Jamhuri ya Muungano wa Tanzania

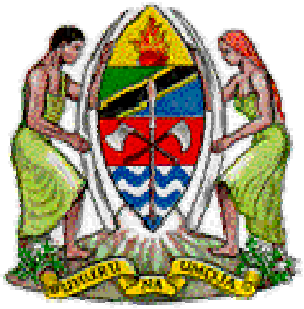
Tanzania
2008

SECOND REPORT ON THE STATE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

DRAFT

Ministry of Agriculture, Food Security and Cooperatives

TANZANIA REPORT ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE (OCTOBER 2008)



Prepared by:

……

……..

Dar es Salaam,

ACKNOWLEDGEMENT

……
……

EXECUTIVE SUMMARY

Tanzania is mainly an agrarian society with agriculture being the mainstay of its economy employing more than 80 percent of the total rural population and contributing 26.5 percent of the total Gross Domestic Product (GDP). Although it plays an important part to the country's economy, agriculture in Tanzania has not been able to provide for the country's population in terms of enough food of high nutrition quality. The reasons being the agricultural productivity in Tanzania has been affected by the change in climatic conditions that has resulted in severe droughts and floods in recent years. Other reasons have been lack of conducive environment in terms of policies that will enable agriculture sector to expand at the rate of population growth. Insufficient and inadequate supply of crop varieties caused by rudimentary system of varietal production and non availability of plant genetic resources.
……
……
……
……
……..

Table of Contents

- **CHAPTER 7: ACCESS TO PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE, SHARING BENEFITS ARISING OUT OF THEIR USE AND FARMER'S RIGHTS**
- **CHAPTER 8: THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT**
- **References**
- **Appendix**

INTRODUCTION

Size and location

The United Republic of Tanzania which comprises of the Mainland Tanzania and Zanzibar islands is located south of the equator in East Africa between latitudes 1^{o} – 12^{o} south and longitude 30^{o} – 40^{o} East. It is bounded to the North by Uganda and Kenya, on the East by the Indian Ocean, to the South by Mozambique and Malawi, to the South West by Zambia, and to

the West by the Democratic Republic of Congo, Burundi, and Rwanda[1].

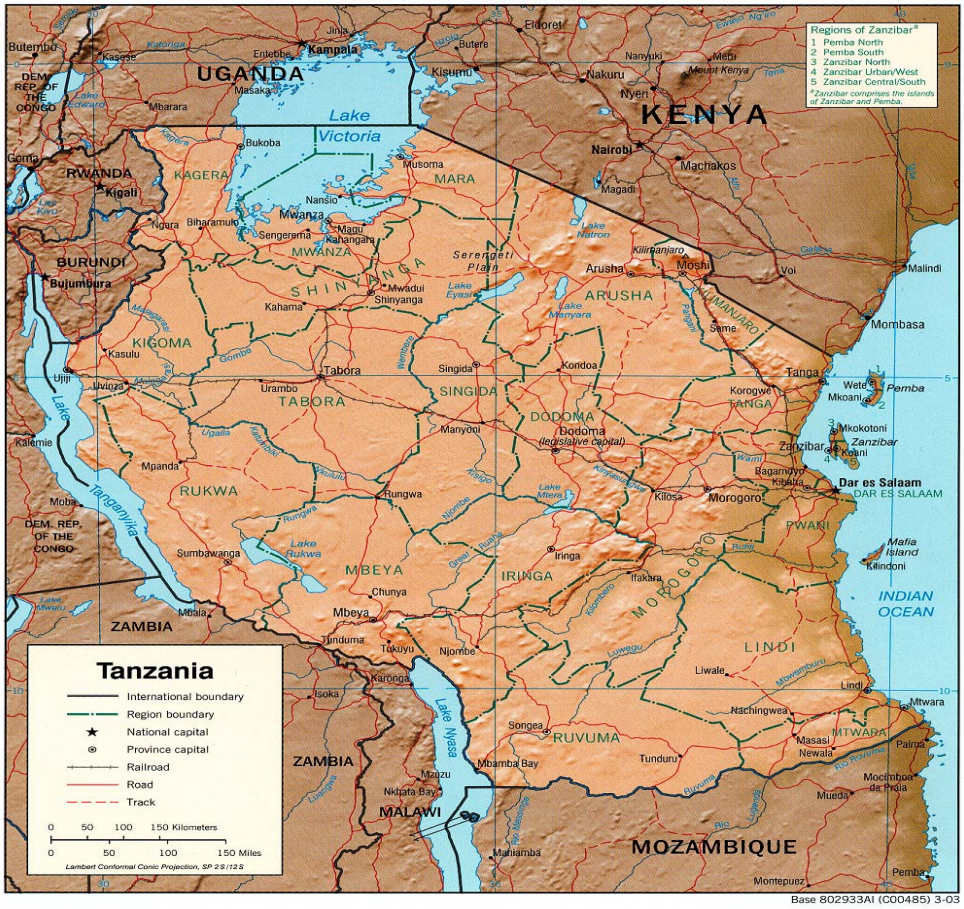


Figure 1: Map of Tanzania

Physical Features

Tanzania is a country of highly varied physical features with a total area of 945,087 sq km (364,900 sq mi), including 59,050 sq km (22,799 sq mi) of inland water. The country is dissected by the two arms of Africa's Great Rift Valley which cut through the central plateau of Tanzania.

In the northeast, near the Kenya border, is a volcanic region with the snow-capped mount Kilimanjaro, an inactive volcano that rises to 5,895 meters above sea level.

Africa's three great lakes Victoria, Tanganyika, and Nyasa are partly in Tanzania. Except for Lake Victoria, the entire lakes lie in the Great Rift Valley. Lakes Tanganyika and Nyasa, in the west, are large, deep bodies of freshwater; those in the eastern rift, such as Lakes Natron and Eyasi, are small and saline and have no outward drainage.

Tanzania has nine major drainage basins[1] that, according to the recipient water body, can be categorized as follows:

[1] http://www.eoearth.org/article/Water_profile_of_Tanzania

- Basin Draining to the Mediterranean Sea:

- The Lake Victoria basin, which is part of the Nile River basin.

- Basins Draining to the Indian Ocean:

- The Pangani River basin;
- The Ruvu/Wami River basin;
- The Rufiji River basin;
- The Ruvuma River and Southern Coast basin;
- The Lake Nyasa (Lake Malawi) basin, which is part of the Zambezi River basin;

- Basin Draining to the Atlantic Ocean:

- The Lake Tanganyika basin, which is part of the Congo River basin.

- Basins Rift Valley (endorheic) basins, of which amongst others:

- The Lake Eyasi and Bubu depression; Lake Manyara;
- The Lake Rukwa basin.

River regimes follow the general rainfall pattern. River discharge and lake levels start rising in November-December and generally reach their maximum in March-April with a recession period from May to October/November. Many of the larger rivers have flood plains, which extend far inland with grassy marshes, flooded forests, and ox-bow lakes.

Climate

Tanzania has two distinct rainy seasons (long and short rains) in the north, from November to December and from March through May respectively. The short rains are low and erratic and poorly distributed along the coast, northeastern and northwestern parts of the country including the regions of Arusha, Manyara, Kilimanjaro, Tanga, Coast, Mara, Mwanza and Kagera. In the south there is one rainy season, from November to March.

The climate on the islands namely, Unguja and Pemba is tropical with heat tempered by sea breezes and is constant throughout the year, except during the rainy seasons. The island has two rainy seasons, the heavy rains fall in April and May, and the lesser in November and December.

Forest and vegetation

A total of 38,811,000 ha or 43.9 percent of Tanzania's land area, is classified as forest. Forests grow mainly in the highlands and along the coast. Elsewhere there are steppe and savannah grasslands and some areas are semi-arid.. There are about 13,000,000 ha of permanent forest reserves.. The eastern border of Tanzania mainland with 800-km coastline is covered by mangroves, coral reefs and other marine life.

The agroecological zones

The country is divided into seven Agro-ecological zones which include the eastern, southern, southern highlands, western, northern highlands, central, and lake zones. The zones are defined by the changes in climate, socioeconomic status; land use, production practices, soil and land form (Appendix 1).

Population

Based on 2006 census estimates, Tanzania's population is about 39 million with a growth rate of 2.072% per year. Nearly 77% of the population lives in the rural areas and only 23% of the population live in urban areas[2].

Agriculture Sector

The agricultural sector is comprised of crops, livestock and forestry sub sectors dominate the economy of the United Republic of Tanzania. The sector is characterized by subsistence farming organized in villages with an average land holding of less than 0.2 to 2 ha per family farm household. Agricultural sector contributes 26.5 percent towards the total gross domestic product (GDP)[3] and 30 percent of the export earnings. The crop sub-sector contributes on average, 21.2 percent of the total agricultural GDP.

The traditional cash crops include coffee, sisal, tobacco, tea, cloves, cashew nuts, sugar and pyrethrum. Food crops include maize, paddy, wheat, sorghum, pulses, millet, cassava, beans, sweet potatoes, round potatoes, pigeon peas, sesames, groundnuts, sunflower, bananas vegetables and fruits. In recent years Tanzania has met its food requirements hence becoming self-sufficient in food demand. For example in 2007/2008 the country produced 10.03 million MT of food which was 106 % of the total food requirement[4].

Farming systems in Tanzania

The country has various farming systems, which are classified depending on climate, altitude, landscape, farm size, tenure and organization, soil types, cropping patterns, main crops, labour use, income levels, the ecological conditions and available natural resource base.

Seed system

[2] UN Report, 2007 ???)
[3] (URT, 2008) ???
[4] Annual Budget Speech, 2008/2009. Ministry of Agriculture Food Security and Cooperatives

Tanzania has a well established public research institutions dealing with development of varieties and production of breeder's seed. The institutes have released a number of improved varieties mostly open and self-pollinating composites, hybrids and clones..

The Agricultural Seed Agency (ASA) which is a government agent is responsible for multiplication, distribution and marketing of basic and certified seeds of the public bred varieties. The agency produces its certified seeds through contract growers located in various parts of the country. Seed quality control is carried out by the Tanzania Seed Certification Institute (TOSCI) which was established under the Seed Act of 2003.

In addition, private companies are also involved in the production, importation and distribution of improved seed of food crops. Public research institutes are responsible for production of basic planting materials of cash crops, whereas bulk multiplication is done by respective crop boards. Production of basic and bulk planting materials for majority of cash crops is handled by semi-autonomous research institutions owned and managed by stakeholders.

The informal seed sub-sector continues to be the major source of seed supply for the majority of farmers in Tanzania. More than 90% of the seeds sown by farmers are seeds saved on their own farms.

CHAPTER 1: STATE OF DIVERSITY

1.1 The state of diversity and importance of major food crops for food security

Tanzania has a great diversity of both cereals and spices germplasm that are of importance for food and income. Surveying and inventorying of these crops has helped in identifying and retaining useful genotypes for various productions and has added value to the present genetic diversity in crop improvement activities.

Surveying and inventorying Plant Genetic Resources for Food and Agriculture

The National Plant Genetic Resources Centre conducted surveys and inventory on endangered species. During the survey and inventory process, indigenous technical knowledge (ITK) of the farmers was used in the process of identifying, assessing threatened and endangered species among the total genetic diversity of plants available (Table 1).
Both formal and informal methods of survey were used for the activities including reconnaissance surveys, random sampling, transect walk, home and back yard survey, focus group discussion and semi-structured questionnaire and interviews. The coverage was at the regional, district, division, wards, and village levels. A number of threatened species were

identified as presented in Appendix 7 and 8. The survey and inventory activities were part of the National Biodiversity Action Plan.

The major findings were the identification of priorities, range of species on indigenous vegetables and the collection, identification and conservation of these species. Most of the identified species were low yielding, pest and disease tolerant, early maturing with poor culinary qualities. The concern is that the project is at its infant stage although some of the species have already disappeared. The results also indicated that the less commonly used vegetables (most of the wild and under-utilized vegetables) and fruits were potentially rich in both macro and micronutrients. Among the surveyed areas, Ruvuma region was found to have many wild and under-utilized food plants of high nutritional value which have not been documented.

The major constraints that affected the process was inadequate financial and human resources which limited the frequency of conducting the surveys and inventories. Despite such constraints, there are several opportunities such as enabling policy environment, accessible indigenous knowledge and existing collaboration between high learning institutions and NPGRC. The opportunities should be used in setting future priorities. In the future surveys, priority will continue to be given to indigenous crops and their wild relatives. Other priority areas include;

- Strengthening agricultural curriculum in agricultural colleges and universities by including indigenous vegetables.
- Improving documentation of indigenous vegetables and availability of data to stakeholders,
- Improving marketing of indigenous vegetables,
- Increasing collaboration between national and international research centres
- Strengthening national breeding programmes for under-utilized crops

Landraces and old cultivars

Tanzania is endowed with a rich genetic potential of landraces which harbour a great gene pool for crop improvement. Unlike high-yielding varieties whose variability is limited due to homozygosity and a narrow gene pool, the landraces maintained by farmers are endowed with remarkable genetic variability, as they are not subjected to subtle selection over a long period of time. Aiding in the adaptation of landraces are the wide agro-ecological niches with unmatched qualitative traits and medicinal properties rich germplasm. These germplasm have wealthy variability of complex quantitative traits that have remained unexploited.

Landraces are also important genetic resources for resistance to pests and fungal diseases. Old cultivars of crops play a very important role in crop varietal improvement. The situation on the ground is different in that landraces and traditional varieties are used extensively in Tanzania owing to the limited acceptance and supply of commercial seed of improved varieties. Some of the old cultivars still used in production include maize varieties Katumani and UCA which were released in late 1950s and 1976 respectively. Currently only **10%** of the total cultivated land is planted with certified seeds of improved varieties and the rest of the area is planted with farm saved seeds of improved varieties, farmers varieties and landraces.

Despite inadequate support to farmers', local plant genetic resource management systems are responsible for providing seeds for the vast majority of food crops in Tanzania. The sustained cultivation of food crops has primarily been based on farmers' use of indigenous landraces acquired through exchange with traditional old cultivars. There are a great representation of diversity in terms of varieties from different crop which are well adapted to local production conditions and household requirements cultivated around the country (Annex 16).

The links and interactions between local plant genetic resource management systems and formal plant genetic resource institutions are limited and weak. Commodity plant breeding programs have primarily been based on on-station trials and have taken little notice of the results from the farming systems research. Seed regulations have been based on international standards, which are incompatible with farmers' management practices..

Efforts have been made to strengthen farmers' participation in the agricultural research process through farming different systems research approaches such as Client Oriented Research (CORE) which was later changed to Client Oriented Research Development and Extension Management Approach CORDEMA. Experiences gained from this approach have shown that farmers can be useful partners in research and development and management of plant genetic resources.

