tseka Regional Research Station representing the Highlands.

It is being done with the objective of availing characterization data to enhance utilization of the accessions, and acquisition of sufficient seed quantities for active and base collections to close the gap at the NPGRC and SPGRC.

(ii) Seed Germination Tests of Accessions in Active Collection

This proposal is justified by the fact that frequent power cuts could affect the lifespan of material in active collecting and therefore conducting germination tests will determine the need for regeneration/rejuvenation of material. If the germination % is found to be below 90%, there will be need to regenerate the accessions.

(iii) Maintenance of the existing plant species in field genebanks to ensure their survival and continuity and add new species

Mozambique

(i) Gap filling multi-crop germplasm collection mission in Niassa province

Justification: Exploratory expeditions will be conducted in regions particularly targeting on districts which have not been covered in the previous expeditions.

Objectives: The main objectives of this mission will be to collect as much possible the existent germplasm (grain legumes) occurring in Niassa province for conservation and future use.

Namibia

(i) Multiplication and Characterisation

The NPGRC planned to multiply and characterise five accessions of *Citrullus lanatus* at Sandveld Research Station 2013/2014

(ii) On-farm conservation

The NPGRC planned to document at the same time collecting Maize seeds from the Zambezi region (Caprivi region). Maize is a popular diet to most Namibians and yet the Namibian NPGRC has few samples in custody. It is known that the existing and traditional farming systems in Namibia play a pivotal role in protecting agro biodiversity and supports the sustainable land management. Therefore the objective will be to collect Maize seed for gab filling and to document the farming practices with regard to crop conservation.

The information obtained can be used in promoting effective management and maintaince of plant genetic resources of the landraces/traditional varieties at farm level. Farmers group can be identified immediately which can work together with the NPGRC Namibia.

(iii) Germination Tests

The NPGRC proposed to continue with germination tests of 120 *P. glaucum* accessions in 2013/2014.

(iv) Documentation and Information

- Update SDIS registration module with new accessions
- Update SDIS Base/Active module
- Update the germplasm collecting information system from 3,917 to 3,983
- In collaboration with SPGRC, sort out problems with passport data which is not saving on the collecting module.
- Continue to update the NPGRC web page.
- The Namibian NPGRC is looking into the possibility of using Botanical Research and Herbarium Management Systems (BRAHMS), as an alternative

database. BRAHMS can be custom made to suit the need of the genebank and possibilities exist that a component can be added to the software for SPGRC to be able to view the information on the database. The species list from most species of Southern Africa is already on BRAHMS making it easy when entering data. The Millennium Seed Back Project, Kenya Genebank and most of the National Botanical Research Institute sections (in Namibia) currently use the database.

- However, the decision still lies with SPGRC for the NPGRC (Namibia) to store and process data using BRAHMS.

Seychelles

Seychelles NPGRC is proposing the following activities for next financial year:

- Initiate holding of the first NPGRCom meeting in last quarter of 2013 or first quarter of 2014 in order to launch all activities mentioned
- Creation of Unit responsible for the Conservation of PGR in Seychelles. Proposed name is National Agricultural Crop Conservation Unit (NACCU)
- Identification of new staff for training in PGR
- Training of staff members in PGR documentation and database management
- Arrange for staff to attend short courses on PGR with the assistance of SPGRC as and when requested
- Securing space for SDIS in the SAA server, with the help of SPGRC technical personnel
- Initiate collection mission
- Attend SPGRC meetings and workshops as requested

Swaziland

The following activities are proposed during the 2013/2014 cropping season:

(i) Germplasm multiplication

The NPGRC propose to multiply some accessions that include: maize-2, jugobeans – 2, beans – 3, cowpeas – 1, pearl millet – 1, and finger millet -1.

(ii) Inbred line development

The NPGRC will continue to collaborate with the University of Swaziland, Faculty of Agriculture in advancing the 37 Generation 1 (S1) inbred lines to Generation 2 (S2).

