SADC PLANT GENETIC RESOURCES CENTRE
"Safeguarding plant diversity for sustanable livelihoods
Network News
Mid Year Newsletter 2021

SADC through Zimbabwe Genebank Supports Restoration of Local Seed Systems in Chimanimani District after Tropical Cylone Idai

Crops destroyed by the floods following the Tropical Cyclone Idai (Left). Restoration of Local Systems (Right).

By Onisimus Chipfunde-Genetic Resources & Biotech Institute, Harare Zimbabwe

1. **Impact of Disasters on PGRFA and local seed systems**
   Disasters such as tropical cyclones, disease and pest outbreaks, and droughts amongst others disrupt local seed systems leading to food and nutrition insecurity. Such disasters have a negative impact on local seeds which include disruption of local seed sources leading to severe seed scarcity. Floods, tropical cyclones (e.g. Cyclone Idai) destroy crops and arable land resulting in loss of farmers' varieties. Successive droughts leading to poor germination and crop failure and depletion of seed stocks due to frequent replanting. Cont'd on page 2

The New SPO Insitu and Assistant Admin/HR touch Base

By Mike Daka - SPGRC Lusaka Zambia

The SPGRC is pleased to announce the arrival of new Members of staff.

The Senior Programmes officer In-situ Ms. Tilabilenji Phiri who joined in September 2020. She holds a Masters of Agriculture (Crops/ Soils) from Sydney University, Australia, and a Bachelor's Degree in Agricultural Sciences (Crops) from the University of Zambia. Cont'd on page 4

Ms. Tamara Phiri
SPO Insitu

Tamara Phiri
Asst. Admin/HR

Zambia NPGRC Revives Sweet Potato Genebank

By Masiye Tembo - Zambia Agriculture Research Institute Lusaka Zambia

Sweet potato (*Ipomoea batatas L.*) is a dicotyledonous plant of the Convolvulaceae family. Though perennial, Sweet potato is normally grown as an annual, and is generally propagated vegetatively from vine cuttings. Sweet potato is a good food security crop, very popular especially among the resource poor smallholder farmers, particularly women. In Zambia, the sweet potato production area is estimated to be 58,271 ha (CIP, 2018). The crop can grow from sea level to altitudes of up to 2,500 masl, from temperatures of 15-33°C, and has flexible planting and harvesting times. It needs little care and matures relatively quickly. Cont'd on page 11

ARTICLES IN THIS ISSUE:

2. The Tropical Cyclone Idai in Zimbabwe

Zimbabwe experienced the most devastating tropical cyclone disaster in the country's recorded history, from 15 to16 March 2019. The cyclone was characterised by heavy rains and flooding including mudslides in some parts of Mozambique, Zimbabwe and Malawi. In Zimbabwe, Cyclone Idai hit the eastern parts of the country, in particular, Chimanimani district. Its peak strength was recorded as being equivalent to a Category 3 major hurricane in the Atlantic or eastern Pacific oceans (RINA report, 2019). Cyclone Idai was first tracked into northcentral Mozambique as a tropical depression with torrential rains before moving back over water and rapidly strengthening over the northern Mozambique Channel, making landfall in both Mozambique and Malawi during its trajectory. The result was strong winds and heavy precipitation totaling 200mm to 600mm (equivalent to 1–2 seasons of rainfall), and severe flash flooding across parts of the provinces of Manicaland, Mashonaland East and Masvingo provinces, home to 44 percent of the country's population of 16.5 million. The extent of the devastation prompted the government to declare a State of emergency which triggered humanitarian assistance in many forms including infrastructure rehabilitation of bridges, roads, housing, and support with food, clothes and many other items.

3. Impact of the Tropical Cyclone Idai on local seed systems in Chimanimani District of Zimbabwe

With support from the German Government through the International Treaty on Plant Genetic Resources secretariat, the Zimbabwe National genebank with other Government departments under a regional project titled 'Foundations for rebuilding seed systems post Cyclone Idai in Mozambique, Malawi and Zimbabwe conducted a PGRFA impact assessments to establish the extent of disruption of local seed systems and PGRFA in Chimanimani district. The assessment established that in addition to loss of lives, the tropical cyclone disrupted livelihoods on many smallholder farmers who depend on agriculture. The washing away of fields, crops and small scale irrigation infrastructure as a result of floods and mudslides are the major effects that are attributed to lose of PGRFA and disruption of local seed supply systems. The project is also supporting a number of interventions, which include the restoration of local seed systems and of the lost PGRFA, training of smallholder farmers on disaster management, and the review the National Disaster Management framework with a view to incorporate PGRFA disaster response and raising awareness on the conservation and sustainable use of PGRFA.