A large proportion of Tanzania farmers are still subsistence producers who value and take pride for using crop varieties originating from their own societies or farming environment which are also very diverse. The number of traditional varieties selected to suit the different cultural values and environmental conditions, is also very large. Many traditional varieties are often given names which emphasize the qualities of the varieties thus resulting in easy sharing of information and seed of such varieties. As a result, traditional varieties are easily accepted and spread within ethnic grounds.

1.2 The state of diversity and importance of minor crops and underutilized species

Threatened species

Species under threat are those used for medicinal purposes, timber and fuel wood which are on the point of extinction due to over harvesting, deforestation or climate change. No proper documentation is available on the extent neither of genetic erosion nor to what extent of the threat has been caused by human or natural disasters. The decline of crop diversity is largely a result of the replacement of traditional varieties with high yielding modern varieties. The decline is also brought about as a result of change in natural habitats caused by changes that have been occurring in the environment which are likely to speed up the loss of crop diversity even further. Other threats include over-exploitation of land and other natural resources, land use changes, fewer farmers cultivating the threatened crops, pests and diseases, drought, floods, lack of markets, deforestation, low priority of research and production of indigenous vegetables, poor seed distribution and availability and lack of awareness on indigenous vegetables. Indigenous

crop species such as *Cordyla africana, C. densiflora, Strychnos coculoides, S.spinosa, Ximenia mericana, members of the family Orchidaceae, Arrow root (Tacca pinnatifida)* are in threat of extinction.

Minor crops (forest genetic resources and under-utilized crops).

Tanzania has about 33.5 million hectares of forests and woodlands representing about 40 percent of the total land area. The forest ecosystems are categorized as pure forest reserves comprise of 3.4 percent, mangroves 0.3 percent and woodlands 96.3 percent of the total area. About 37.3 percent of the forest has been gazetted as forest reserves, 5.96 percent are forests and woodlands in national parks and 56.74 percent being non reserved forest land.

A modest area of 80,000 hectares of the gazetted area owned by the government is under plantation forestry and about 1.6 million hectares are under water catchments management. About 77% of the indigenous vegetation is under some form of protection and deforestation rate is over 1% per annum.

A number of indigenous tree species including agro forestry species have been massively cut for various uses such as sawn timber, construction and carvings. As a result, these species are threatened with extinction because of their low regeneration and are therefore protected from uncontrolled harvesting. Such species include:

- *Afzelia quanzensis*
- *Allanbalankia stuhlmannii*
- *Beilshmeidea kweo*
- *Brachystagia butchinsii*
- *Cephalosphaera usambarensis*
- *Dalbelgia melanoxylon*
- *Juniperus procera*
- *Khaya nyasica*
- *Milicia excelsa*
- *Ocotea usambarensis*
- *Olea capensis*
- *Ossyris spp*
- *Podocarpus usamberensis*
- *Podocarpus latifolius*
- *Pterocarpus angolensis*

Moreover, the coastal area are rich in mangroves with at least ten known species which are important sources of fuel wood, structural timber; medicinal and die plants. The mangroves are also important breeding areas for fish. The survival of some the mangrove species is threatened by salt making industry along the coast and anthropogenic effects.

There are sectoral policies in agriculture, forestry, land, and minerals. that affect land tenure. These sectoral policies have many limitations which make it difficult to achieve sustainable utilization of resources. Some of the limitations are:

- Tenure insecurity,
- Ambiguity with respect to village boundaries,
- Omission of grazing and access to water rights of nomadic groups in the semi-arid and arid areas.
- Existence of communal grazing lands

The overall goals of the National Forest Policy of 1986 is to enhance the contribution of the forestry sector to sustainable development of Tanzania and the conservation and management of the natural resources for the benefit of present and future generations.

The objectives of the forestry sector based on the overall goal are defined as follows:

1. Ensure sustainable supply of forest products and services by maintaining sufficient forest area under effective management.
2. Increase employment and foreign exchange earnings, through sustainable forest based industrial development and trade.
3. Ensure ecosystem stability through conservation of forest biodiversity, water catchments and soil fertility,
4. Enhance national capacity to manage and development the forest sector in collaboration with other stakeholders.

Inspite of the conducive policies there are several problems facing forest conservation in Tanzania as a result of:

- Anthropogenic effects such as deforestation and destruction of the forest by fire.
- Outbreaks of insect pests, particularly in plantation forests.
- Massive overgrazing due to migration of livestock.

.

1.3 Factors influencing farmers' crop and variety choices

Concerns have been raised about the genetic erosion of crop genetic resources since it has become an important part of national policies and international treaties. Over the last decade both *ex situ* and *in situ* conservation have been set up to maintain threatened crop genetic resources in the country.

Land degradation is strongly linked to biodiversity erosion such that in degraded lands farmers tend to concentrate on production of stress adapted species eg. cassava, sorghum and millets. Furthermore, changes in agricultural practices and use of genetically uniform modern varieties are replacing the highly diverse local cultivars and landraces in traditional agro ecosystems.

While urbanization, has resulted in the changing lifestyles the outcome being different preferences in consumption habits and utilization of crops.

In areas where there has been an influx of refugees there has been severe genetic erosion due to over exploitation of the traditional germplasm. Also replacement of traditional varieties with improved varieties and environmental changes has resulted in the emergence of new diseases. .

1.6 Promoting *in situ* conservation of wild species and relatives of crop plants

The status of wild relatives of crops and rare species has not been addressed consistently as a result one cannot be certain of the status of these species. There are, however, a number of major crops which have known wild relatives (See Table1.6.1).

There are also important pasture species in the major habitats which could be improved to derive cultivars for modern farming and ranching. There is also a great wealth of species that are exploited or have potential for ornamental use such as orchids and the world famous African violet (*Saintpaulia* spp) which has 20 endemic species.

Records show that numerous plant species are used for food and medicinal purposes in various parts of the country. Msangi (1991) indicated that about 290 indigenous plant species in 77 families and more than 175 genera are used in Tanga and Kilimanjaro regions alone

Wingfield (1979) compiled a comprehensive list suggesting that over 700 species of vascular plants were seemingly rare or vulnerable. However, the World Resources Institute recognizes 158 plant species that are threatened.

Table 1.6.1 Activities contributing to *in situ* conservation of crop wild relatives and wild plants for food production.

Name of programme/project/ activity	Name of conservation area	Type of area	Name of taxon
Domestication and Commercialization of Indigenous Fruit Trees of Miombo Woodland	Mbeya(uyole), Iringa (Ruaha),Shinyanga (Rubaga) Morogoro (TTSA)	Restoration	*Uapaca kirkiana; Strichinose cocloides; Vitex Mombasae;Flacourtia indica; Vitex Doniana; Sclerocarya birrea*
Promotion of conservation and sustainable utilization of *Uapaca kirkiana* in Southern Tanzania	Southern zone of Tanzania	Protected	*Uapaca kirkiana*
Conservation of Edible Orchids in the	Kitulo	Protected	Orchids spp.

Southern Highlands - Makete/Kitulo	
Studies on the Indigenous Knowledge and Plant Bioversity in Kasulu District, Kigoma Region, Tanzania	Kasulu, Kigoma Region Tanzania

In addition, there are several activities that have been carried out to raise awareness of the value of crop wild relatives and wild food plants in food security and plant breeding.

The current status on the conservation of crop wild relatives and wild plants relevant to food production is still in progress with some work been undertaken. There are no existing plans or national policy that supports conservation of crop wild relatives. There has been quite an effort in the identification of endangered, nutritious richness, underutilized, multipurpose uses of wild food plants. Work has been done on the implementation of management practices to maintain high level of Crop Wild Relative (CWR)/Wild Food Plants (WFP) genetic diversity with the involvement of local communities. Other activities undertaken include encouraging public participation, arrangements for *ex situ* conservation of threatened and endangered CWR/WFP.

1.6 Policies affecting protection of traditional varieties and wild resources

In 1995 the government formulated the National Land Policy (NLP) and its guidelines, which has a direct effect on the protection of traditional varieties and resources. The national land policy has categorized land use into;

- General lands -- lands removed from the domain of deemed rights of occupancy, also known as granted rights of occupancy;
- Reserved lands -- lands reserved principally for various conservation purposes; and

- Village lands - the rest of rural lands.

Furthermore, the NLP protects highly sensitive areas such as water catchments, forest areas of biodiversity, national parks and wetlands. Also it reserves village lands and some communal areas for conservation purposes.

1.7 Promotion of *in-situ* conservation of wild crop relatives and wild plants for food production

There has been great focus on the establishment and strengthening of zonal and regional botanical gardens in the country with the involvement of stakeholders. Exploratory missions have been taken towards the promotion of *in situ* conservation of wild crop relatives and wild plants for food production.

Farmers as well as policy makers are not sufficiently aware of the value of crop wild relatives and wild food plants; hence no effort is made to domesticate them. The domestication of these food plants needs to be technically and financially supported by regional and international organizations.

CHAPTER 2. THE STATE OF *IN SITU* MANAGEMENT

2.1 Introduction

The genetic diversity present in thousands of plant species constitutes an intergeneration resource of vast social, economic and environmental importance. In recent years the intensified exploitation of plant genetic resources has been under threat due to population explosion. This has led to the extensive destruction of nature to the extent that several natural ecosystems are on the verge of extinction in Tanzania. Efforts to conserve plant genetic resources have been coordinated by NPGRC since 1991 when it was established.

An increasing number of people, national institutions, as well as international bodies have realized that urgent measures are required to save representative samples of most tropical ecosystems and its biodiversity The aim of genetic resource conservation is to maintain conditions in which the genetic makeup of a species can continue to evolve in response to changes in its environment, at the same time reducing the rate of genetic erosion.

2.1 *In situ* conservation activities

2.1.1 Inventories and surveys

There have been threats to the integrity of plant genetic resources from a myriad of causes such as ;

- deforestation,
- changes in land use,
- inappropriate forest use and management practices,
- pollution and climate change,
- uncontrolled movement of germplasm.

Therefore valuable gene pools of prevalent species may disappear undetected, either because not enough is known about the distribution of genetic variation. By protecting and maintaining most wild species in their natural habitats, the process of evolution will continue with minimum interruption by anthropogenic forces. Large areas of land (≥25% of the country) are protected by various laws and established as National Parks, Game Reserves and Forest Reserves in which the NPGRC are in collaboration in the maintenance of these plant species.

Measures aimed at sustainable forest management

The overall national objective is to conserve natural ecosystems with their genetic resources so that the values and benefits of the forests are perpetuated. However, the draft forest policy of 1986 is fairly general and thus does not include specific policies to encourage sustainable utilization of the resources. The weakness was addressed in the Tanzania Forestry Action Plant (TFAP) 1991-2008. TFAP is very specific on such issues like increasing awareness on nature conservation, sustainable conservation by management of natural forest, research and training in conservation and creation of a network of nature reserves.

Thus, NPGRC has embarked on the routinely collection, conservation and management processes taking into account different levels of threats, patterns of land use, forest management practices and future selection and breeding programmes. At present *in situ* and *ex situ* approaches are being used to maintain the importance of data on species that are of significance to conserve, and the levels of threat to them, be collated with *in situ* and *ex situ* management approaches in mind.

Table 2.1.1: Activity carried out to raise public awareness of the value of crop wild relatives and wild food plants in food security and plant breeding.

Name of activity	Public awareness of the value of CWR and WPF raised for:
Promotion, utilization of indigenous fruit species	Food security
Indigenous fruit trees project	Food security
Promotion of conservation and sustainable utilization *of Uapaca kirkiana* in Southern Tanzania	Food security
Development of conservation strategies for the wild edible orchids in Tanzania	Food security
Baseline survey of neglected and underutilized crops in Tanzania.	Food security
Studies on the Indigenous Knowledge and Plant Bioversity in Kasulu District, Kigoma Region, Tanzania	Food security
A survey of wild and underutilized edible plants in Ruvuma Region, Tanzania	Food security, Plant breeding
Indigenous fruit processing	Food security

2.2: Conservation of wild genetic resources for agriculture

There are several activities that have been undertaken by the NPGRC on the *in situ* conservation of wild relatives and wild plants for food in agriculture. Such activities include:

- Domestication and Commercialization of Indigenous Fruit Trees of Miombo Woodland in Mbeya(Uyole), Tabora (Tumbi), Iringa (Ruaha),Shinyanga (Rubaga) Morogoro (TTSA) whose main areas of work was the restoration site of species from the following taxon: *Uapaca kirkiana; Strichinose cocloides; Vitex Mombasae;Flacourtia indica; Vitex Doniana; Sclerocarya birrea.*
- Promotion of conservation and sustainable utilization of *Uapaca kirkiana* in Southern Tanzania protected area.
- Conservation of Edible plants at Kitulo protected area for *Orchids spp.*
- Studies on the Indigenous Knowledge and Plant Bioversity in Kasulu District, Kigoma Region, Tanzania.

2.3 Ecosystems management for conservation of plant genetic resources

Germplasm exchange

Exchange of agricultural germplasm is generally done between local plant breeders and International Agricultural Research Centers. However, since most previous collection missions were initiated from outside, there have been substantial amounts of materials deposited in gene banks outside the country annually. NPGRC has been responsible for collecting and conserving the germplasm at its gene bank. They have also been involved in repatriating whatever was conserved outside the country

2.4 On-farm management and improvement of plant genetic resources

On-farm activities have been addressing management and improvement of PGRFA in local farming communities with the involvement of farmers as outlined in **Table 2.4.** Some of the activities include:

- Assessment of farmers' knowledge;
- Characterization and evaluation of local varieties;
- Studies on local varieties, population structure and dynamics;
- Seed multiplication and distribution of improved varieties;
- Assessment of improved varieties utilization and management;
- Socio-economic assessment of PGRFA
- Pilot sites establishment in areas of high diversity;
- Establishment of stockiest, collection centres and warehouse receipt system
- Training of extension officers,
- Collection of indigenous vegetables.
- community based research,
- participatory plant breeding

Despite the aforementioned activities, there is a need of promoting on-farm management and improvement of PGRFA at both the regional and international levels through:

- Formulation of networks at National, Regional and International levels that shall actively involve farmers and others stakeholders
- Develop and disseminate information to farmers and other stakeholders
- Incorporation of Indigenous /Traditional Knowledge to scientific systems
- Strengthen monitoring and evaluation system
- Establishing of early warning system
- Strong awareness creation by national, regional and international institute on PGRFA
- Close collaboration by NARS and farmers by such institutes
- Capacity building of farmers involved in conservation of horticultural crops (indigenous vegetables, spices and herbs, indigenous fruits and banana)as well as establishment of demo sites for the same
- Training of field inspectors and seed producers
- Agricultural policy should influence improvement of on-farm management of PGRFA
- Initiate focused Zonal Seed Banks with support of regional and international PGR

At present there is no mechanism in place which facilitates rapid acquisition, multiplication, distribution and cultivation of reintroduced germplasm in areas that have been faced with natural disasters. A few institutes have been involved in some activities of reintroduction of germplasm following a natural disaster as illustrated in Appendix 10.