Tanzania

(i) Exploration and Collection

Due to funding constraint the continuation of germplasm collection will depend on proposal development to seek funds from donors. With funds available, priority areas for collection will include Coastal Areas and Eastern Zone, targeting mainly spices, vegetables, cereals, legumes and oil crops.

Possible collection is justifiable by the fact that the identified areas are among the areas with great risk for genetic erosion due to its fast urbanization and development

(ii) Multiplication, Regeneration and Characterization

Regeneration, multiplication and characterization of selected crop accessions at the genebank for conservation, safety duplication, utilization and distribution of the accessions are rationalized by insufficient amount of seeds for storage as base and active collections, existing huge gap between *Ex-situ* conservation and safety duplication, and for effective utilization of accession through characterization data.

However, number of accessions to be multiplied and characterized will depend on the availability of funds.

(iii) Documentation

The NPGRC wishes to add more data to SDIS database because apart from passport data, most of the information such as characterization data *etc.*, is not incorporated into SDIS. More effort will be relevance and attract more users such as breeders, *etc.*

It will generally enhance information availability, utility and accessibility through harnessing of SDIS database with the rest of information from the collection forms and characterization data.

Zimbabwe

(i) Sweet Sorghum Germplasm Collection

Sweet sorghum has the potential for use as bio fuel (Ethanol) production. It can replace sugarcane and jatropha because sorghum is an annual crop. Sorghum can produce 1500 litres of ethanol per acre in four months, compared to sugarcane, with the potential of 2500 litres of ethanol per acre in twelve months. The NPGRC is targeting collection of sweet sorghum inorder to enhance its genetic diversity under *ex-situ* conservation for future breeding purposes.

An Ecogeographic desk study will be carried out to find out the target sites for collecting a wider genetic diversity of the crop. Collection will be carried out just before harvesting the crop from March up to April in the year 2014.

(ii) Groundnut seed collection Mission for Aflatoxin Research

The NPGRC will also carry out a groundnut seed collection mission and the seed is mainly required for an ongoing Aflatoxin Research project in the Department.

(iii) Screening Sorghum Landraces for Resistance/Tolerance to *Striga asiatica*

One of the major constraints to increased sorghum productivity in the small holder farming sector in Zimbabwe is attack by witch weeds, the most common of which is Striga asiatica (L.) Kuntze. Striga asiatica is a devastating obligate root parasite of cereal crops of the Graminae family (maize, sorghum and millets) (Stroud, 1993). Crop yield losses can be up to 100% depending on the extent of the damage and level of infestation. Striga asiatica resistant varieties offer an economically feasible and culturally sustainable technology for small holder farmers since they do not require additional inputs (Mabasa, 1996).However there are no high yielding *S asiatica* resistant varieties for resource-poor farmers in Zimbabwe. If highly striga resistant sorghum varieties are found this problem could be resolved. It is envisaged that such desirable unique sorghum characteristics could be found in the large sorghum genebank collection preserved at the National Genebank of Zimbabwe. It is therefore worthy to screen some of the sorghum landraces at the genebank for striga resistance and high yield potential.

Much effort has been accorded towards the development of resistant or tolerant lines of crops so as to combat the striga problem. The man effort using this approach has been in sorghum. In India Rao, attempted to develop varieties of sorghum which are resistant to S asiatica because other methods of controlling this pest were too costly (Rao, 1967). A resistant variety, designated N13, was released after six years of selection for resistance. Also in Zimbabwe there has been some research on screening and developing lines for S asiatica resistance. However as reported by Ramaih (1986), there are various limitations to breeding for the resistance in sorghum. These limitations include low yield and grain quality in the resistant varieties, hybridization of Striga plants which results in new strains that may overcome resistance genes and great variability in the resistance exhibited by developed lines. Mutengwa et al 1999 did screening experiments for striga resistence on sorghum and found a few varieties that significantly delayed the germination of striga but however their yield potential was low. It is also important to note that the variability exhibited by the lines is influenced by other various factors such as level of infection, climatic factors and management practices.