4. Restoration of lost PGRFA and reconstruction of the local seed systems

i) Disaster impact assessment.

An impact assessment was carried out through household level surveys, focus group discussions, and key informant interviews, to establish the status of local seed systems and PGRFA pre-and post the tropical cyclone. The survey was conducted in six wards of Chimanimani district.

Figure 1: Crops destroyed by the floods following the Tropical Cyclone Idai.

Figure 2: A Genebank officer carrying out an interview with a farmer during disaster impact assessment survey (top) and focus group discussion (bottom).

ii) Enhancing the adaptive capacity of communities through training on PGRFA management post disaster

Affected communities were trained on disaster risk reduction strategies centered on biodiversity conservation, development and implementation of action plans at all levels.

Figure 3: A genebank officer conducting farmer training on disaster response strategies.

iii) Restoration of lost PGRFA and reconstruction of local seed systems post Cyclone Idai

Following the findings of the disaster assessment several immediate recovery strategies are being implemented. Preferred and adapted genebank stored germplasm (previously collected from the affected areas) was repatriated to the affected farmers. The genebank germplasm was not sufficient hence farmers were engaged in participatory seed multiplication of the selected germplasm for onward distribution to more farmers in the communities (Figures 4 -6).

Figure 4: Established demonstration and germplasm multiplication plots onfarm.

Figure 5: Finger millet at early reproductive stage (top) and cowpea at soft to hard dough stage (bottom) Chakohwa.

Figure 6: Farmer displaying recently harvested bean germplasm (top image) and Cowpea at late vegitative stage at Nyanyadzi site (bottom).

iv) Increased national awareness on the impact of recent disasters on PGRFA.

Awareness raising initiatives are being promoted on various platforms such as interactive talk shows on radio and TV, using prime-time slots to discuss the ITPGRFA, Farmers' rights, conservation and sustainable use, sensitization on the need for strengthening national programmes on PGRFA conservation and sustainable utilization. Some of the communication and visibility products for awareness training that have been developed include;

i. The recording of three television documentaries targeted for broadcasting via the national broadcaster Zimbabwe Broadcasting Corporation (ZBC). Below are the pictures and links for the documentaries:

https://youtu.be/8xb7eEq0Sks

https://youtu.be/ckv3ksBchbU

Figure 5: Genebank staff explaining the importance of PGRFA during recording of a TV documentary. *Documentary accessible on https://youtu.be/zg3XGcQ_624*

ii. The procurement of visibility regalia carrying communication messages which includes round necked T-shirts, sunhats hats and shirts for distribution to farmers and local partners.

v) Development of National Strategy for PGRFA management under disaster situation

In an effort to promote the incorporation of PGRFA management into the National Disaster Management framework, a Disaster Response Strategy for PGRFA was developed. The disaster assessment established that there is very weak recognition of PGRFA in the national disaster management framework such that key components of PGRFA like local seed supply systems are often forgotten during recovery interventions.

Cont'd from page 1

The New SPO Insitu and Assistant Admin/HR touch Base

Prior to joining SADC Plant Genetic Resources Centre, she worked at Zambia Agriculture Research Institute (ZARI) as a Senior Agricultural Research Officer in charge of Oilseeds Crops Team. My main work program was breeding of crops like Sunflower, Sesame, Safflower, Castor Bean and Jatropha and also timely implementation of all research activities of the team.

Ms. Tilabilenj has interest in promoting and enhancing food and nutritional security and resiliency among the smallholder farmers in the region through agricultural diversification, conservation and utilization of plant genetic resources

Also joining the centre is Ms. Tamara Phiri who joined the SPGRC as Assistant Human Resources and Administrative Assistant in July 2021. She is a holder of an MBA in Project Management. Prior to joining SPGRC she worked in the Banking sector for eight years before Joining the International Institute of Tropical Agriculture (IITA) as Executive Assistant to the Research for Development Directorate. Her interests include philanthropy and events Management

We wish them the best in their new roles. I urge you to provide all the necessary support for them to settle quickly and contribute to the organization.