The reintroduction of locally adapted germplasm and assistance to farmers in the restoration of agricultural systems following disaster has been possible because of food crop parental stocks that are preserved at International agricultural research centres, with assistance from regional collaborators/countries.

Efforts have been made to establish on-farm management of PGRFA but have been restricted by several constraints including, inadequate incentives provided to farmers, insufficient seed or planting materials, insufficient number of staff; insufficient skills and staff training, insufficient financial support,

Considering the fact that on-farm management and improvement of PGRFA are not a national priority, there is a need to promote PGRFA through establishment of coordinated networks at national, regional and international levels by involving farmers and others stakeholders..

.

Table 2.4: On-farm conservation by farmers

Name of on-farm conservation programme/project	Local farmer community involved	Number of farmers involved
Improving Food Security in Sub - Saharan Africa through increased Utilization of Indigenous Vegetables; Studies on Seed Production and Agronomy of Major		100

African vegetables.		
Cassava collection and characterization.		
Agricultural Sector Program Support (ASPS) Phase I & II (Seed Production Component)	Individual farmers and farmers groups	>12000
Babati Farmers Participatory Research Project	Farmers Research Groups	900
Agricultural Marketing Project	Farmers Research Groups	900
Survey on the status of *in-situ* and on farm conservation of Plant genetic resources in the country	Small- scale farmers in various districts	
Sorghum variety trials		
Grape varieties evaluation		>12000
Participatory Irrigation Development Program		20
TARP II-SUA Project		15
Community based seed multiplication for sesame, groundnuts, sorghum, cowpeas, pigeon peas, maize, green gram, rice and cassava		30000

2.5 Assessment of major needs for *in situ* management

Farmers and other stakeholders are not sufficiently aware of the value of crop wild relatives and wild food plants because there is lack of initiative to domesticate them. There is a need to assess farmer's knowledge on *in situ* management and characterize local varieties for utilization.
The domestication of these food plants needs to be technically and financially supported by regional and international organizations.

CHAPTER 3 THE STATE OF *EX SITU* MANAGEMENT

E*x situ* collections in the country stands as a buffer for any emerging calamity/disaster and is frequently used in crop improvement. To realize its value, the national, regional and international organizations must support the collection process, in terms of capacity building, financial assistance and materials while ensuring that all activities are well coordinated.

Most of the *ex situ* collection in agriculture are maintained as breeders' working collections for seed production or in field gene banks. In forestry, *ex situ* collections are mainly maintained in arboreta.

3.1 Collecting local and exotic germplasm

Both local and exotic germplasm are included as collections. The balance between local and exotic germplasm depends on the crop and resources available. Presently, most of the national collections are exotic. There is a bias towards using exotic materials as working collections in research stations since they are usually in more advanced stage of development (Appendix 11).

There have been several efforts to collect and establish *ex situ*, accessions under specific storage conditions (Table 3.2).

Table 3. 2: *Ex situ* collection and the number of accessions stored under specified storage conditions.

Name of *ex situ* collection	Name of taxon	Name of crop
Rangewide collection		*Uapaca kirkiana, Sclerocarya birrea*
Maize landraces collection	*Zea mays*	Maize
Rice Germplasm	*Oryza sativa*	Rice
Spices Gremplasm		Rice, Ginger, Cinnamon, , Vanilla, Cloves, Black pepper, Tumeric, Paprika
Cotton germplasm	*Gossypium sp.*	Cotton
Maize germplasm	*Zea mays*	Maize
Cassava germplasm	*Manihot esculentum*	Cassava
Sweet potato germplasm	*Ipomea batatas*	Sweet potato
Sorghum germplasm	*Sorghum bicolor*	Sorghum
Naliendele	*Sesamum indicum*	Sesame
Naliendele	*Arachis hypogea*	Groundnuts
Naliendele	*Manihot esculenta*	Cassava
Naliendele	*Anacardium occidentale*	Cashewnut

There are several activities within the national research programmes dealing with *ex situ* collections such as short term seed collection at the gene bank, production of foundation seed for commercial purposes by the National vegetable seed programme. Other activities include the storage of reference materials of seed, training of field inspectors and seed producers. The centre has also been collaborating with the Millennium Seed Bank Project for short term collections..

For the medium term activities, research is conducted to determine the percent propagation of *ex-situ* materials, conservation and nutritional quality of endangered indigenous forest foods, fruit plant species and establishment of arboretum in selected Miombo and montane areas. There has been concerted effort by the centre to develop conservation strategies of wild edible orchids in Tanzania. There is also work on exploration and collection of crop germplasm from the Lake and Southern zones of Tanzania.

Furthermore, several missions have been organized as part of long term conservation strategies including collection of vegetables, pigeon peas, maize land races and chick peas collected from various parts of the country (Table 3.3).

Table 3.3 Collection mission, on long-term conservation

Collection mission	Collection area	Collection taxon and crop	Number of collected accessions	Number of collected accessions secured in long-term conservation

Indigenous Vegetable	Dodoma rural,Iramba Singida,Missugwi and Magu Mwanza	*Cleome gynandropsis(-)* Amaranth, Jews mallow,Spider plant	2	2
Pigeon pea	Coast, Dar Es Salaam, Morogoro, Tanga, Arusha, Mtwara, Lindi and Manyara regions	*Cajanus cajan* Pigeon pea	123	123
Maize landraces	Iringa, Mbeya and Arusha regions	*Zea mays* Maize	81	81
Chick pea landrace	Mwanza, Shinyanga, Mara,Singida,tabora and Arusha	*Cicer arietinum* Chickpea	89	89

The centre is also involved with the development of indigenous vegetables germplasm collection, characterization, multiplication and conservation of crop and wild species.
In addition, survey on the status of *ex-situ,* frequent monitoring of the collections is done to maintain their viability, genetic integrity and inventorize the available stock
SADC Documentation and Information System is used to store, manage, and analyze data on *ex-situ* collections. The system is currently holding 4600 accessions. Data on tree seed collected for different uses have been stored in Microsoft excel data base. Conservation of accessions has been carried out in collaboration with SADC Plant Genetic Resources Center (SPGRC) and other international centres such as International Rice Research Institute (IRRI).

In the process of implementation of *ex-situ* conservation activities the centre faced several constraints including inadequate human and financial resources, prevalence of pests and diseases and power outrage as well as inadequate capacity for regeneration of germplasm. Gaps were detected in the collection process in terms of incomplete geographical coverage of targeted taxa especially for the rice germplasm.

In order to address these challenges there is a need to strengthen collaborations with regional and international organizations and information exchange networks, training on conservation, and use of tools for mapping and soliciting funds from local and international bodies for conservation of ex-situ. In future priority should be given to the regeneration of *ex-situ* germplasm particularly rice (*Oryza sativa)* and spices (Ginger, Cardamom, Vanilla) and the identification of genotypes with different levels of adaptations for various disasters.

CHAPTER 4: STATE OF USE

4.1 Importance Of Utilization Of Plant Genetic Resources Collection

Agricultural research and development in Tanzania, is organised on commodity basis involving both private and public institutions. Use of germplasm largely depends on the objective of the

individual commodity programme. Each programme has its own working collections, maintained at various research institutes under different storage conditions.

Food crop research and development is under different national research institutions, private seed companies while cash crops such as coffee and tea are under Tanzania Coffee Research Institute (TaCRI) and Tea Research Institute of Tanzania (TRIT) respectively and operate as semi-autonomous institutions. Forestry research and development is done under TAFORI, which has a Silviculture Research Centre at Lushoto in Tanga region. The National Plant Genetic Resources Centre (NPGRC) has responsibility of monitoring the use of all plant genetic resources in the country, but currently lack sufficient capacity to undertake this task.

NPGRC has continued to improve its capacity to collect and characterize germplasm materials of landraces for cereals, vegetables, oilseed crops, spices, and others and made available for use by various crop breeders in the country (Appendix 13). NPGRC and research institutions characterize the genetic resources based, on agronomic and biochemical traits. Recent efforts are underway to apply molecular markers techniques for characterization.

At present most of the crop varieties are locally bred using introduced germplasm as their sources with the exception of vegetables and forest germplasm that use landraces. Different research institutions receive germplasm from other international research centres to increase diversity within the current varieties.

At present the capability to perform breeding for specified crop groups differ from one crop to another, for example the capability of breeding cereals, roots and tubers is increasing while the fruit breeding capability is decreasing (Appendix 13). The decline is caused by low priority given to fruit crops and lack of human and financial resources.

4.2 Utilization Activities

A number of activities are still ongoing including crop improvement, post harvesting processing, marketing, multiplication of seed/planting material and documentation and collection of information (Appendix 14).

4.2.1 Use of forest plant resources

Forest germplasm are usually collected, preserved and distributed by TAFORI as research samples or for various afforestation programmes in Tanzania and elsewhere. Due to limitations in the storage of tree seeds at the Silviculture Research Centre in Lushoto, a National Tree Seed Project was developed to meet the country's own seed requirement. The project started in July 1989 under Forest and Beekeeping Division, which was later changed to a National Tree Seed Programme (NTSP) with the same main objectives. The activities of the programme are now under the Tanzania Tree Seed Agency (TTSA) with its headquarters in Morogoro and operate with three zonal tree seed centres at Iringa (Southern Tanzania), Lushoto (N.E Tanzania) and Morogoro.

Forestry activities have improved in areas where people are likely to derive immediate benefit such as in traditional medicine and in afforestration projects. For example the Institute of Traditional Medicine of the University College of Health Science, Muhimbili, has sensitized a large number of

traditional healers on the value of local plants and the need to collect as much information as possible. In addition, there have been a lot of campaigns and tree planting in the country in order to conserve the environment.

There are several factors affecting activities related to forestry plant genetic resources, which include lack of proper infrastructure, financial, and human resources considering the large number of species known to exist in Tanzania. Studies on plant genetic resources in the wild require heavy investment in resources and finance for a long period

The immediate need required to improve the development of forestry plant genetic resources activities include detailed ecogeographic surveys, capacity building to local institutions to achieve reasonable standard of conservation and skills to handle sufficient volume of information and materials..

4.3 Characterization, evaluation and pre-breeding

Some of the materials needed in plant breeding are drawn from germplasm received from international research centres. These materials received are evaluated and assessed as prebreeding materials under local conditions by various research institutes for their adaptability and resistance or tolerance to abiotic and biotic stresses.

National Research Institutes have been involved in the assessment and improvement of a number of crops such as maize, finger millet, pigeon pea, pumpkins, rice and spices to mention a few with the participation of farmers. Areas of assessment and improvement included increasing intra-specific diversity in crops, monitoring intra-specific diversity in crops; increasing diversity in agricultural systems and participatory diversity methods applied. Other areas of assessment included improved quality protein maize, High yielding sorghum varieties, improvement of agronomic characteristics, qualities, tolerance to striga and resistance to pests and diseases. These traits/stresses assessed were based on the agroecological zones prevailing in Tanzania (Figure 1).

4.4 Genetic Enhancement

Most of the research institutes in the country have been involved in genetic enhancement activities including introgression of specific traits. The purpose of genetic enhancement has been to introduce specific traits not available in the current breeding materials due to narrow genetic base existing improved crop varieties. In addition, phenotypic screening and assessment has been done. Assessment of genetic diversity was made through pedigree studies and farmers were involved in setting priorities and implementation of various crop improvement programmes.

SADC documentation and information systems were used to store manage and analyze data on germplasm characterization and evaluation using AGROBASE and NCSS software. A total of 2060 accessions were characterized and evaluated **(Table 4.4)**

Table. 4.4. Information used and number of germplasm evaluated

Name of information system	Number of accessions with Characterization/Evaluation data
SADC Documentation and Information System	2000
AGROBASE	30
NCSS	30

NPGRC received a total of 2237 collections of sesame, rice, vanilla and cashew nuts from different global and other national research centres and 52 accessions were distributed within the research institutes (**table 4.4.1).**

Table 4.4.1. Collection and distribution of germplasm of important crops

Name of core collection	**Total number of accession**	**Number of accession distributed**
Rice	408	32
Sesame	200	20
Cashewnut	1,474	0
Total	**2,237**	**52**

Despite the efforts made by the NPGRC to collect germplasm there are some drawbacks which include inadequate working facilities, limited financial support, insufficient trained personnel, less priority given to core collection and complexity of collection methodology.

For more effective characterization, evaluation and core collection to facilitate the use of germplasm, priorities should be given to acquisition of expertise and procurement of laboratory facilities to carry out molecular characterizations and evaluation of accessions. There are opportunities such as agricultural research institutes at zonal level which collaborate with NPGRC and National Gene Bank in characterization, evaluation and collection of plant genetic materials for food and agriculture..

4.5 Promoting Development and Commercialization of Underutilized Crops Species

Many activities have been undertaken to promote and develop underutilized crops species of both agricultural and horticultural crops and traditional cash crops. To ensure its sustainability of such activities, three subject matter specialists from each district have been trained and two of them are responsible for supervision of seed production and one for seed quality. In addition, the government has formed the Agricultural Seed Agency (ASA) with the objective of producing, processing and marketing public bred varieties.

The Ministry of Agriculture Food Security and Cooperatives, through its Crop Promotion Unit has carried out activities to promote commercialization of underutilized field and horticultural

crop species in many parts of the country and in some cases this work has been done in collaboration with institutions such as the Prisons and the National Service

Factors which affect promoting development and commercialization of underutilized crop and species include funding to achieve effective research, awareness creation and promotion, lack of reliable information and limited staff specialized on such underutilized crops like yams, bambaranuts, groundnuts, pumpkins and spices.

4.6 Seed Production and distribution

Formal and informal seed systems determine the production and distribution of improved seed in the country. Formal seed supply system includes public and private sectors. The government supports public sector, which include research institutions responsible for plant breeding activities. The informal seed production and supply system still dominates 90 percent of cultivated seed

Tanzania Official Seed Certification Institute (TOSCI) is responsible for seed quality control in the country. Crop Development Division in the Ministry of Agriculture Food Security and Cooperatives is responsible for co-ordination and monitoring of seed availability and distribution in the country.

Seed delivery system for traditional cash crops is through crop marketing boards for various individual crop types such as cotton, coffee, tobacco, pyrethrum, tea, cashewnut and private research institutes in coffee and. tea,

Besides the establishment of ASA in 2006, in order to improve the supply of quality seed with the mandate to multiply public bred varieties the government initiated intensive program for the production of quality declared seed (QDS) using small scale farmers. These programmes have been useful to improve farmers accessibility to quality seed use by farmers. Public and private institutions such as Horti-Tengeru, FARM Africa and NPGRC have been supporting the process of expansion of local seed grower's associations.

Inspite of the government's efforts to improve the availability of quality seed supply, the industry is still faced with several constraints which include insufficient and availability of foundation seed, improper distribution channels, poor storage facilities which has resulted in the production of poor germination seed materials, high cost of seed and illegal seed traders. Private seed companies are biased to crops that are more profitable.