Statement of the Problem
Sorghum is a very important cereal crop for the semi arid areas of Zimbabwe which are mainly low growing potential areas for the staple crop, maize. Therefore Sorghum is an important crop for food security, though however it is very prone to attack by Striga Asiatica. Depending the level of infestations Striga can cause yield losses of up to 100% which is a serious parasite among other problems that affect sorghum. Hybrid sorghum technology is a highly economical avenue to alleviate the problem through the development and use of Striga resistant or tolerant varieties, however there a number of limitations to the technology in that the varieties developed exhibit poor yields and grain quality, the great genetic variation of the Striga strains resulting in new strains that make the developed varieties susceptible.

General Objective
The main objective of the study is to screen the sorghum landraces preserved at the Genetic Resources and Biotechnology Institute for Striga resistance.

Specific objectives
- To compare the response of sorghum landraces and sorghum hybrids to striga infestation
- To identify sorghum landraces that can tolerate the striga infestation
- To map the genetic diversity of Striga Zimbabwe.

Materials and Method
The Study will be carried out as both pot and field experiments. The field experiments will be carried out in Rushinga District about 180 km from the NPGRC in Striga infested fields. The pot experiments will be done at Henderson Research Station which is about 25 km from the NPGRC. The crops will be established in November 2013.

7. Other Presentations

7.1 Web-SDIS Developments

Efforts to develop a web-SDIS (to replace the current standalone version) started in mid-2000s and its programming stalled due to unavailability of the database central synchronizing server which was withheld under the custody of the donor (Sida/NordGen Technical Advisor). When the server was lastly made available in

December 2011 through the SADC Secretariat, a SADC Technical Team was constituted to ascertain whether the server was working. Even though the central server was claimed and believed to have been communicating with installed NPGRC servers, the Team found that the server was not configured with applications and had no databases installed.

Based on the report by the Technical Team, the SPGRC Board directed SPGRC to abandon the long-awaited web-SDIS that was being collaboratively being developed with the donor. It instructed SPGRC to develop a new web-SDIS, possibly in collaboration with the SADC Secretariat and use own available resources.

In response, SPGRC in collaboration with the SADC Secretariat started the re-designing and programming of the new web-SDIS late in 2012 and has so far made a lot progress with the prototype already uploaded on the web. The remainder part of the programming should be concluded by the end of 2013, while installations and some basic user training shall commence in early 2014.

The Web-SDIS was demonstrated to the meeting offline.

7.2 MSc Theses by Candidates Sponsored by SPGRC

7.2.1 Abilio Afonso: Study on the genetic diversity of local maize (*Zea mays* L.), germplasm from 8 agro-ecological zones in Mozambique

Aims:

- Collect accessions in the field of farmers in Mozambique for evaluation of genetic diversity
- Use SSR markers to characterize the accessions
- Identify duplicates that will allow the gene bank manager to reduce the number of accessions kept in gene bank
- Help in the formulation of a new national maize breeding programme for Mozambique

Conclusions:

- This study confirmed the presence of high genetic diversity within and among local maize accessions from 8 agro-ecological zones
- The SSR markers in this study were highly polymorphic and reveled differences among the maize accessions.
- Since this was one of the first studies involving molecular markers analysis of farmers varieties from Mozambique, similar studies would be valuable to characterise the collections kept at the national genebank of Mozambique.
- The detection of high genetic diversity in 27 accessions used in this study should be an incentive to plant breeders in Mozambique to included local farmers varieties in the breeding programme of IIAM.

7.2.2 Busie Nsibande: In-vitro regeneration of four Hypoxis species

Objectives:

- To establish *Hypoxis* species collected in different agro-ecological regions of Swaziland *in vitro*.
- To study effects of plant growth regulators on the performance of different explants from *Hypoxis* species during *in vitro* establishment.