Madagascar National rice genebank: Status and Importance activities: A Review Article

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Madagascar National Rice Genebank in FOFIFA Mahitsy

ABSTRACT

This article gives an overview of the important activities of Madagascar national rice genebank. It is a division with the Department of Rice Research of the National Center for Applied Research in Rural Development (FOFIFA) and was established in 1989 as a rice genebank through the financial support of USAID and IRRI. Currently, Madagascar rice genebank is a national repository of local- and foreign-sourced rice genetic materials. A total of around 7000 rice accessions are conserved and registered at the Madagascar national rice gene bank. Germplasm collection is important for the maintenance of biological diversity and food security. About 1000 rice accessions were characterized only using agro-morphological traits, other remaining germplasm were not characterized yet. All the germplasm need to be characterized agro-morphologically, biochemically and molecular level because these are the source of valuable genes which is important tool of crop improvement. Molecular and biochemical characterizations of rice germplasm were very limited. Personnel and physical facilities were not available for the systematic evaluation of the germplasm. A systematic activity was conducted to characterize the rice accessions agro-morphologically level to provide descriptive information on the highly heritable traits of an accession. Some research activities on rice germplasm are being conducted at the local of Madagascar national rice genebank and at FOFIFA regional stations in Madagascar.

Key words: Germplasm, accessions, rice (*Oryza sativa* L.)

Introduction

Rice (*Oryza sativa L.)* is one of the most important food crops grown worldwide. All the varieties of rice found in Asia, America and Europe belong to *Oryza sativa* and varieties found in West Africa belongs to *Oryza glaberrima*. *Oryza sativa* is a diploid species having 24 chromosomes. The sativa rice species are commonly grouped into three sub-species, namely, Indica, Japonica and Javanica. Rice was originally cultivated in tropical Asia, the oldest record dating 5000 years BC, but then expanded also to temperate regions (Watanabe, 1997; Choi and Jung, 2018). In Madagascar, rice is the staple food and the first most important crop in terms of area and production. Rice grown area occupied 82% of total cultivating area and production was around 3000 000 tons paddy rice in 2018 (FAO, 2019) with productivity of 2- 4 ton per hectare.

Rice is cultivated in six zones of the country; North, Northwest, and Central-Western regions, the East, the Central-Eastern part and the Central part of the Malagasy highlands at elevations up to 1500- 1900 meter above the sea level. Rice accounts for about 12% of agricultural GDP and supplies comprising more than 50% of the daily caloric intake (FAO, 2019) for the people of Madagascar with an average per capita annual consumption of 135 (Daniel and Hilary, 2017). Rice is abundant in carbohydrates and is a major source of protein. Apart from these, it is also an important source for animal feed.

Germplasm collection is important for the maintenance of biological diversity and food security. Thousands of crop varieties were collected by crop genebanks or germplasm collections store. There are now about 1,750 gene bank around the world, holding a total of around 7.4 million accessions of germplasm. Guardians of diversity: The network of genebank helping to feed the world (Halewood, M et al, 2020). The CGIAR Centers hosting international plant genetic resources for food and agriculture (PGRFA) collections are Africa Rice Center, International Center for Agricultural Research in the Dry Areas (ICARDA), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Institute for Tropical Agriculture (IITA), International Potato Centers (CIP), International Rice Research Institute (IRRI), International Livestock Research Institute (ILRI), Alliance of Bioversity International and the International Center for Tropical Agriculture (Alliance of Bioversity and CIAT), International Maize and Wheat Improvement Center (CIMMYT), and the World Agroforestry (ICRAF). To assemble data on the genebanks acquisitions and distributions from 2013 to 2019 inclusive, records were compiled from the CGIAR Gene bank Research Program 2012–2016 and the CGIAR Gene bank platform 2017–2021 (Halewood, M. et al 2020). In rice genetic conservation, IRRI holds the largest collection of rice germplasm, with 132,000 available accessions conserved (IRRI, 2019). To date, for Madagascar, rice genebank is a national repository of local- and foreign-sourced rice genetic materials.