4.7. Market situation of plant varieties and value-addition
The market and distribution of plant varieties varies between crops (Appendix 15).
For example maize, sorghum and rice are mostly consumed crops in the country and therefore easily marketed. Efforts are underway to develop markets and increase consumption of plant

varieties through processing of protein rich amaranths into flour and oil, processing of cassava and finger millet into flour and establishment of small scale industries for extraction of sunflower oil.

The government has also facilitated marketing of diversity rich crops at national, regional and district levels through promotion campaigns during annual agricultural shows, seed fairs, trade exhibitions and farmers field-days. Upscaling of on-farm seed production is another initiative aimed at promoting such crop varieties.

Despite these efforts, marketing of varieties of low-volume, low-value crops which are not attractive for commercial production is still a challenge.

CHAPTER 5 THE STATE OF NATIONAL PROGRAMMES, TRAINING NEEDS AND LEGISLATION

5.1 Introduction

There are several government ministries and other institutions which deal with or whose activities affect plant genetic resources. The Ministry of Agriculture Food Security and Cooperatives (MAFC), Ministry of Tourism and Natural Resources and Vice President's Office - Environment are, however, the key ministries which manage and coordinate programmes, legislations and polices directly related to plant genetic resources.

The National Plant Genetic Resources Committee (NPGRCCom) was established in 1987 and draws membership from a wide range of institutions in order to ensure good representation of the relevant bodies. The NPGRCom is an advisory body, under the Ministry of Agriculture Food Security and Cooperatives that deals with all matters related to plant genetic resources. NPGRC is responsible in day to day management of activities related to plant genetic resources and is closely supervised by the NPGRCCom.

5.2 National programmes for plant genetic resources

5.2.1 Goals, objectives

The overall goal of the government policy remains to be achieving a sustainable development that maximizes the long-term welfare of both present and future generations of Tanzanians. The following objectives are aimed at achieving this goal:

- To ensure sustainable and equitable use of plant genetic resources without degrading them or the environment;

- To conserve, protect and enhance the nation's natural and man-made heritage in plant genetic resources in all ecosystems as a base for development;

- To enhance derivation of direct benefits from existing plant genetic resources including raw materials for industrial sector and eco-tourisms;

- To raise public awareness and understand of our heritage in plant genetic resources and promote individual and community participation in this cause;

- To promote international co-operation in matters related to plant genetic resources.

Government of Tanzania has established various programmes and institutions and has taken initiatives to strengthen them in order to meet the above objectives.

The National Plant Genetic Resources Centre (NPGRC) was initiated in 1991 as a project under the Ministry of Agriculture Food Security and Cooperatives and operates as a semi-autonomous institution at the Tropical Pesticides Research Institute (TPRI) Arusha. The rationale to put the NPGRC at TPRI was to allow it to have basic institutional support while preparing for more elaborate centre, as well as bringing it close to the National Herbarium of Tanzania (NHT) and the National Plant Quarantine Station (NPQS) both of which were already established by Act of Parliament. In the last three years the government has initiated internal procedures aimed at putting in place a legal framework that will legalise and empower the NPGRC in its role to coordinate access and sustainable utilization of plant genetic resources.

The NPGRC has mandate on the following activities related to management of plant genetic resources:

- *Ex situ* and in *situ* conservation
- Documentation
- Collection and characterization
- Multiplication of *ex situ* materials
- Sustainable utilization of Plant Genetic Resources
- Distribution for scientific use
- Germplasm enhancement through conventional methods and biotechnology
- Training and public awareness.

MAFC through the directorate of research and development is responsible for carrying out research on agricultural crops, production of breeder's seed, technology dissemination, and training of stakeholders. Such activities are performed by eight Agricultural Research Institutes (ARI's) which are supervised by seven zonal research institute found in different agro-ecological zones in the country. Higher learning institutions such as Sokoine University of Agriculture (SUA) also conduct agricultural research on plant genetic resources. In addition private seed companies utilize the introduced plant genetic materials in development of new varieties.

Tanzania Forestry Research Institute (TAFORI) which was established in 1980 is responsible for research and development of forestry genetic resources, while Tanzania Tree Seed Agency, under the Ministry of Tourism and Natural Resources enhance the supply of forest products and

environmental conservation by producing and marketing of high quality tree seed and other propagating materials.

Vice President's Office – Environment coordinates legal and institutional matters related to sustainable management of the environmental quality standards, public participation, environmental compliance and enforcement.

Tanzania Official Seed Certification Institute controls production and marketing of quality seed in the country, including breeder's seed.

In addition to the institutions a number of collaborative projects and programmes are developed and run by non-governmental and private organisations such as Farm Africa.

5.2.2 Funding of the National Programmes

NPGRC and other institutions receive funds through their respective ministries for implementation of national programmes on plant genetic resources. For the last five years the funding for NPGRC programme has improved through government and DANIDA supported programme on seed production Table 5.2.1).

Table 5.2.1 Funds Received By NPGRC From Various Sources Over The Years 2003 to 2008

	FINANCIAL YEARS				
SOURCE OF FUNDS(T.Shs.)	2003/04	2004/05	2005/06	2006/07	2007/08
MAFC	16,852,435.00	25,310,000.00	17,525,120.00	31,250,000.00	20,650,000.
SPGRC	NA	NA	7,725,119.15	10,808,302.43	18,047,820.
MSBP **	0	0	154,151,659.00	64,272,829.25	95,758,819.
ASPS/DANIDA	9,305,860	8,898,879	0	7,113,000	0
	7,542,000	8,267,000	0	9,450,000	0
	7,197,540	6,648,000	0	0	0
	5,954,000	0	0	0	0
ASPS/DANIDA(subtotal)	29,999,400	23,813,879	0	16,563,000	0

Note: ** Millenium Seed Bank Project

NA = Records not available

5.3 National Networks for Plant Genetic Resources

In the last decade there has been very little national networks specifically designed for plant genetic resources for food and agriculture. Babati Farmers Research project was one of a few opportunities for farmers to network on plant genetic resources.

5.3 Education and Training

5.3.1 Current Status and new initiatives

In the last decade there has been tremendous improvement in training of technical staff at the NPGRC especially in the area of Plant Genetic Resources Management. The training ranged from short courses to PhD and MSc levels which were all done at Swedish and Danish universities. The staff received in-service training in a number of areas related to the management of PGRFA as shown on table5.3.1.

Table5.3.1 Number of NPGRC staff trained on specific areas of PGRFA between 2000 and 2007

Name of training course	Number of staff
M.Sc. in Plant Genetic Resources Management	3
Plant Genetic Resources Management	14
Management of Forage seeds	1
Information system course	3
Exploration of Plant Genetic Resources	2
Ph.D. in Plant Genetic Resources Management	1
M.Sc. in Ecology	1
Ph.D. in Bio-policy	1
Documentation and Information certificate	2
Seed production and marketing	10
Participatory planning, monitoring and evaluation of development projects	10
Project management for senior managers	10
Seed Quality control	20

Although improvement in training of the existing staff is expected to improve the performance of NPGRC, staff development in terms of new recruitment and specialized training for NPGRC is still needed in terms of short and long courses in the following areas:

- Management of plant genetic resources
- Documentation and data management
- Laboratory techniques
- Glasshouse techniques

- Micro propagation
- Applied genetics
- Cytogenesis
- Plant taxonomy/systematic
- Plant exploration
- Survey statistic/biostatistics.
- Plant Breeding
- Seed Technology
- Plant biotechnology
- Geographical information system /DIVA GIS

In order to carry out its activities efficiently, NPGRC which is understaffed need to recruit new staff as indicated on Table 5.3.2.

Table 5.3.2. Desired Manpower requirement for the National Plant Genetic Resources Centre

Post	Duties	Preferred Qualification	No	Remarks
Curator	Head of Centre	Ph.D/M.Sc	1	Filled
Collector	Exploration, collection and in situ conservation	M.Sc.	1	Filled
Seed Technologist	Conservation of ex situ orthodox seeds, character station	B.Sc. (computer Science) or M.Sc.	1	Filled
Documentation officer	Management of records an accessions, generation of reports	M.Sc.	1	Filled
Agronomist	Management of field gene banks, multiplication, character station	M.Sc.	1	Vacant
In vitro culture officer	Propagation by tissue culture, maintenance in vito culture, virus indexing	M.Sc	1	Vacant
Geneticist	Genetic studies and biotechnological	Ph.D.	1	Vacant

	manipulations			
Field Officers	Assist one or more scientist in field activities	Diploma	1	Vacant
Lab. Technicians	Assist scientists in the laboratory, supervise routine lab. Work	FTC	1	Vacant
Supporting staff	Assist in various activities e.g data entry, lab routines, secretarial service etc	Form IV/VI plus skill	1	Vacant

Source: NPGRC Report, 1997.

In addition to training and recruitment initiatives, NPGRC need technical assistance from bilateral and international development partners in order to continue carrying out on-the-job training.

The Sokoine University of Agriculture continued to offer general and specific agricultural training courses which had focus on areas of plant genetic resources for food and agriculture. International technical and financial assistance may play a useful role in assisting the University to establish short and long courses on plant genetic resources for food and agriculture. In addition inclusion of PGRFA curriculum at all levels of higher learning training has been recommended by many stakeholders.

The main challenges that limit success in providing education and training to staff working with PGRFA programmes include:

- Low priority accorded to PGRFA
- Lack of financial resources for training on PGRFA
- Scarcity of trainers of trainees

5.4 National Legislations affecting plant genetic resources

A number of legislations and policies have been put in place to protect, regulate and manage the access of the national plant genetic resources which include:

- Constitution of the United Republic of Tanzania of 1977
- National Environmental Management Act of 2004
- Plant Protection Act of 1997 (under review)
- Seed Act of 2003
- Plant Breeders' Rights Act of 2002
- Various Acts of Parliament which established the reserves and the institutions which are managing the reserves such as Forest Reserves, Game Reserves, Ngorongoro Conservation Area and National Parks.
- Agriculture Policy of 1997 (under review)

- National Environment Management Policy
- Bio-safety Guidelines of 2007

Currently there is no specific legislation for management of materials maintained ex situ but a bill to provide for conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use for sustainable agriculture and food security and other related matters is in final stage of enactment. The proposed legislation is also expected to establish a legal status of the NPGRC and is expected to be operational early 2009.

5.5 Information System

The national information management and exchange system on plant genetic resources are still very weak and access to information for food and agriculture in the country is limited. Currently, there are very few activities which are involved in development of data and information management systems for PGRFA such as Documentation of Data and Information on Plant Genetic Resources, Rice germplasm activity and Spices germplasm activity

Launching of the National Information Sharing Mechanism on the Global Plan of Action for PGRFA in 2006 created opportunity for major stakeholders to share information in an organized manner

As far as international collaboration is concerned very minimal consultation on PGR information system such as SINGER of Bioversity DGC was practiced. On the other hand however, a system such as the SADC Documentation and Information System (SDIS) is being used extensively.

Despite the opportunities available for developing a comprehensive information system for efficient management plant genetic resources, on the other hand, there are challenges and constraints including financial and technical support which is not adequate at the moment.

The following are priority areas that need support:

- Maintenance of the national information sharing mechanism on PGRFA which has been effectively used to collect information for preparation of this report
- Strengthening of ministerial data base system and link to the national data base
- Improvement of internet connectivity within national research centres for better access to information on PGRFA from national and international PGR Centres Institutionalize and strengthen information sharing mechanism with other stakeholders.
- Publication and dissemination of findings on PGRFA among stakeholders
- Development, maintenance and dissemination of a catalogue of gene bank germplasm

5.6 Public awareness

The general public is not sufficiently informed about conservation plans which have often been made without the consideration of the demands of the surrounding communities, resulting in land and natural resources use conflicts. The government through campaigns on specific issues such

as forest conservation, soil erosion control, prevention of bush fire, indirectly educates people about plant genetic resources.

The issue of staff-turn-over has implications on public awareness creation. However, the programme does not have sufficient and well trained staff to execute the various activities including awareness creation.

5.6 Challenges

Main challenges, needs and priories for maintaining and strengthening national programme on plant genetic resources over the next ten years (in the future) include:

- Need to increase budget allocations to the national programme on plant genetic resources and related programmes
- Need to establish a fully fledged unit for coordination of various programmes related to plant genetic resources that will promote networking at national level
- Need to speed up the process of putting in place a legal framework on plant genetic resources

CHAPTER 6: THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

6.1 United Nation initiatives

Tanzania is among the signatories of the Convention on Biodiversity in 1992. Since adopting Agenda 21, the country has initiated and implemented a National Environmental Action Plan (NEAP). The NEAP emphasizes, among other things, rational development and use of forest resources: promotion of alternative sources of energy to reduce consumption of fire wood, and the development of a national biodiversity profile as a baseline assessment and as an ongoing monitoring process. The government has also enacted an Environmental Management Act to regulate matters related to protection of environment and establish the National Environment Management Council (NEMC).

International Agreements
Tanzania acceded to the ITPGRFA and many other related Treaties/Conventions which are related to PGRFA.

6.2 International agricultural research centres

6.2.1 The CGIAR

Tanzania has continued to benefit from the activities of the CGIAR Centres and its specialized bodies such as Bioversity International (formerly known as IPGRI) , the defunct International Services for National Agricultural Research (ISNAR) and Central Advisory Service on Intellectual Property (CAS – IP)..

The centres which include CIMMYT, CIAT, ICRAF, CIFOR, CIP, ICRISAT, ILCA, IITA, and IRRI have been actively involved in training and exchange of germplasm of their respective mandate crop through international nurseries and regional networks.

Participation of these institutions in regional networks has greatly benefited research programmes in the country. A number of improved varieties of maize, beans, sorghum, cowpeas, wheat, rice and vegetables have been released based on materials received from the centres and work done in collaboration with them. .

Research in multipurpose Trees (MPT's) for fodder, fuel wood and improvement of soil fertility has been possible through technical support of ICRAF and supply additional materials from ILCA, CIFOR, and ICRISAT.

Bioversity International has been instrumental to a number of activities in Tanzania, including training and search for training opportunities, direct involvement in inventory and documentation of plant genetic resources.