Conclusions:

- 75% regeneration (3 shoots/explant) of corm explants of *H. argentea* on MS supplemented with 3 mg/l kinetin following initial culture on MS supplemented with 1 mg/l NAA.

- 50% regeneration (2 shoots/explant) in corm explants of *H. hemerocallidea* initially cultured in MS supplemented with 1 mg/l kinetin and transferred to MS with 3 mg/l BAP.
- 30% germination of *H. argentea* seeds with crushed seed coats.

7.2.3 Onismus Chipfunde: Response of sorghum and maize landraces for resistance to *Striga asiatica*

Course Objectives:

- Training on Plant genetic resources policy management
- Understanding Biodiversity and threats to extinction
- Climate Change
- To understand International Policy Instruments and how they influence national policy development
- The Influence of scientific knowledge on policy development

Discussion & Conclusion:

- Results support the hypothesis that early maturing sorghum landraces are more sensitive to *Striga* than late maturing landraces.
- Effect on the vegetative growth of both the maize and sorghum landraces and the effect was varietal and time dependent.
- Striga asiatica caused a decline in the growth rate of the two maize landraces
- Recommending Maize landrace NPGRC 1714, Sorghum landraces for further evaluation *Musoswe, Nhongoro* and *Khakhi.*

7.3 SPGRC Generic Project Proposal

The SPO – Documentation & Information presented a draft proposal that SPGRC is developing for future funding by potential donors. The same document shall be submitted to PPRM Directorate which is reponsible for resource mobilization at the SADC Secretariat for them to help identify possible funding agencies/organisations.

The proposal covers such areas as:

- Improvement of infrastructures at SPGRC and NPGRCs
- Enhancing capacity in use of modern technologies
- Capacity Building for handling vegetatively propagated plant Species
- Provision of chemical reagents for biotechnology laboratory at SPGRC
- Data Inventorying to enhance increased germplasm usage
- Development of mechanisms for networking and collaboration
- Development of policies for enhancing rescue collection missions
- Strengthening of the informal seed sector in SADC region
- Identification of genetic traits of economic importance
- Documentation and application of IKS in PGR
- Identification and development of crops with potential to improve nutrition of HIV/AIDS patients, and other ailments
- Training in management, conservation and sustainable utilization of PGR

7.4 Status of implementation of the FAO-TCP

Project Title: Support for the Development of National Strategies for Plant Genetic Resources for Food and Agriculture: Botswana, Lesotho, Malawi, Mozambique, Tanzania and Zambia.

Output 1: Development of national strategies for the effective conservation and use of PGRFA

Draft strategies were developed in all six participating countries and national stakeholders' workshops done to finalize the strategies. The consultant and national teams are in the process of incorporating the comments and the documents will be sent to countries again for confirmation of comments.

Baseline studies on the conservation status and the status of *in situ*/on-farm conservation of priority crops has been done by Zambia and Malawi. Both countries submitted reports. Botswana and Lesotho still conducting data collection. Mozambique and Tanzania are yet to start doing the studies.

The promotion of the national strategies through regional stakeholders such as the SADC Secretariat, SPGRC Board, Agriculture Ministers is not yet done. SPGRC management and FAO are to prepare a brief to be presented to council in 2014.

Output 2: Utilization of conserved material in crop improvement as means for addressing climate change threats.

Identification of promising material in genebanks that have traits adapted to extreme climate conditions using FIGS or other GIS approaches has not been done. The capacity for FIGS and GIS is lacking. This will be done by selecting promising material through passport data and characterization data.

Development of plans for breeding programmes is ongoing in all countries. Botswana identified sorghum, maize, pearl millet and cow pear to be used in the breeding programmes.

Output 3: Networking and collaborative partnerships for PGRFA conservation use and seed delivery strengthened.

Botswana has developed catalogues for cow pea. The activity is ongoing in other countries.

Holding of consultative and joint planning meetings between genebankers and breeders has only been done by Botswana. NPGRCs to report on this activity by December 2013.