All varieties have unique genetic traits. They can potentially be used in fighting biotic and abiotic stresses, increasing yield and nutritional value and adjusting to environmental changes such as drought, soil acidity, soil salinity, etc. Rice germplasm including its wild relatives, landraces, local traditional varieties, breeding lines and elite genotypes serve as the foundation of any rice breeding program because they are the source of important traits necessary for improving and developing new breeds of rice varieties.

The conservation and characterization of these genetic resources is a necessity not only for posterity, but also for utilization in different improvement programs such as breeding for improved yield and tolerance to various stresses. It is important to assess the diversity of these germplasm materials to provide insights in the diversity of these germplasms. Evaluation of germplasm collections is essential for maintenance of the diversity and identification of valuable genes. The only way to ensure food security for future generations is to exploit the genetic diversity of different crops and to identify the promising one for future breeding programs. This review provides information about the Madagascar national rice germplasm, and conducted the following objectives:

a) To know the status of rice germplasm in Madagascar.
b) To know the principal activities of Madagascar national rice germplasm
c) To know the gaps also prospects and the future direction of Madagascar national rice germplasm

Status of Rice Germplasm in Madagascar

Madagascar is a biodiversity hotspot for rice (Mather et al., 2010; Radanelina et al., 2013). Following Madagascar national rice genebank establishment in 1989 as a rice genebank through the financial support of USAID and IRRI project. The germplasm holdings increased through donations and various explorations conducted around the country. To date, the Madagascar national rice gene bank is conserving approximately 7000 rice accessions. Rice germplasm which are from local prospecting, breeders work (research), exchanges with overseas research institution. About fifty eight percent (58%) of rice at the rice genebank are landraces and local traditional rice varieties and most of them was get by local prospecting.

While the second largest portion of the collection (33%) represents rice germplasm from foreign sources, only 9% represents breeding lines and improved varieties donated by various researchers and breeders. In the 2008-2012 with the Eastern Africa Plant Genetic Resource Network project (EAPGREN) which is under the umbrella of ASARECA (Association for Strengthening Agricultural Research in Eastern and Central Africa) and supported by SIDA (Swedish International Development Agency), Madagascar national rice genebank has been renovated. Basic facilities and equipment required for seed handling and storage have been provided which included one backup generator, seven (07) freezers, seed driers, seed moisture content monitor, aluminum foil, heat sealer, photocopier, computer and printer, seeds count, weighing scale and one vehicle. During that time, a reasonable proportion of rice accession particularly landraces and local traditional varieties have been being rejuvenated in order to establish active and base collections and to increase available seed quantity. Since more than ten years, cold room for active collection storage is not functioning because of technical issues problem.


Rice Genebank new equipment

Principal activities of Madagascar National Rice Germplasm

Collection and conservation

Conservation activities include increasing the sample size through grow-out if there are few seeds, maintaining the material to preserve its genetic integrity, and ensuring that there is sufficient material for use. In general, as a standard germplasm, two kinds of conservation collections present at Madagascar national rice genebank. Active collections, and base collections which are back-up reserves of the active collections held under conditions of long-term storage. The base collection at rice germplasm which is stored frozen (–18°C to –20°C).

Seeds in sealed pouches

Apart from multiplication, regeneration, characterization and conservation, Madagascar rice genebank activities include the following duty: processing of seed from harvesting, cleaning, threshing, drying, packaging and storing in freezers for long-term conservation. It also includes determination of seed moisture content, germination tests to assess viability of the seed going into storage and periodically. Seed regeneration is recommended if the germination is below 85%.

Long term conservation in the freezers

Multiplication and regeneration

Viability tests, seed distribution, and the decline of viability in storage all reduce the numbers of viable seeds of an accession. Multiplication and regeneration considered as primary priorities of Madagascar rice genebank, it is necessary for maintenance of viability and the availability of rice genebank accessions. It is obvious that due to the ageing process seeds loose viability. Specifically, this activity also aims at increasing seed quantities of collections in the National rice genebank for duplication to base collection; and to provide enough seeds for farmers, breeders, and other researchers, while maintaining quality and genetic integrity. Two thousand (2000) accessions of rice landraces and local rice have been regenerated during the last 10 years, it depends on the financial issues.