Tanzania like many development countries has numerous other crops which have not been developed to a level that will attract research support from commodity based international institutions. Therefore, it would be more supportive if some of the less known crops are studied within the CGIAR system as alternative to the major crops in the same environments. Surveying and carrying out inventory the lesser known edible wild fruits are among the he activities that need such support. Other areas which need collaborative action include:

Enhancing curriculum development on indigenous vegetables and other food crops in high learning institutions
Strengthening research on underutilized crops
Increasing funding and resources for in-situ and ex-situ collection in the country
Increasing manpower skills through training , exchange visits and networking
Improving working facilities and infrastructure
Strengthening germplasm exchange with international centres and other collaborative centres

6.2.2 Other International Research Centres

Tanzania also benefited from the services of non-CGIAR centres such as AVRDC-World Vegetable Centre, which is an observer member to the CGIAR. AVRDC has its regional centre for Africa which is based in Arusha, Tanzania. It has done a great deal of developing new varieties of exotic and indigenous vegetables in collaboration with national research institute. A

good example of such collaboration is development and release of two tomato varieties, Tanya and Tengeru 97 by national horticultural research institute (HORTI-Tengeru) where AVRDC provided germplasm and additional resources including necessary expertise. The two varieties are now the most popular varieties in Tanzania as well as in the neighbouring counties. In 2007 The AVRDC-World Vegetable Centre has initiated a new programme at its African regional headquarters aimed at promoting vegetable breeding and development of sustainable seed systems in Africa. The programme is known as Vegetable Breeding and Seed Systems (vBSS) and is expected to last for ten years. The country also benefited from ICIPE in the same manner as the CGIAR centres.

6.3 Regional inter-governmental initiatives

Tanzania is a member of SADC, which has a plant genetic resources programme under SACCAR. Under this programme, the SPGRC was formed to run plant genetic activities for the member states. This director collaborative programme has led to establishment of NPGRC's is member states and has promoted exchange of information within the SADC region. Apart from exchange of information, the SPGRC maintains base collections for the region leaving the individual countries to handle active and working collection. The programme also includes a training component, which is critical for the establishment of NPGRC's. Thus the initiative to have a SADC Plant Genetic Resources Centre has been of great advantage to the region in terms of training, conservation and ability to solicit funds for a common problem.
The SPGRC could further be developed into a reference centre for a member states on matters of plant genetic resources; particularly on documentation and eco-geographic surveys and provide on the job training for newly employed scientists.

FAO has been active in Tanzania in many areas of agriculture and has been instrumental to the initiation of many training programmes in research and in production sectors. The efforts of FAO have had direct effects on seed production of good crops including indigenous vegetables.

Networks for maintaining ex situ collections

Most of survey and inventory work on has been done in collaboration with the consultative groups of International Agricultural Research Centres (CGIAR), Bioversity International and non CGIAR centres such as AVRDC and ICIPE. In terms of information on ex situ collections, Tanzania has maintained its membership to SADC plant genetic resources centre based in Zambia. Since 2000, NPGRC has conducted several in situ and on-farm inventories of germplasm collection.

The underlying priorities, needs, constraints and opportunities for further action at the national, regional and international levels include:

Enhancing curriculum development on indigenous vegetables and other food crops in high learning institutions

Strengthening research on indigenous vegetables and other crops
Increasing funding and resources for in-situ and ex-situ collection in the country
Surveying and inventorizing the lesser known edible wild fruits
Increasing manpower skills through training , exchange visits and networking
Improving working facilities and infrastructure
Strengthening germplasm exchange with international centres and other collaborative centres

Challenges and Priority Needs
A number of challenges are facing the country need to be addressed in collaboration with international community. These challenges range from insufficient funds to protection and maintenance of threatened genetic materials. In addition there are too many accessions in the gene bank that need regeneration, and need to train more staff to manage such accessions.

Improved collaboration and support from the international organizations and programmes will play a big role in finding solutions for the above challenges. Such collaboration and assistance should focus on the following areas:

- Preparation of a complete map, using satellite technology such as GIS to determine the
- distribution of the diversity of various crop land races,
- Monitoring and evaluation of threats.
- Training on the use of new equipments and tools and conservation techniques
- Strengthening communication skills among scientists working in the area of PGRFA management
- Increase financial to facilitate strengthening of refrigeration system and equipment
- Research on agronomy and domestication of neglected and unadvertised plant species including indigenous vegetables

CHAPTER 7: ACCESS TO PLANT GENETIC RESOURCES AND SHARING OF BENEFITS DERIVED FROM THEIR USE, AND FARMER'S RIGHTS

7.1 Introduction

Tanzania is among the few countries in the world which are endowed with the rich diversity of various plant species. In order for the country to benefit from these resources concerted efforts need to be done in conserving and creation of conducive environment for accessing the resources. Currently, very little *ex-situ* conservation has been done by NPGRC and a legal frame work to guide the access and use of plant genetic resources is in its final stages of development.

Tanzania has been collaborating with international agricultural research centres, in *ex situ* conservation. in their facilities outside Tanzania. These materials are stored by ICRISAT - in the case of sorghum, CIMMYT (maize) and IRRI (rice).

At regional level, Tanzania collaborates with SADC Plant Genetic Resources Centre (SPGRC) based in Lusaka, Zambia. to conserve crop accessions. The SPGRC apart from carrying out long term conservation of germplasm from all member states also provides technical support to the various NPGRCs. Bioversity International also carries similar task.

SPGRC was established in 1989 and was able to take materials into their stores around 1990. SPGRC has been keeping duplicate materials sent to them from sources such CGIAR. The amount of accessions received from Tanzania by the year 2007 amounted to 5 percent of the total accessions from SADC region[5]. The duplicate of these materials are now being conserved in the country. The materials are conserved at the regional facilities with conditions and terms as provided in the International Treaty on Plant Genetic Resources for Food and Agriculture (IT-PGRFA).

7.2 Relevant International Conventions or Agreements Signed/ or Ratified by Tanzania

Tanzania has acceded and ratified a number of international treaties and agreements providing guidance on access to plant genetic resources and sharing benefits derived from their use.

Convention on Biological Diversity (CBD)

Tanzania signed and ratified this convention in 199--- . The Office of the Vice President-Environment is the National Focal Point for the implementation of the convention. In order to domesticate the convention the country has put in place legal framework to regulate access and utilization of genetic resources. National Environmental Management Act was enacted in 2004 among other thing to domesticate the Convention.

International Treaty on Plant Genetic Resources for Food and Agriculture (IT- PGRFA)
Following the adoption of the International Treaty on Plant Genetic Resources for Food and Agriculture by the FAO Conference (through Resolution 3/2001) in November 2001, each country which is party to the treaty was required to put in place a legal framework to domesticate the Treaty. The treaty is in harmony with the Convention on Biological Diversity and aims at conservation and sustainable use of plant genetic resources, and fair and equitable sharing of benefits derived from their use.

Tanzania signed and acceded to this treaty in 2004. The national focal point responsible for the Treaty is in the Ministry of Agriculture Food Security and Cooperatives. Tanzania is in the final stage of putting in place a legal framework to domesticate the Treaty. A Draft Bill that will provide for the conservation and sustainable use of plant genetic resources for food and agriculture, and fair and equitable sharing of the benefits will soon be sent to the Parliament. The proposed Act, among other things, addresses issues such as scope and coverage, sovereign rights over PGR, establishment of the National Plant Genetic Resources Institute, functions and powers of the Institute, conditions of Access to PGR, benefit sharing, Farmers and local communities rights, and establishment of PGR Conservation Fund.

[5] SADC Plant Genetic Resources Centre 18th Annual Report, 2007-2008

Benefits gained by Tanzania through PGRFA Networks

Tanzania is a member of SADC-PGRC and has benefited on the transfer of technology among member countries, exchange of germplasm, exchange of information, training for National Programme Scientists, joint characterization and evaluate of germplasm and avoiding duplication of efforts.

Despite, its capacity NPGRC has managed to collect about 3346 accessions of various plant genetic resources(Table 3.3). In addition, NPGRC managed to collect and register a total of 5,008 crop landraces to date. Currently there is an urgent need to carry out targeted collection of PGRFA that are endangered, endemic and of economic importance.

In 2006, the NPGRC, National Herbarium of Tanzania (HNT), Tanzania Tree Seed Agency (TTSA), the Botany department of the University of Dar es Salaam and the Royal Botanic Gardens Kew of UK launched the Millennium Seed Bank Project (MSBP) which aimed at collecting and conserving indigenous Tree Seeds of Tanzania.

Farmer's rights

Farmers through continuous process of natural selection within the plant genetic resources have been selecting plants as varieties for crop production. Several initiatives have been undertaken to promote the use of farmers knowledge in the identification of useful plant genetic materials that breeders could use as their breeding materials. After a variety has been developed it is made available to farming communities through formal and informal seed systems. That is farmers are allowed to save seed of open pollinated varieties for a given period of time and it is normally recommended not to exceed three generations. In case of protected varieties, the Plant Breeder's Rights of 2002 privileges farmers to save seeds of such varieties on their own farms but does not allow farmers to sell farm saved seed of such varieties.
The proposed Bill on PGRFA is expected to further provide for the procedures for conservation and sustainable use of plant genetic resources for food and agriculture, and fair and equitable sharing of the benefits.

Future Needs

Finalization of the proposed Bill on plant genetic resources for food and agriculture and its operationalization will be the top priority need for Tanzania in the next few years.

CHAPTER 8: CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

Plant genetic resources are the basis of food security and sustainable agricultural

development as they comprise diversity of genetic material contained in traditional varieties, modern cultivars, wild and weedy relatives of crop plants. The importance Agricultural sector, is evidenced by its contribution towards the total gross domestic product (26.5 percent).

Due to environmental pressure, the wild relatives of crop varieties are continued being eroded as farmers switch to improved varieties that better meet their immediate needs. In response to the problem several collection missions have been undertaken and gene bank established. **B**reeders in Tanzania have gradually been using genes from the plant genetic resources for cultivar development, against diseases, pests and other agronomic attributes.

Indigenous crops such as sorghum, millets and vegetables play an important role in food security and also improve the nutritional value of food. Production and marketing of small grains, legumes and indigenous vegetables such as nightshade, amaranths, have been at an increase. The government in collaboration with external donor assistance has been involved in a number of farmer support programmes, aiming at diversifying and increasing food security..

Herbal products for medicinal and nutrition purposes are of no exception to the danger of genetic erosion because of the unsustainable use of these products. Products derived from herbs/shrubs/trees are now gradually being commercialized e.g sandal wood and, aloe vera plant. Since these trees/herbs are found in the wild, there is a danger of unsustainable harvesting that may lead to depletion of the germplasm.

Rural based people have benefited from sales of herbal products such that markets and services for such products are growing generating an alternative source of income.

Future needs, constraints and priorities

At national level policies are not adequately integrated into agricultural, science and technology policies. At the community level lack of appreciation of the diversity of genetic resources leads to its erosion through the displacement of landraces by improved varieties, loss of forest resources and anthropogenic activities.

References

Hawtin G.2004. The Global Crop Diversity Trust: A Foundation for Food Security. Plant Genetic Resources Newsletter,2004,No.139:7-10

J.Esquinas-Alcazar, 2004. International Treaty on Plant Genetic Resources for Food and Agriculture. Plant Genetic Resources Newsletter,2004, No.139:1-6

Kapange B. 2008. Germplasm Contribution to Food Security . SADC Plant Genetic Resources Centre (SPGRC) Network News, (January-June, 2008), -Pp.2-3 & 8.

E. Mutegi, Herman Akonaay and Patrick Ngwediagi,2006. Report on the Second National Stakeholders Workshop on Establishing the National Information Sharing Mechanism on Implementation of the Global Plan of Action for PGRFA in Tanzania.

H. B. Akonaay, C. S. Mushi, W. H. Ntundu, W.C. Hamisy, L.P. Millinga and L. R. Nyange, 2004 . Baseline survey of Neglected and Underutilized crops species (NUCS) in Tanzania. Final Technical Report submitted to the International Plant Genetic Resources Institute (IPGRI).pp.1-45.

Ministry of Agriculture Food Security and Cooperatives, 2000. Agricultural Extension reform in Tanzania. A vision and strategy outline to year 2010.

Source MAFC/Seed Unit 2007

Agricultural Sector Development **programme framework and process document, final draft March, 2003.**

United republic of Tanzania 2000. Tanzania agriculture; performance and strategies for sustainable growth.

UN report of 2001.

APPENDIX 1: Main features of agro- ecological zones in Tanzania

Zones	Sub zones and areas covered	Main Problem	Soil and topography	Altitude (m)	Rainfall (mm/yr)	Area millions of hectares
1. Coast	North: Tanga (except Lushoto), coast, Dar es Salaam, South: Eastern Lindi and Mtwara (except Makonde escarpment)	-Infertile soils -Shifting cultivation -Bushfires -Deforestation -Water shortages -Soil erosion	-Infertile sands on gently rolling uplands. -Alluvial soils in Rufiji sand and infertile soils. -Fertile soils ion uplands and river flood plains	Under 300	North: Bimodal 750-1200 South: Unimodal 800-1200	6
2. Arid lands	Serengeti, Ngorongoro, Mkomazi, Pangani	-Bush fires -Shifting cultivation	-North: Volcanic ash and	North: 1300-1800	North: Unimodal, unreliable:	

	in Same , Eastern Dodoma	-Deforestation -Water Shortage	sediments. Soils variable in texture and very susceptible to water erosion. South: Rolling plains of reddish sandy	South: 500-1500	500-600 South: Unimodal and unreliable 400-600	
3. Semi-arid lands	Central Dodoma, Singida, North Iringa, some parts of Arusha, Shinyanga, Mwanza, Southern: Morogoro (except Kilombero, Wami basin, Uluguru Mts), Lindi and South West Mtwara	-Soil erosion -Poor farming practices -Shifting cultivation -Bushfires	Central: Undulating plains, with rocky hills and low scarps. Well-drained soils with low fertility. Alluvial hardpan and saline soils in eastern rift valley and lake Eyasi black cracking soils in Shinyanga. South-eastern: Flat or undulating plains with rocky hills. Moderately fertile loam and clay in south (Morogoro) infertile sands in center.	Central: 1000-1500 South-eastern: 200-600	Central: Unimodal and unreliable 500-800. Southern: Unimodal: 600-800	21.1
4. Plateau	Western Tabora, Rukwa (North and Centre) Mbeya (North), Kigoma and Parts of Mara Southern: Ruvuma and southern Morogoro	-Deforestation -Bushfires -Uncontrolled grazing -Shifting cultivation -Soil erosion	Western wide sandy plains and rift valleys scarps. Flooded swamps of Malagasi and Ugalla rivers have clay soils with high fertility sands in north.	800-1500	Western: Unimodal, 800-1000 Southern: Unimodal, very reliable, 900-1300	32.7
5. Southern	Southern: A broad	-Bushfires	Southern:	Southern:	Southern:	12.8

and western highlands	ridge from Morogoro, North of Lake Nyasa covering parts of Morogoro, Iringa and Mbeya Ufipa pleateaux in Sumbawanga Western: Along the shores of Lake Tanganyika in Kigoma and Kagera	-Soil erosion -Uncontrolled grazing -Poor farming practices -Shifting cultivation -Deforestation -Poor mining practices	Undulating plains dissected hills and mountains. Moderately fertile clay soils, with volcanic soils in Mbeya, South western: Undulating pleateaux above rift valleys. Sandy soils of low fertility. Western: North-south ridges separated by swampy valleys. Loam and clay soils of low fertility in hills with alluvium and clays in valley ponds.	1200-1500 South western: 1400-2300 Western: 100-1800	Unimodal, reliable, local rain shadows, 800-1400 South-western: Unimodal, reliable800-1000 Western: Bimodal 1000-2000	
6. Northern highlands	Northern: Foot of Mt. Kilimanjaro and Mt. Meru, Eastern rift to Lake Eyasi, Granitic Mts: Uluguru Mts in Morogoro, Pare Mts. In Kilimanjaro and Usambara Mts, in Tanga and Tarime Highlands in Mara.	-Poor farming -Bushfires -Shift cultivation practices -Deforestation -Soils in dry areas are prone to water erosion	Northern: Volcanic uplands, volcanic soils from lava and ash. Deep fertile loam and clays. Soils in dry areas prone to water erosion. Granitic mts steep mts sides to highland pleateaux. Soils are deep friable and moderately fertile on upper slopes, shallow and stony on steep slopes.	North: 100-2500 Granitic mts: 1000-2000	Northern: Bimodal, varies widely: 1000-2000	5.8
7. Alluvial plains	K-Kilombero (Morogoro)and W-Wami in	Overgrazing in the Usangu plains	K-Central clay plain with alluvial fans		K-Unimodal, very reliable 900-1300. R-	10.2