Output 4: National and regional capacities for the conservation and sustainable use of PGRFA strengthened.

A training course was done on molecular characterization in collaboration with the University of Zambia. Two participants per country participated.

The procurement of conservation infrastructure is ongoing. Those items that could not be sourced in the region are to be procured by the FAO Rome office though the office in Harare. Air conditioners and freezers were delivered at SPGRC. Freezers were also delivered in Tanzania. Malawi received farm inputs.

A request for funding the configurations and installation of servers was submitted to FAO Sub-Regfional Office, Harare. There has been no response at the time of the compilation of this report.

8. General Discussions

8.1 Financial sustainability

At the moment, SPGRC is financially fully dependent on contributions from Member States, amounting to about US$ 1.2 million a year. SPGRC lately got some funds from FAO, SANBio to implement project activities.

The meeting strongly felt that establishment of Biotechnology Laboratory at SPGRC would help for income generation; and in addition, facilities allowing, it should consider conducting training courses at the Centre both for the network scientists and outsiders.

The growing trend in international organisations has been that of recruiting Resource Mobilization staff who are responsible for resource mobilization to relieve scientists from doing this. SPGRC was advised to engage the SADC Secretariat through its fully-fledged resource mobilization directorate (PPRM) to assist mobilize resources for the SPGRC network.

Participants proposed establishment of a R&D team that can work on developing medicinal plant for commercialization.

8.2 Sharing responsibilities between SPGRC and NPGRCs

This is an issue that was last year discussed at length. It for example, recommended some NPGRCs with expertise and capacity to assist multiplying germplasm materials for others with less capacity. Although this happened; for example, Malawi multiplied for Namibia, SPGRC multiplied for Namibia but has been low amongst other Member States.

Upon scrutiny, it was noted that there are cobncerns by some Member States not agreeing to multiply in other countries due to variability in environment; and also, there was the problem of limited funding to implement this.

8.3 Bridging the gap between Active Collections at NPGRCs and Base Collection at SPGRC

The meeting was asked to brainstorm about a possible small project to fund closing the gap activities. With funding, multiplication could start as early as 2014 and see how much could be duplicated to SPGRC by end of 2015 (at least 50% of materials deposited at SPGRC by planning meeting of 2015).

Participants were further informed that since the Network had not effectively rectified the gap over the past six years, as a matter of concern; SPGRC developed 'Evidence Based Balanced Evaluation' for the office of *Ex-Situ* Conservation to use and find the key factors that influence results. The meeting provided additional ideas to improve the tool and concluded the study should be carried out in all the Network Member States.

In order to reduce expenses, NPGRCs were once again requested to bring along with them the germplasm materials when attending the planning meetings. SPOs were also asked to help carry germplasm materials for deposit at SPGRC when they visit NPGRCs.

8.4 Role of SPGRC in Multilateral System (MLS)

The meeting was informed that the Board not in favour of SPGRC distributing materials. However, in seek to increase SPGRC relevance and in line with changing global environment in management of PGRs, this technical meeting need to find ways to change the Board thinking about SPGRC's role of distributing materials.

8.5 Benefits to the Network from global frameworks

The participants saw the need for SADC Secretariat as well as the Board to help promote SPGRC works. We, together with promoters should come up with statements for presentation during international/regional events.

SPGRC should find ways of talking to organisations that are helping on achieving MDG goals with emphasis on food security, which is an area we strive to contribute. As a network, it was urged that it should develop proposals aimed at strengthening regional capacity both at technical and policy level.

8.6 Network contribution to regional food security

The network felt the need to define its own research agenda in a clearer manner. SPGRC network should come up with issues on PGRFA climate change, intensify research on pre-breeding, crop diversification; and realign its priorities to suit on going global changes relating to PGRFA.

In the same pursuance, the network should identify neglected crops in Africa and see if we can join the cause to conserve and develop them. It also needs to do a situation analysis on traits that might be of interest to breeders and probably see if they can be commercialised.