Regenerated rice, Seed bed

Regenerated rice, Transplantation

Regenerated rice maturity stage

Characterization and evaluation

Characterization serves to provide descriptive information on the highly heritable traits of an accession. To date less than 10%, about 1000 of the rice accessions conserved are fully characterized in Madagascar.

Morphological characterization

Qualitative characters are important for plant description and are mainly influenced by the consumers' preference, socio-economic scenario and natural selection (Hien et al., 2007). Phenotypic traits are the basis of morphological characterization (Collard et al., 2005). Accessions are characterized using morphological data obtained from growing plants. Characterization is achieved by using the descriptors for rice *Oryza sativa* and the standard evaluation systems during the different growth stages of the rice plant. Most of morphological character are observed such as awning, leaf length, width, stigma color, ligules color, ligules shape, plant height.

Plant height measurement

Stigma color observation

- **Agronomical characterization**

Rice accessions were evaluated for agronomical traits viz., time of 50% heading, length of stem, panicle length, number of panicles per plant, time of maturity, 1000-grain weight, grain length, spikelet fertility, panicle exsertion, panicle threshability, lodging Incidence, etc. Evaluation also focuses on the agronomical important traits such as diseases resistance and yield. The information generated is important for breeders and other end users.

Rice seeds

Laboratory observation

Documentation and information

To be useful and accessible to breeders and researchers, the information about the rice germplasm have been described, it contained for specific characters and indicate origin for some accessions. It will enable users to know which accessions are likely sources for particular genetic traits. The maintenance of this information in a retrievable form is referred to as documentation. A computerized information system for the documentation of accessions that are stored at National rice gene bank. Digitalization of documentation has been developed for recording information to facilitate decision making and taking action in gene bank activities such as: registration, inventory of rice gene bank collections, collecting priorities, regeneration and multiplication time, production of catalogues distribution and exchange of germplasm, finding relationships and detecting duplicate.

Gaps of Madagascar national rice germplasm

Germplasm characterization/research:
Madagascar national rice germplasm characterization mainly focused only for agronomic and morphological characterization, and not all accessions have been characterized because of lacking of funding. Molecular and biochemical characterization of rice germplasm was never done. Physical facilities and personnel in charge were not available for the systematic evaluation.

Germplasm conservation and utilization:
The large number of landraces and local traditional rice are still maintained by farmers in Madagascar. However, there is very limited use of landraces and local rice in improvement process, education, production and training. The potentialities of these landraces and local rice have been underused and not well explored. Poor investment and interest on R&D of landraces and local rice resulted in them remaining underutilized and non-commercialized.

There are almost no incentives and support for to promote the use of local genetic resources in breeding, production and marketing. Focus is only on modern varieties which have replaced very valuable and important local traditional rice. There are many cases of lost landraces and local varieties, e.g. Botojingo, Telovolana, Rojomena, and Zavamena. The Policy even favors only released and registered varieties, ignoring the age-old varieties grown by the farmers. In the past, many important characters were identified in many landraces and local rice varieties. However, those characterized landraces and local rice were not used for further research due to lack of documents accessibility. To get the benefit from our local landraces and local traditional rice, first of all should characterize and conserve all available germplasm.

Prospects and the future direction of Madagascar national rice germplasm

The present Madagascar national rice genebank unit is considered as a nucleus for national plant genetic resources. Efforts to gather more genetic resources need to be increased in the program, so that conservation programs in the different geographical regions are developed. Some specialized laboratories such as an in-vitro conservation facility should be attached to the central genebank as well.

The technical capacity of national plant genetic resources documentation system also need to be strengthened. Establishment of in-situ conservation activities will be a shared responsibility between the centre and the regional units. In order to establish such a program there is need financial support which will result in improved capacity of the present unit with qualified personnel, transportation facilities, laboratory equipment and buildings.

Another prospects and the future direction to rice genebanking will make availability of phenotypic evaluation data of all germplasm collections for potential traits that can be utilized in breeding programs. One of the major reasons why germplasm may be under-utilized is a lack of evaluation data that breeders can use for their parental choices. This is a common challenge in most genebanks around the world, and it has become a major priority activity for the Global Plan of Action on the Conservation and Sustainable Use of Plant Genetic Resources particularly for Food and Agriculture.