	Morogoro, U-Usangu in Mbeya, R-Rufiji in the coast	Poor farming systems Bush fires Deforestation	East and West R-wide mangrove swamps delta. Alluvial soils sandy upstream, loamy downstream in floodplains. U-Seasonal alluvial fans with well drained black loam in West.		Unimodal often inadequate 800-1200. U-Unimodal 500-800 W- Unimodal 600-1800	

Appendix 2. The main farming systems and its physical features in Tanzania

S/No	Farming System	Found in	Crops grown	Distinctive features
1	Banana/coffee/ horticultural/tea and dairy farming	Kagera, Kilimanjaro, Arusha, Kigoma, Tanga, Ruvuma, Mbeya	Tree crops, coffee, tea, bananas, cereals, pulses, maize, pasture, horticultural crops (high value vegetables grown),	High intensive land use, vol with high fertility, land scar rainfall
2	Maize/legumes	Shinyanga, Rukwa, Morogoro, Arusha, Kigoma, Kagera, Iringa ,Mbeya	Maize, legume, rice, cotton, coffee, palm oil, potatoes. There has been an increase in vegetables particularly tomatoes, onions and paprika in recent years.	Land not scarce, shifting an cultivation, practiced by a la of small holder farmers and marketed maize is produced system
3	Cassava, Coconut and Cashew nut system	Coastal Region, Eastern Lindi and Mtwara	Cassava, coconut and Cashewnut	The subsistence crop is cass Cashewnut and coconut are crops. Low rainfall, low soil Land not scarce, shifting cu practiced.
4	Wetland and irrigated Rice and sugarcane system	Alluvial valleys of the major river basins of Rufiji, Kilombero, Kyela, Lower Moshi, Ruvu and Usangu	Rice and sugar cane	Rice is the a staple for this f system. Sugar cane cultivati out on a large scale basis. C water is not uncommon.
5	Sorghum/Bulrush millet/livestock system (cotton and rice)	Sukumaland, Shinyanga, Rural Mwanza	Sorghum, Millet, Maize, Cotton, oilseeds and rice	Intense population pressure Declining soil fertility. Majo crop production, livestock p role in providing for meat, r draught power for cultivatio transportation
6	Tea/maize/pyrethrum system	Njombe and Mufindi in Iringa region	Tea, maize, irish potatoes, beans, wheat, pyrethrum, wattle trees, sunflower	Intense population pressure Declining soil fertility
7	Cotton/Maize system	Tabora, Kilimanjaro, Arusha, Mwanza, Shinyanga, Kagera, Morogoro, Mara, Coast, Mbeya, Singida	Cotton, sweet potatoes, maize sorghum groundnuts	Intensive cultivation livesto
8	Horticultural based system	Lushoto district , Tanga , Morogoro, Iringa, Arusha	Leafy vegetables, fruits, tomatoes ,cabbages, sweet potatoes and pepper, indigenous vegetables passion fruits	
9	Pastoralists and agro pastoralists	Dodoma, Singida, part of Mara, Arusha, Chunya district Mbeya and Igunga district in Tabora	Sorghum, millet, maize groundnuts ,tobacco and livestock	Deep attachment to livestoc cropping system, shifting cu Moderate population density km. Limited resource base a variable rainfall. However, c production is by continuous search for pastures
10	Plantations	Found along major	Wheat, tea, sugarcane, sisal,	Large state owned plantatio

		railroads in the north and south of the country	coffee, tree production	private owned land

Appendix 3. Private and Public Sector contribution to seed distribution in Tanzania 2003/04-2007/08 in metric tonne (mT)

Year	**Private (mT)**	**Public (mT)**	**Total (mT)**
2003/2004	4,280.436	357.934	4,638.37
2004/2005	8,698.17	1436.8	10,134.97
2005/2006	8,748.25	1728.92	10,477.17
2006/2007	14,869.51	1656.3	16,525.81
2007/2008	16,174.36	217.24	16,391.60

Appendix 4: Production of major food crops during the period 2005/2006 to 2006/2007 ('000 tons)

Crop	Year			
	2005/06		2006/07	
	Ha	Tonne ('000)	Ha	Tonne ('000)
Maize	2,570,147	3,373,391	3,167,531	5,446,470
Rice	663,770	783,775	764,082	1,624,307
Sorghum	715,884	700,815	1,236,277	1,383,242
Finger Millet	214,965	221,421	805,518	677,602
Wheat	53,224	110,200	58,232	89,948
Cassava	994,171	2,005,912	1,564,227	3,905,783
Bananas	499,620	1,140,001	167,659	1,392,074
Irish potatoes	-	-	92,565	590,254
Sweet potatoes	-	-	650,277	1,413,262
Beans	-	-	836,515	812,548
Cowpea	1,105,874	1,017,642	379,350	402,422
Sunflower	-	-	285,937	369,803
Soybean	-	-	1,922	1,537
Sesame	-	-	217,574	155,794
Total	6,786,655	9,353,157	10,227,667	18,265,046

Appendix 5: Production of major cash crops during the period 1999/00 to 2004/05 ('000 tons)

	Year					
Crop	**1999/00**	**2000/01**	**2001/02**	**20002/03**	**2003/04**	**2004/05**
Cashewnut	121.20	121.90	67.37	95.00	80.00	81.60
Coffee	47.80	50.00	36.18	52.44	32.00	54.00
Cotton	100.60	123.56	148.18	188.69	139.82	341.59
Pyrethrum	1.00	2.00	3.00	3.50	2.00	1.00
Tea	23.60	26.39	24.73	30.13	30.26	32.00
Tobacco	24.70	27.70	27.90	33.55	47.45	52.25
Sisal	20.60	20.50	23.54	23.64	23.86	26.76
Sugar	116.90	135.54	163.36	190.12	223.84	229.62

Appendix 6: Current Productivity levels on food and cash crops and their potential yields

S/No.	Crop	Current yield (Kg/ha)	Potential yield (Kg/ha)
1	Maize	600-2200	5000
		1000-3000 (Regions: Ruvuma, Rukwa, Mbeya and Iringa)	5000
		2900 (Rainfed)	4000-5000
2	Paddy	4500 (Irrigated)	6000
		640	1200
3	Millet	8000-12000	20000-25000
4	Cassava	700	1500-3000
5	Legumes	800-1000	3000
6	Wheat	200-700	1500-3000
7	Beans	8000-10000	20000-30000
8	Sweet potatoes	9000	25000-35000
9	Bananas	9000	25000-35000
Traditional crops			100-170
1	Coffee	100-170	550-600
2	Cotton		500 1400
	Eastern zone	500	1400
	Western zone	500	1400
3	Tobacco		950-1000 1800
	Tobacco-smoked	950	1800
	Tobacco-cured	950	1800
4	Tea		3500 5500
	Large scale	470	3000
	Small holders	470	3000
5	Sugar cane		75000 120000
	Estates	70000	110000
	Smallholders	70000	110000
6	Oilseeds		300 1200
	Sunflower	300	1200
	Sesame	600	1500
	Groundnuts	500	1500-3000
	Soya	400-500	1200-1300
7	Cashewnuts	1000	1500
9	Pyrethrum		

Appendix 7. PGRFA survey and inventory covered and priority area(s)

S/No	Title of survey/inventory	Area surveyed/inventoried	Area priority ranking for in-situ conservation
1	Survey on the status of in-situ and on farm conservation of Plant genetic resources in the country	Dodoma, Lushoto, Manyara, Singida, Tabora, Mwanza, Iringa, Kisarawe, Muheza	High
2	A survey of wild and underutilized edible plants in Ruvuma Region	Lake Victoria catchments basin, Tanzania along the lake for Kagera, Mwanza and Mara Regions	High
3	Baseline survey of neglected and underutilized crops in Tanzania.	Southern zone of Tanzania Mtwara and Lindi	High
4	Informal survey of farmers with local expertise on seeds and their knowledge	Mtwara and Lindi regons	Medium
5	Survey of rice genotype in rice growing areas of Tanzania		High
6	Survey/inventory for spices germplasm in Tanzania	Kasulu, Kibondo and Kigoma rural district	High
7	African eggplant collection, characterization and selection	Hedaru, Lushoto, Tengeru, Manyara, (Mbulu, Hanang, Kiteto, Babati), Arumeru, Arusha, Mwanga, Hai, Same	Medium-High
8	Indigenous vegetables germplasm collection characterization and enhancement	Dodoma and Mwanza	
9	Enhancing Production and Utilization of African Indigenous Vegetables through sustainable seed Production and Distribution for Better Health,	Tanzania, Rwanda, Malawi and Uganda	
10	Documentation and Nutritional Quality Assessment of Selected Edible Wild Plants in Lake Victoria Catchments Basin, Tanzania	Kasulu, Kigoma rural, and Kibondo district	Medium
11	Sweet potato on farm yield trial	Arusha	Medium-High
12	Sweet potato germplasm Conservation and enhancement	Tanzania	Medium
13	Promotion of Neglected Indigenous Leafy and Legume Vegetable Crops for nutritional	Tanzania, Rwanda, Malawi, Uganda	High

	Health in Eastern and Southern Africa (Phase 1)		
14	Promotion of conservation and sustainable utilization of *Uapaca kirkiana* in Southern Tanzania	Ruvuma Region	High
15	Promotion of spices/herbs production for sustainable income generation and poverty alleviation in Northern Tanzania	Ausha Singida and Dodoma	High
16	Germplasm Management of Underutilized African Vegetables for Improving Agro-biodiversity, Food Security and Increasing Income of Rural and Urban Poor in Southern Africa	Arusha and Kilimanjaro	High
17	Identification and maintenance of seed sources for indigenous edible fruit trees	Mbeya and Makete	Medium-High
18	Introduction and evaluation of high value fruit materials	Iringa, Morogoro, Kilimanjaro, Lushoto, Dodoma	High
19	Personal scientific observations and farmer responses	Kasulu Kigoma rural and Kibondo District	High
20	Rural seed fairs	Mtwara and Lindi Region	Medium
21	Farmers indigenous knowledge on seeds, forest products and medicinal plants	Mtwara and Lindi region	Medium-high

Appendix 8. Surveying methods, threatened species, proven causes and presumed cause of threat on PRGFA

Description of methods used	Major threatened species of PGRFA	Proven causes of threat	Presumed causes of threat
Reconnaissance survey, Random sampling,	*Cordyla africana, C. densiflora, Strychnos coculoides, S.spinosa, Ximenia americana*	Overexploitation	Introduction of exotic vegetables, poor/low market, low priority on research and production of indigenous vegetables, poor seed distribution and availability, Wild fires during harvesting,
Transect, Home and back yard surveys	Members of the family Orchidaceae	Overexploitation for trade and land use changes	poor access to markets, no research and development intervention
Focus groups and semi structured questionnaire	Arrow root (*Tacca pinnatifida*),Tomato tree (*Cemaphora betacea*), Local hitherto grown maize varieties	-Few farmers cultivating the crop	-Lack of research and promotional support to improve uses of these species, use of a narrow genetic base in crop improvement
	Local landraces and old varieties of finger millet, pearl millet, fiwi and yams.	Pests and diseases, drought, floods, lack of markets, introduction of new seeds	ignorance, genetic erosion due to overexploitation refugees as a result of replacement by improved and exotic vegetables/emergence of new diseases/environmental stresses and changes/
Survey was conducted in Ruvuma region. Visit coverage was Regional, District, Division, wards, and village	Mushroom spp., Medicinal plots	Deforestation	lack of awareness on indigenous vegetables,

Appendix 9. On-farm management and improvement of PGRFA with the participation of local farmer communities

Name of on-farm conservation programme/project	Local farmer community involved	Number of farmers involved
1.Improving Food Security in Sub - Saharan Africa through increased		
2. Utilization of Indigenous Vegetables		100
3.Studies on Seed Production and Agronomy of		

Major African vegetables		
4. Cassava collection and characterization		
5. Quality control of on-farm seed production in selected regions of Tanzania	No(-)	
6. Babati Farmers Participatory Research Project	Farmers Research Groups	900
7. Agricultural Marketing Project	Farmers Research Groups	900
8. Survey on the status of *in-situ* and on farm conservation of Plant genetic resources in the country	Peasant farmers from various districts	
9. Sorghum variety trials		
10. Grape varieties evaluation		50
11. Agricultural Sector Program Support (ASPS) Phase I (Seed Multiplication) Project		20
12. Agricultural Sector Program Support (ASPS) Phase II(Seed Multiplication) Project		20
13. Participatory Irrigation Development Program TARP II-SUA Project		15
14. Community based seed multiplication for sesame, groundnuts, sorghum, cowpeas, pigeon peas, maize, green gram, rice and cassava		30000

Appendix 10. Reintroduction of any germplasm following a disaster

Name of disaster area	**Name of crop**	**Type of disaster**	**Other types of disaster**	**Date of disaster (YYYY/MM)**	**Other sources of germplasm**
Mpiji Songa Babati district	mango, coconut, citrus, banana, apples, jackfruit, pineapples	citrus greening disease		1980	Sokoine University, Zanzibar, Hort Tengeru Songea, Bagamoyo and Tanga
Lake Zone of Tanzania	Kilima maize	2006/02	CMD-cassava mosaic disease	2005/11	IITA,ESSARC, Uganda, EARRNET Musoma

Appendix 11. Activities relating to sustaining *ex situ* collections, conservation method(s) used and the number of professionals involved.