The SPGRC needs to come up with a communication strategy that will clearly classify different stakeholders to be reached. All Member States should be encouraged to start promoting prebreeding cause in respective countries.

8.7 Replacement of equipment/facilities

SPGRC prepared an equipment replacement plan, which is on a 5 year plan. SPGRC will share with NPGRCs .

It is investigating within the region and beyond to find the best suppliers on genebank equipment. This will be shared with Member States.

8.8 Creation of a breeder domain/forum on SPGRC website for discussions

A lot of information has been done that breeders wish to share with SPGRC. A platform will be created to enhace this information and experience sharing amongst practiotioners and users.

8.9 Power Cuts

Countries were urged to invest in standby generators or use of solar power as an alternative to the public power supply systems that have of late, failed to consistently supply power to the genebanks.

Annex I: Programme SPGRC/NPGRC Planning and Review Meeting, Lusaka

Tuesday, 10th September 2013: Arrival of Participants	
General Rapporteurs: Ms Natalie Feltman and Mr Chiyapo Gwafila	
Wednesday, 11th September 2013	
Session 1:	**Opening Ceremony** **Chair: L. Qhobela**
	Rapporteur: **O Chipfunde**
09:00 – 09:40	Welcome address – Head of SPGRC
	FAO Representative
	AVRDC Representative
09:40 – 10:00	Programme and logistics announcements – T. Lupupa
	Issues arising from the previous meeting (2012) – L. Qhobela
10:00 – 10:30	**MORNING TEA BREAK**
Session 2:	**Presentations: Country Progress Reports and Work Plans (Including FAO Project – Activity 2.2, Crop Evaluation)** **Chair: Remmie Moses**
	Rapporteur: **Thomas Mausa**
10:30 – 13:00	**Country Presentations**
13:00 – 14:00	**LUNCH BREAK**
14:00 – 15:30	**Country Presentations** **Chair: Chair: Kudzai Kusena**
	Rapporteur: **Edwin Chiwona**
	Country Presentations
15:30 – 17:00	**AFTERNOON TEA BREAK**
	Country Presentations
	Discussions on breeding programmes and on-farm participatory evaluations
Thursday, 12th September 2013	
Session 3:	**Presentations: Country Progress and Plans Reports** **Chair: Thabo Tjikana**
	Rapporteur: **Busie Nsibande**
09:00 – 10:30	Country Presentations
10:30 – 11:00	**MORNING TEA BREAK**
11:00 – 13:00	Country Presentations
13:00 – 14:00	**LUNCH BREAK**
Session 4:	**Presentations: FAO Project Surveys and Activities** **Chair: Dr Dickson Ng'uni**
	Rapporteur: **Mrs Nolipher Mponya**
14:00 – 15:30	Country Presentations
15:30 – 16:00	**AFTERNOON TEA BREAK**
16:00 – 17:00	Country presentations
Friday, 13th September 2013	
Session 5:	**Presentations: SDIS Development, SPGRC Project**

	Proposal – Mr B. Kapange **Chair: Evaldina Pedro**
	Rapporteurs: **Ms Rudo Musango**
09:00 – 10:10	SDIS Development
10:10 – 10:30	SPGRC Project proposal
10:30 – 11:00	**TEA BREAK**
Session 6:	**General Issues** **Chair: P. Munyenyembe**
11:00 – 12:15	Summary of Presentations - *Ex-Situ*: L L Qhobela - *In-Situ* / On-farm: T J Lupupa - Documentation & Information: B W Kapange
12:15 – 12:30	General Discussions
12:30 – 13:00	Presentations by MSc Students – Mr O. Chipfunde, Abilio Afonso, and Mrs Busie Nsibande
13:00 – 14:00	**LUNCH BREAK**
14:00 – 17:00	Visit to SPGRC
19:00 – 21:00	Reception
Saturday, 14th September 2013: Departure of Deligates and Participants	

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