Unlike characterization that can be carried out during the regeneration of germplasm, phenotypic evaluation requires more technical expertise, financial inputs and specialized facilities. One approach to address the issue of insufficient evaluation data in the germplasm collection will to share the responsibilities with researchers and other germplasm users and should collaborate with researchers from various fields (plant breeding, entomology, plant pathology and chemistry) to generate phenotypic evaluation data that can be useful for breeders and other stakeholders. All the germplasm will need to be characterized agro-morphologically, biochemically and at molecular level because these are the source of valuable genes which is important tool of crop improvement.

CONCLUSION

Madagascar is a biodiversity hotspot for rice. A total around of 7000 rice accessions are conserved in the Madagascar national rice genebank. About 1000 rice accessions were characterized agro-morphologically and physiologically. All other remaining rice germplasms need to be characterized. All germplasms are a source of variation, which can be exploited by plant breeders in crop improvement programs. Few researches were carried out on molecular and biochemical characterization of rice germplasm, but no satisfactory results were obtained because of lack of laboratory facilities and technical knowhow. It was very important to characterize all the rice genotypes in all aspects of characterization, i.e. agro-morphological, physiological, molecular and biochemical, for their proper utilization in crop improvement programs.

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Cont'd from page 1

Zambia NPGRC Revives Sweet Potato Genebank

Figure 1: Farmer donating Sweet potato germplasm in Petauke, Eastern Zambia.

The roots of sweet potatoes are usually boiled or roasted, and then taken as a snack. Sometimes, the fresh roots are mashed into a puree, which mixed with peanut butter, a mixture which in eastern Zambia is popularly known as *futali*. The roots can also be cut into small pieces, sun-dried and kept as an important food stock to eat later in the year, or made into flour. The leaves are nutritious (good source of vitamin A, B and C, calcium, iron, potassium and sodium) and are widely eaten as a vegetable dish in many parts of the country. They are, however, also used as an animal feed.

The Zambia National Plant Genetic Resources Centre (NPGRC) lost its previous collection of Sweet Potato germplasm to both disease and lack of a functional irrigation system about ten years ago (2010). Nevertheless, through support from the Seeds for Resilience (SFR) project, funded by the Global Crop Diversity Trust (Crop Trust), a Sweet potato re-collecting mission was recently (April, 2021) undertaken across the country.

Figure 2: Collecting germplasm coincided with harvest

where the germplasm was previously collected, in an attempt to reconstitute the local sweet potato landraces that were lost. On this first leg of the mission, 208 samples were collected from three provinces, namely; Southern, Eastern and North-western Provinces. The second leg of the mission is, however, expected to concentrate mainly on the Copperbelt Province.

Figure 3: Collecting environmental and other relevant data at the point germplasm collection.

The collected germplasm has since been safely deposited into the field genebank, alongside the Cassava (*Manihot esculentum*) field collection.

Figure 4: Some germplasm samples prior to transportation

Figure 5: Re-establishing field genebank (L) and irrigating the field shortly after planting the vines (R).

Like many food crops, the cultivation of improved sweet potato varieties across the country is slowly changing the smallholder farmer agricultural landscape. This is because improved varieties are usually very high yielding and are early-maturing, allowing farmers to produce more within a short space of time. This trend is leading to the neglect of indigenous (landrace/farmer) varieties, which are tasty, highly nutritious, grow without fertilizer and are tolerant to many diseases and pests. Moreover, with climate change that is also characterized by shorter rain seasons, many smallholder farmers find it convenient to grow very early maturing (improved) varieties at the expense of landraces. Undertaking periodic germplasm collection missions is thus cardinal as it also helps to cushion against potential loss of neglected farmer varieties.

Plant Genetic Resources: What are they?

By Tilabilenji Phiri- SPGRC Lusaka Zambia

The strength of every nation and region lies in its natural resources which include plant genetic resources also referred to as biological resources. Biological resources are the living landscape such as plants, animals, and other aspects of nature that occur on farmland, forests, and other natural lands. The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) defines plant genetic resources as "*any genetic material of plant origin that is of actual or potential economic value*" (FAO, 2004).