***Ex situ* conservation programme/project/activity**	**Type of activity**	**Other activity type**	**Number of professionals involved**
National Vegetable Seed programme	Seed genebank	Production of	2

	(short term collections)	seed foundation for breeding companies for commercial purposes	
Storage of Reference Materials	Seed genebank (short term collections)	Training of Inspectors and Seed producers	6
Research on project survey on propagation, ex-situ conservation and nutritional quality of endangered indigenous forest food and fruit plant species in selected Miombo and montane	Seed genebank (short term collections);Arboretum		4
Exploration and Collection of crop germplasm from the Lake zone and the Southern zones of Tanzania	Seed genebank (medium term collections);Seed genebank (short term collections)		6
Development of Cryopreservation of coffee germplasm	In vitro conservation;Cryopreservation		4
Millennium Seed Bank Project	Seed genebank (short term collections)		6
Development of conservation strategies for the wild edible orchids in Tanzania	Seed genebank (medium term collections);Seed genebank (short term collections)		2
Indigenous vegetables Germplasm collection characterization and conservation	Seed genebank (medium term collections);Seed genebank (short term collections)		7
Multiplication and Characterization of crop germplasm accessions	Seed genebank (medium term collections);Seed genebank (short term collections)		7
Survey on the status of in-situ and on farm conservation of Plant genetic resources in the country	Seed genebank (medium term collections);Seed genebank (short term collections)	inventory survey of plant genetic resources in Tanzania	
Rice germplasm and conservation activity	Seed genebank (short term collections);Field genebank		4
Spices germplasm collection and conservation activity	Seed genebank (short term		3

	collections)	
Cotton	Field genebank	3
Cassava, Sweet potato	Field genebank	7
Sesame, Groundnut, Cassava and Cashewnut breeding	Seed genebank (short term collections);Field genebank	3

Appendix 12. Available publication, the type of information covered related to *ex situ* collections

Title of publication	Name of ex situ collection	Publication media	Publication coverage	Data type
Tanzania Variety Catalogue	Storage of Reference Materials	Hard-copy (printed/facsimile)	Passport data;Evaluation/characterization data	Analyzed data
Seed germination on indigenous trees in Tanzania. Including notes on seed processing, storage and plant uses	Tree seed collection for different end use	Hard-copy (printed/facsimile)	Evaluation/characterization data	Analyzed data
A catalogue of plant genetic resources under ex-situ conservation at the NPGRC ,Arusha	orthodox seeds	Hard-copy (printed/facsimile)	Passport data;Evaluation/characterization data	Raw data; Analyzed data
Characterization of Germplasm	orthodox seeds	Hard-copy (printed/facsimile)	Evaluation/characterization data	Analyzed data
Evaluation of five accessions of *Cucurbita maxima* collected from different Ecological zones in Tanzania	Evaluation of accessions belonging to the family *Cucurbitaceae*	Hard-copy (printed/facsimile)	Passport data;Evaluation/characterization data	Analyzed data
Rice germplasm collection and characterization in Tanzania (Unpublished)	Rice germplasm characterization	Hard-copy (printed/facsimile)	Evaluation/characterization data	Analyzed data

Appendix 13. Status of breeding capability and utilization of genetic resources for the period from 1996-2007

Programme	Crops		Status of Breeding CapabilityI	
			Plant Breeders & related	Breeding Capability
Maize	Maize	*Zea mays*	5	Increased

Rice	Rice	*Oryza satira*	6	Increased
Sorghum and Millets	Sorghum Pearl millet Finger millet	*Sorghum biootor* *Pennisetum Americana* *Eleusine coracana*	1 1 1	Increased
Wheat and Barley	Wheat Barley	*Triticum cestirum* *Hordeum vulgare*	1 2	Increased
Grain Legumes	Cowpea Cowpea Creen gram Pigeon peas Soy beans	*Vigna auguiculata* *Vigna mungo* *Cajan oajan* *Glycine max*	1 1	Stable
Common Bean	Common bean	*Phaseolus vulgaris*	5	Increased
Oil seeds	Sim sim	*Sesamum indium*	1	Increased
Sunflower	Sunflower	*Helianthus annun*	2	Decrease
Roots and tuber	Cassava Sweet potatoes Rounds potatoes	*Manihot esculenta* *Ipomea botatas* *Solanum tuberosum*	1 1 2	Increased
Coffee	Coffee	*Coffee Arabica* *Coffee robusta*	2 1	Increased
Cotton	Cotton	*Gossypium hirsutum*	3	Stable
Tea	Tea	*Thea sinensis*	2	Increased
Sisal	Sisal	*Agrave sisalana*	1	Stable
Coconut	Coconut	*Cocoa nucifera*	3	Stable
Cashew	Cashew	*Anacadium accidentale*	2	Increased
Sugarcane	Sugarcane	*Saraharum afficinale*	5	Increased
Tobacco	Tobacco	*Nicotiana tabacum*	1	Stable
Vegetable Crops	Tomato	*Lycopersicum*	1	Increased

	Onions Amaranths	*esculentum* *Allum cepa* *Amaranthus spp*	3	
Fruits crops	Oranges Avocado	*Citrus sinensis* *Persia amaricana*		Decreased
Viticulture	Grapes	*Vitis sp.*	1	Stable
Bananas	Bananas	*Musa sp.*	3	Increased
Pyrethrum	pyrethrum	*Chrysenthemum anerairiceblum*	2	Decreased

Appendix 14. Evaluation and characterization of *ex situ* collections

Ex situ collection	**% accessions evaluated for/based on**					
	Morphological traits	**Molecular marrkers traits**	**Agronomic traits**	**Biochemical traits**	**Abiotic stress**	**Biotic stress**
coconut	85	50	54	66	87	87
Maize landraces collection *(Zea)*	60	0	60	0	0	0
Common bean land race collection *(Phaseolus vulgaris)*	70	0	30	30	10	10
Sorghum landrace collection *Sorghum bicolor*	30	0	10	10	10	5
Finger millet landrace collection *(Eleusine coracana)*	80	0	40	30	20	10
Pumpkin landrace collection *(Cucurbita maxima*	40	0	20	20	10	10
Characteristics of East African Highland Bananas of Tanzania *Musa spp.*	100					
Rice germplasm	86	0	86	2	86	0

Oryza sativa						
Spices (Ginger, Cinnamon, Cardamon, Cloves, Blach pepper, Vanilla, Tumeric, Paprika)	0	0	0	0	0	0
Oil palm	50	0	0	0	0	0
Cotton *Gossypium sp.*	53	46	53	46		
Sesamum indicum	60	0	40	0	5	0
Groundnuts *Arachis hypogeal*	90	0	60	0	20	0
Cassava *Manihot esculenta*	60	0	30	0	20	0
Cashewnut *Anacardium occidentale*	90	30	0	30	0	0

Appendix 15. **Market situation of seed varieties**

Name of crop /taxon	**Current market situation**	**Number of local varieties in the market**	**Number of local varieties with economic potential for new markets development**
Sorghum *Sorghum bicolor*	Attempts are underway to develop new markets	10	2
Maize *Zea mays*	Attempts are underway to develop new markets	26	
Rice *Oryza sativa*	Existing markets have been expanded and some new markets developed	15	6
Bambara ,*Vigna subterranea*	No attempts are presently being made to develop new markets	3	1
Soybean *Glycine max*	No attempts are presently being made to develop new markets	0	0
Yams *Dioscorea bulbifera*	No attempts are presently being made to develop new markets	7	1
Sesame *Sesamum indicum*	Markets are well established and expanded;Attempts are underway to develop new markets	0	0
Groundnut	Markets are well established	0	0

Arachis hypogaea	and expanded;Attempts are underway to develop new markets Markets are well established		
Cashewnut *Anacardium occidentale*	and expanded;Attempts are underway to develop new markets	0	0

ANNEX 16: National Variety List as Updated in 2008

Species: Maize (*Zea mays L.*)

Variety	Year of release	Owner(s)/Maintainer	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Special attributes/Disease reaction
1. Katumani	Late 1950's	KARI - Katumani	<1500	3.0 – 3.5	Suitable in areas with short rainfall
2. H622	1968	EAC/KARI/Kenya Seed Co.	1200 - 1650	6.0-7.0	Fairly tolerant to leaf blight and leaf rust but susc to grey leafspot.
3. H511	1968	EAC/KARI/	1300 - 1700	4.0 -5.0	Earlier in maturity
4. H632	1968	Kenya Seed Co.	1200-1650	6.0-7.0	Fairly tolerant to leaf blight and leaf rust but susc to grey leaf spot
5. H6302	1976	EAC	>1500	8.0 – 8.5	Highly tolerant to northern leaf blight and rust
6. UCA	1976	ARI-Ukiriguru	900-1500	4.0 – 6.0	Suitable in drier areas
7.Tuxpeno	1976	ARI - Ilonga	0 -900	3.0 -4.0	Suitable in coastal and lowland areas
8. H614	1977	EAC	>1500	7.0	Very susceptible to maize streak virus.
9. ICW	1977	ARI - Ilonga	0-900	4.0 -6.0	Suitable in lowland areas
10.Kilima St	1983	ARI - Ilonga	900 -1500	5.0 – 6.0	Streak tolerant
11.Staha	1983	ARI - Ilonga	0 -900	4.0 5.0	Streak tolerant
12. Kito	1983	ARI -Ilonga	0 -1300	2.0 – 3.0	Suitable in drier areas
13. TMV - 1	1987	ARI - Ilonga	<1500	4.0 – 4.0	Streak and rust resistant
14. TMV - 2	1987	ARI - Uyole	>1500	7.5 – 8.0	Resistant to *Turcicum* leaf blight
15. Cholima 1	1992	Dakawa	0 -900	6.5	Tolerant to maize streak virus, leaf blight and lea

16. Cholima 3	1992	Dakawa	0 -900	6.5	Tolerant to maize streak virus, leaf blight and lea
17. CG4142	1993	Cargill Zimbabwe (PTY) Ltd	900- 1500	4.8	Ear rot, leaf blight and leaf rust resistant
18. C6222	1994	Cargill Zimbabwe (PTY) Ltd	900 - 1500	10.0 – 15.0	Tolerant to ear rot, leaf blight(*Helminthosporium turcicum* Pass) and leaf rust (*Pucinia sorghi*)
19. PAN 6195	1995	Pannar Seeds Co.Ltd	1000 - 1500	6.0	Tolerant to maize streak, intermediate resistant t rot and leaf blight
20. PAN6549	1995	Pannar Seeds Co. Ltd	500 - 1500	6.0	Tolerant to rust, maize streak, ear rot and leaf bli
21. PAN 6481	1995	Pannar Seeds Co. Ltd	1000- 1500	6.0	Moderately tolerant to maize streak and leaf bligh Tolerant to ear rot and rust
22. PAN 695	1995	Pannar Seeds Co.Ltd	1000 - 1500	6.0	Tolerant to ear rot, leaf blight and rust
23. C5121	1997	Cargill - Zimbabwe	1000 - 1600	10.0 – 15.0	Resistant to blight (*Helminthosporium turcicum* P leaf rust (*Pucinia sorghi*), ear rot
24. C5051	1999	Cargill - Zimbabwe	1000 - 1600	10.0 – 15.0	Resistant to blight leaf (*Helminthosporium turcicu* Pass), leaf rust (*Pucinia sorghi*), ear rot
25. PAN 6243	1999	Pannar Seed Co. Ltd	1000 - 1500	8.0	Tolerant to grey leaf spot,Northern Leaf Bright (N rust and ear rot
26. CRN3631	1999	Monsanto Hybrid Seeds Co.	900 - 1500	8.1	Resistant to ear rot. Moderately tolerant to maize streak virus and grey leaf spot
27. PHB30A15	1999	Pioneer Seed Co. Ltd	1000 - 1500	5.0 – 10.0	Partial resistance to maize streak virus. Tolerant grey leaf spot. Very resistant to leaf blight and ear rot
28. H625	2000	Kenya Seed Co. Ltd	1500 - 2400	9.0 – 10.0	Resistant to lodging, leaf rust, leaf blight, drough grey leaf spot Prolific Good husk cover
29. H513	2001	Kenya Seed Co. Ltd	900 - 1500	7.0 – 8.5	It is fairly resistant to moisture stress
30. Uh615	2001	ARI - Uyole	1200 - 1800	6.0 – 8.0	Tolerant to grey leaf spot (GLS) and leaf blight
31. Lishe - HI	2001	ARI - Selian	1000 - 1500	4.0 – 7.0	Quality protein maize [Has 10 % protein like othe maize varieties but its protein has twice level of essential amino acids (Lysine and tryptophane)] Tolerant to GLS and *E.turcicum* leaf blight, susce to MSV, good resistant to Diplodia, Fusarium cob and *Puccinia sorghi* rust
32. Lishe –H2	2001	ARI -Selian	500-1600	4.0 -7.0	Quality protein maize [Has 10 % protein like othe maize varieties but its protein has twice level of

					essential amino acids (Lysine and tryptophane)] Very good resistant to Maize streak virus (MSV), resistant to Grey leaf spot (GLS), *Diplodia*, *Fusa* cob rots, *E.turcicum* leaf blight and *Puccinia sorg*
33. Lishe –K1	2001	ARI-Selian	500-1600	4.0-6.0	Quality protein maize [Has 10% protein like othe maize varieties but its protein has twice level of essential amino acids (lysine and tryptophane)] Susceptile and moderate resistant to Maize Strea Gley Leaf Spot respectively, good resistant to *Diplodia*, *Fusarium* cob rots, *E.turcicum* leaf bligh *Puccinia sorghi* rust
34. Situka-M1	2001	AR-Selian	1000-1500	3.0-5.0	Tolerant to maize streak and Grey leaf spot. Resistant to *Diplodia, Fusarium* le bright and *Puccinia sorghi*
35. Situka 2	2001	AR-Selian	500-1600	4.0-6.0	Tolerant to maize streak and grey leaf spot Resi to *Diplodia, Fusarium,* leaf bright and *Puccinia so*
36. PAN 15	2001	Pannar Seeds Co. Ltd	500-1500	7.0	Tolerant to maize streak virus, grey leaf spot , no leaf blight, Rust, ear rot
37. PAN 77	2001	Pannar Seeds Co. Ltd	>1500	7.0	Tolerant to maize streak virus , grey leaf spot, no leaf blight , Rust, ear rot
38. PAN 691	2001	Pannar Seeds Co. Ltd	>1500	7.0	Tolerant to maize streak virus, grey leaf spot, no leaf blight, Rust, ear rot
39. Pwani H04	2001	Kenya Seed Co	0-800	7.0	Well adapted to hot, humid low lands, Partially resistant to maize streak virus
40.CRN 3891	2001	Mansanto Hybrid Seeds Co.	900-1500	8.0-9.0	Moderately tolerant to maize streak virus
41. DK 8071	2001	Monsonto Hybrid Seeds Co.	1000-1600	8.0-9.0	Tolerant to grey leaf spot and rust
42. PHB30H83	2001	Pioneer Seed Co.	800-1800	7.0-10.0	Medium resistant to leaf blight and rust, ear rot a grey leaf spot resistant
43. SC 627	2001	Seed Co. Ltd	500-1400	5.0-10.0	Excellent resistance to grey leaf spot. Moderatel resistant to rust and resistant to leaf blight. Good stress tolerance, lodging resistance and prolificacy. Has very good adaptability Rust resistance: average
44. PHB30G97	2001	Pioneer Seed Co.	800-1500	7.0-10.0	Tolerant to grey leaf spot and ear rot.
45. DH01	2002	Kenya Seed Co.	90-120	2.0-5.0	Drought resistant and good husk cover