FAO (1998) defined plant genetic resources for food and agriculture (PGRFA) as the diversity of genetic material contained in traditional varieties and modern cultivars as well as crop wild relatives and other wild plant species that can be used now or in the future for food and agriculture.

In other words, Plant Genetic Resources are the biological basis of the world's food security supporting the livelihoods of every person on earth. Thus, they are the foundation for growth and stability in Agriculture, Forestry and Adaptation to climate change. Plant genetic resources are very important natural resources on this planet. This is because genes are the link from generation to generation of all living matter and attention to genetic resources means attention to the vast diversity among and between species.

Plant genetic resources provide the diversity of genetic material contained in traditional varieties and modern cultivars grown by farmers as well as crop wild relatives and other wild plant species that can be used as food, medicines, essential oils, gums and resins, fodder and forages, fibres, shelter, wood, timber and fuel wood among others. Wild food plants play an important role in the provision of food security for many people especially those living in the rural setting, and is also, increasingly, a commercial commodity which is traded nationally and regionally. Rural and urban populations across Africa depend largely on medicinal plants, often collected from the wild, for their human and livestock health needs, due to preference or lack of affordable alternatives. Some are also proving useful in the fight against the HIV/AIDS pandemic and Covid-19.

Plant genetic Resources are also valuable raw materials used in modern plant breeding, allowing breeders to develop varieties adapted to different environments and to respond to emerging challenges, such as climate change.

Plant genetic resources are the substance of agriculture and food production, a major economic enterprise. The high level of productivity has also resulted from the development of new crops and new uses of old crops, the protection of annual productivity by use of pest-resistant varieties and pest-management, and continuing research into the genetic systems that give rise to critical characteristics of crop species. These developments are totally dependent on the availability of genetic resources.

Plants, in their natural habitats are valuable for their aesthetic values, their potential uses by humans, and for maintaining functioning ecosystems,thus, special considerations for protecting the biological and habitat diversity are needed. Genetic resources must be maintained as an investment for the future. However, plant genetic resources of cultivated crops and their wild relatives as well as other wild plants are being lost alarmingly due to human activities such as clearing land for cultivation, deforestation for various products, burning, urbanization and industrialization, over-harvesting of selected species, spread of alien species and other threat factors. Burning and clearing of vegetation for agricultural and other developmental purposes, particularly also impacts adversely on the diversity of wild crop relatives.

Furthermore, climate change is also posing yet another big threat to the survival of the already threatened species. The main threats to crop diversity include occurrence of droughts and floods, disease and insect pest outbreaks.

According to the IUCN Red List of Threatened Plants, 2,652 plant species occurring in Southern Africa are threatened, i.e. face extinction. For this reason, plant genetic resource conservation has become increasingly important as more plants have become threatened or rare. At the same time, an exploding world population and rapid climate change have led humans to seek new resilient and nutritious crops.

The primary justification for the conservation of plant genetic resources is their importance for breeding improved varieties of crops for food, fuels and medicines. Conservation focuses explicitly on maintaining the diversity of the full range of genetic variation within a particular species or taxa. Thus, conserving PGRFA is to ensure the future adaptability of cultivars and wild populations; to preserve data and traits that ensure sustainable agriculture; to promote the use of genetic resources in commerce and biotechnology; to conserve genetic diversity for cultural reasons

Furthermore, a better understanding of genetic diversity and its distribution is essential for its conservation and use. It will help us in determining what to conserve as well as where to conserve, and will improve our understanding of the taxonomy and origin and evolution of plant species of interest. Knowledge of both plant genetic resources is essential for collecting and use of any plant species and its wild relatives. In order to manage conserved germplasm better, there is also a need to understand the genetic diversity that is present in collections. This will help us to rationalize collections and develop and adopt better protocols for regeneration of germplasm seed.

There is, therefore, need to promote wider and more effective use of PGRFA for the enhancement of the resilience and productivity of the agricultural sector, especially in view of the effects of climate change. The conservation and sustainable utilization of this vital component of biodiversity (Plant Genetic Resources) is, therefore, very important for people's sustainable livelihood, food security, agricultural productivity and economic development.

NPGRC (Zambia) Undertakes Re-collection Mission for Wild Relatives of Rice and Sorghum

By Masiye Tembo - Zambia Agriculture Research Institute Lusaka Zambia

Crop wild relatives (CWRs) are a valuable gene pool for crop improvement and offer unique potential and opportunity for enhancing food security and adaptation to climate change. They are of relatively close genetic relationship to a crop (Maxted *et al.*, 2006), and harbour valuable genetic diversity potentially important for crop improvement (Maxted & Kell., 2009). Despite the recognition of their profile and potential value in crop

Figure 1: Different species of wild Rice in the Kafue National Park (Photo: Priscilla Sichone Mukanga)

development, CWRs are highly threatened by factors which are impacting all wild plant species, such as the effects of habitat destruction, eutrophication and climate change (Kell *et al*., 2012). A decrease in the availability of CWR genes and alleles will also restrict the options of farmers and breeders and have a negative impact on future food security. Loss of populations of CWR can lead to a decline in the viability of plant communities, as well as a reduction in the evolutionary potential of the CWR species themselves, which can, in turn, eventually lead to species extinction and cause unforeseen changes in ecosystems.

Following an in-depth study undertaken to validate the occurrence of priority crop wild relative (CWR) species for inclusion in the SADC crop wild relative network database by the Department of National Parks and Wildlife (Ministry of Tourism and Arts) and the National Plant Genetic Resources Centre (Zambia Agriculture Research Institute), in March and September, 2020, a collection mission targeting Oryza and Sorghum wild species was undertaken between 15 - 31 March, 2021 (Figure 2). The mission was undertaken in order to increase on the quantities of conserved germplasm of specific CWRs in the national genebank by collecting as many wild relative species of Rice and Sorghum in the Kafue, South Luangwa and Kasanka National Parks as possible.

Figure 2: Combined team of researchers from DNPW & NPGRC in the Kafue National Park

Where locations of species distribution were identified and collections made, Global Positioning System (GPS) coordinates and other location information were recorded. A collection form was dully filled at the point of seed collection and accompanying photos were captured.

Eight species of *Oryza barthii* and *Oryza longistaminata* (Figure 1) were identified and collected in the aquatic landscape of the Kafue National Park (along the Lusaka-Mongu road, mainly between the Tateyoyo sector and the Kafue River).

Figure 3: Collecting wild relative samples of rice in the marshy lands of the Kafue National Park

Below is a table showing the total number of species and corresponding samples collected during the collecting mission in the Kafue National Park.

Table 1: Number of CWR species samples collected in the KNP

Species Collected					
Priority CWR Taxa	**No. collected**	**Species collected**			
		Species	**# of Samples**	**Species**	**# of Samples**
Oryza spp.	7	*O. longistamina ta*	4	*O. barthii*	3
Sorghum spp.	1				1
TOTAL COLLECTED	**8**				

In the South Luangwa National Park, 11 samples of Oryza species and 2 samples of Sorghum bicolor were collected as tabulated below.

Table 2: Number of CWR species samples collected in the SLNP

Species Collected					
Priority CWR Taxa	No. collected	Species collected			
		Species	# of Samples	Species	# of Samples
Oryza spp.	11	*O. longistaminata*	6	*O. barthii*	5
Sorghum spp.	2	*S. versicolor*	2		
TOTAL COLLECTED	**13**				

In the Kasanka National Park, located in the central province district of Chitambo, only one CWR species of the Oryza taxa was collected. Apparently, this was due to the wrong timing of the visit, as most of the seeds had already been lost to the birds and other environmental elements.

Table 3: Number of CWR species samples collected in the Kasanka NP

Species Collected			
Priority CWR Taxa	No. collected	Species collected	
		Species	# of samples
Oryza spp.	1	*O. longistaminata*	1
Solanum	0	*S. incanum*	0
TOTAL COLLECTED	**1**		

Figure 4: Combined team of researchers from DNPW & NPGRC *en route* to Kasanka National Park

The total number of accessions collected during this mission was 22 (19 wild Rice species and 3 wild sorghum species). As expected, the target CWRs species had limited and restricted distributions across all biomes. For example, species of Oryza could only be located in certain areas with aquatic terrain. Future collection endeavors are, however, planned for wild rice and other priority wild crop relative species, resources permitting.

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