46. H628	2002	Kenya Seed Co.	150-180	9.0-12.0	Lodging resistant
47. DK8051	2002	Monsanto Hybrid Seed Co.	120-140	6.0-9.0	Excellent tolerance to grey leaf spot
48. DK8031	2002	Monsanto Hybrid Seed Co.	100-110	5.0-8.0	Good tolerance to grey leaf spot.
49. Longe 4	2003	FICA SEED Ltd	900 -1500	6.38	Have acceptable levels of resistance to foliar dis and drought tolerant Drought tolerant and Maize Streak resistant
50. Longe 2H	2003	FICA SEED Ltd	900 - 1500		
51. DH 04	2003	Kenya Seed Co. Ltd	500-1200	8.0	Very good resistant to Leaf blight and Leaf Rust
52. DH 03	2003	Kenya Seed Co. Ltd	200-1000	Above 6.0	Resistant to Cob rots
53. KS H 519	2003	Kenya Seed Co. Ltd	1400-1700	Above 8	Good resistant to Leaf blight and Leaf Rust
54. SC 407	2003	SEED CO. Ltd	500-1400	1-8	Good stress tolerance and fairly good tolerance t Grey leaf Spot (GLS). Has good tolerance to Ma Streak Virus (MSV)
55. SC 403	2003	SEED CO. Ltd	500-1400	1-6	Very good adaptability and stress tolerance, goo lodging resistant Very good resistant to MSV, good resistant to co and leaf blight, and moderate rust rust resistance
56. SC 513	2003	SEED CO. Ltd	500-1400	4-9	Moderate resistant to Cob rots and good resista Leaf blight (*Helminthrosporium turcicum*) and Ru resistance Excellent tolerant to grey leaf spot Prone to *Phaeosphaeria* leaf spot Good adaptability and stress tolerance
57. H 515	2003	Kenya Seed Co. Ltd	1200-1600	4-5	
58. SC 713	2003	SEED CO. Ltd		6-13	It has excellent tolerance to Maize Streak Virus (and good tolerance to Gley Leaf Spot (GLS)
59. PAN 23	2003	Pannar (Pty) Ltd	850-1500	4-7	Good resistant to Cob rots, Leaf blight *(Helminthrosporium turcicum*) and Leaf Rust
60. PAN 33	2003	Pannar (Pty) Ltd	850 - 1500	4-7	Good resistant to *Maize Streak Virus*, Cob rots, L blight (*Helminthrosporium turcicum*) and Leaf rus
61. PAN 63	2003	Pannar (Pty) Ltd	850 - 1500	5-8	Good resistant to *Maize Streak Virus*, Cob rots, L blight (*Helminthrosporium turcicum*) and Leaf ru
62. UH615	2003	ARI Uyole	1200 - 1800	8-9	Good level of tolerance to Grey Leaf Spot Lodging resistance

63. PAN 4 M-17	2004	Pannar (Pty) Ltd	0- 1500	4-6	Good resistant to Cob rots, Leaf blight (*Helminthrosporium turcicum*), and Leaf Rust Good adaptability, stress tolerance, lodging resis and prolificacy
64. PAN 4M-19	2004	Pannar (Pty) Ltd	0-1500	4-7	Good resistant to Cob rots, Leaf blight (*Helminthrosporium turcicum*), and Leaf Rust
65. UH 6303	2004	ARI-Uyole	1200-1800	9-10	Good resistant to Leaf blight (*Helminthrosporium turcicum*), and Grey Leaf Spot
66. Longe 6H	2004	Finca Seed Ltd	900 - 1500	8 -9	Drought tolerant Good poundability Early maturity
67. TAN H611	2006	Tanseed International Ltd	Low to medium	4-7	Good resistance to Maize streak virus, Turcicum blight, Cob rots, Grey leaf spot and Common rus Has twice level of essential amino acids: Lysine Tryptophane than normal maize
68. TAN 250	2006	Tanseed International Ltd	Low to medium	3-5	Excellent resistance to Maize streak virus and G leaf spot, good resistance to Turcium leaf blight, rot and Common rust
69. TAN 254	2006	Tanseed International Ltd	Low to medium	4-6	Good resistance to Maize streak virus, Turcicum blight, Cob rots, Grey leaf spot and Common rus
70. VUMILIA K1	2007	ARI Selian	Medium	Late	Very good resistant to Maize Sreak Virus
71. VUMILIA H1	2007	ARI Selian	Medium	Late	Good resistant to Maize Sreak Virus, cob rots, le blight and rust
72. WH 505	2007	Western Seed Co. Ltd	1000-1800	135-150	Tolerant to Maize Streak Virus, Leaf blight, and r
73. WH 502	2007	Western Seed Co. Ltd	1000-1800	135-165	Tolerant to Maize Streak Virus, Leaf blight, and r
74. WH 403	2007	Western Seed Co. Ltd	1000-1800	135-165	Tolerant to Maize Streak Virus, Leaf blight, and r

Species: Paddy (*Oryza sativa*)

Variety	Year of release	Owners/ Maintainer and seed source	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Distinctive characters	Special attributes
1. Supa	Before 1950's	ARI KATRIN	0-400	1.5-3.5	-Leaf blade pubescence: pubescent -Leaf angle: erect -Auricle colur: pale green -Days to heading: 93-100 -Culm angle:erect -Flage leaf angle:erect -Panicle type:intermediate -Second branching: light -Awn presence:absent -Grain shape:slender -Seed coat colour: white	Moderately resistant to rice ye rot
2. IR 54	1980's	KATRIN	400-600	4.0-7.0	-Leaf blade pubescence:intermediate -Leaf angle:erect -Auricle colur:pale green -Days to heading:93-100 -Culm angle:intermediate -Flage leaf angle:erect -Panicle type: intermediate -Second branching:heavy -Awn presence:long and partly awned -Awn colur:gold -Grain shape: some white belly -Seed coat colour:white -Scent (aroma):aromatic	Moderately resistant to blight a
3. IR 22	1983	KATRIN	400-1000	6.6-8.0	Days to maturity: 120-134	Resistant to bacterial blight

4. KATRIN	1983	KATRIN	400-1000	6.6-8.0	-Leaf blade pubescence: intermediate -Culm angle:erect -Flage leaf angle:erect -Panicle type: compact -Second branching -Awn presence:absent -Scent (aroma):not scented Plant height: medium statured	Very low panicle shattering
5. Dakawa	1990	Dakawa	400-1000	3.5-5.2	-Leaf blade pubescence: pubescent -Leaf angle:horizontal -Days to heading: 75-85 days -Culm angle:intermediate -Flage leaf angle:horizontal -Panicle type: compact -Awn presence:absent -Awn colur:absent -Grain shape:medium slender grains -Seed coat colour: straw -Scent (aroma): scented -Plant height: 108 cm (semi-tall)	None-photoperiod sensitive. R under very high N levels. Easy
6. TXD 85	2001	Dakawa	0-400	4.8-7.0	-Leaf blade pubescence: glabrous -Leaf angle:erect -Days to heading:98-98 days -Flage leaf angle:erect -Panicle type: intermediate -Awn presence:short and partly awned -Awn colur: gold -Grain shape:slender -Scent (aroma): lightly scented -Plant height: semi-dwarf 103.5 cm	Moderately resistant to sheath Yellow Mottle Virus

7. TXD 88	2001	Dakawa	0-400	2.8-6.5	-Leaf blade pubescence:glabrous -Leaf angle:erect -Days to heading:86-95 days -Flage leaf angle:erect -Panicle type: intermediate -Plant height: semi-dwarf -Awn presence: absent -Grain shape:slender -Scent (aroma):lightly scented	Moderately resistant to shealt Yellow Mottle Virus
8. TXD 306 (SARO 5)	2002	Dakawa	0-600	4.0-6.5	-Leaf blade pubescence:pubescent -Leaf angle:mixture of different types -Days to heading: 100-102 -Flage leaf angle: mixture of different types -Panicle type: intermediate Awn presence:absent Seed coat colour: light brown Scent (aroma): semi-aromatic	Moderated susceptible to Rice sheath rot. Adapted to rain-fed lowlands a
9. Kalalu	2006	SUA		2-3	-Leaf blade pubescence: glabrous -Leaf angle: horizontal -Flage leaf angle: horizontal -Panicle type:intermediate -Awn presence: shortly and partly awned -Scent (aroma): -Plant height: 118 cm	Resistant to Rice Yellow Mottl
10. Mwangaza	2006	SUA		2-3	-Leaf blade pubescence: glabrous -Leaf angle:horizontal -Flage leaf angle:	Resistant to Rice Yellow Mottl

					horizontal -Panicle type: heavy -Awn presence:shortly and fully awned -Plant height: 118 cm	

Species: Wheat (*Triticum aestivum.L*)

Variety	**Year of release**	**Owner(s)/ Maintainer and seed source**	**Optimal production altitude range (Masl)**	**Grain yield (t/Ha)**	**Distinctive characters**	**Special attril**
1.Mamba	1973	ARI Selian	1283-2400	2.0-3.0		Resistant to s
2.Nyati	1973	ARI Selian	1283-2400	2.0-3.0	-Leaf glaucosity: strong -Flag leaf altitude: drooping -Culm glaucosity: strong -Sheath glaucosity: strong -Spike density:moderate dense -Spike glaucosity: weak -Awns: very long -Plant height: 87 cm -Awn colour: -white -Colour:medium red	Moderately re stem rusts.

					Shape: elliptical and shriveled	
3.Mbuni	1975	ARI Selian	1200-2400	1.5-4.1	-Leaf glaucosity: weak -Growth habit: upright -Culm glaucosity: semi-prostate -Auricle pubescence: strong -Sheath glaucosity: strong -Spike shape: fusion -Spike density: lax -Spike glaucosity: weak -Awns: awned -Glume pubescence:absent -Glume colour:light green -Plant height: 80 cm -Awn colour: white -Spike attitude: inclined - Kernel colour:white - Kernel shape: ovate	Susceptible t
4.Kweche	1975	ARI Selian	1283-2400	2.0-3.0	-Leaf glaucosity: weak -Growth habit:upright -Culm glaucosity: mod+pubscence -Stem node pubescence: absent -Auricle pubescence: weak -Sheath glaucosity: strong -Spike shape: fusform -Spike density: mid-dense -Spike glaucosity: strong -Awns: awned -Glume pubescence:absent -Glume colour:bluish green -Plant height : 104 cm -Spike attitude: nodding -Kernel colour:medium red -Kernel shape: elliptical and shriveled	Medium susc
5.Trophy	1975	ARI Selian	1283-2400	2.0-3.0	-Leaf glaucosity: weak -Growth habit:upright -Flag leaf altitude: erect -Culm glaucosity: strong -Auricle pubescence: weak -Sheath glaucosity: strong -Spike shape: oblong -Spike density: lax -Spike glaucosity: medium -Awns: spical awnletted -Glume pubescence:absent -Plant height: 113 cm	Medium red s Susceptible t

					-Spike attitude: erect -Kernel colour:medium red -Kernel shape: ovate	
6.Tai	1977	ARI Selian	1283-2400	2.0-3.0	-Leaf glaucosity: weak -Growth habit: upright -Culm glaucosity: medium -Auricle pubescence: weak -Sheath glaucosity: oblong -Spike shape: mid-dense -Spike density: weak -Spike glaucosity: weak -Awns: awned -Glume pubescence:absent -Glume colour:light green -Plant height: 109 cm -Awn colour: brown -Spike attitude: inclined Kernal colour:dark red Kernal shape: ovate	Has dark red Moderately su stem rust.
7.Kozi	1977	ARI Selian	1283-2400	2.0-3.0	-Leaf glaucosity: weak -Growth habit: upright -Culm glaucosity: strong -Steam node pubescence: medium -Auricle pubescence: absent -Sheath glaucosity: strong -Spike shape: oblong -Spike density: mid-lax -Spike glaucosity: weak -Awns: awned -Glume pubescence:absent -Glume colour:light green -Plant height : 80 cm -Awn colour: white -Spike attitude: inclined -Kernel colour:white -Kernel shape: ovate	Has dark red Moderately su
8.Joli	1977	ARI Selian	1283-2400	2.0-3.0	-Leaf glaucosity: weak -Growth habit: upright -Culm glaucosity: medium -Steam node pubescence: absent -Auricle pubescence: weak -Sheath glaucosity: strong -Spike shape: fusion -Spike density: lax -Spike glaucosity: weak -Awns: awned	Moderately re

					-Glume pubescence:absent -Glume colour:grass green -Plant height:85 cm -Awn colour: white -Spike attitude: nodding -Kernel colour:white - Kernel shape: ovate	
9.Viri	1983	ARI Selian	1283-2400	1.5-4.7	-Leaf glaucosity: medium -Groth habit: upright -Culm glaucosity: strong -Auricle pubescence: medium -Sheath glaucosity: strong -Spike shape: oblong -Spike density: mid dense -Spike glaucosity: medium -Awns: awned -Glume pubescence:absent -Glume colour:bluish green -Plant height:89 cm -Awn colour: white -Spike attitude: inclined - Kernel colour:white -Kernel shape: ovate	Resistant to y Moderately su
10.Duma (Durum)	1983	ARI Selian	1283-2400	1.1-4.5	-Leaf glaucosity: weak -Growth habit:upright -Culm glaucosity: strong -Auricle pubescence: absent -Sheath glaucosity: strong -Spike shape: oblong -Spike density: mid-dense -Spike glaucosity: strong -Awns: awned -Plant height: 79 cm -Awn colour: -brown -Spike attitude: inclined -Kernel colour:amber -Kernal shape: ovate	Resistant to s
11.Mbayuwayu	1987	ARI Selian	1200-2400	1.4-2.8	-Leaf glaucosity: strong -Growth habit: erect -Flag leaf altitude: erect -Culm glaucosity: strong -Spike density: medium -Awns: medium -Plant height: 92 cm -Awn colour: white -Spike attitude: inclined	Moderately re leaf rusts. Ha

					-Kernel colour:pale red -Kernel shape: ovoid	
12.Azimio 87	1987	ARI Selian	1200-1800	1.8-3.0	-Growth habit: erect -Flag leaf altitude: erect -Culm glaucosity: strong -Spike density: strong -Awns: strong -Glume pubescence: -Plant height: 80 cm -Awn colour: white -Spike attitude: inclined -Kernel colour:white -Kernel shape: semi-elongated	Resistant to s
13.Tausi	1987	ARI Selian	1283-2400	2.0-4.0	-Leaf glaucosity: strong -Growth habit: erect -Flag leaf altitude: erect -Culm glaucosity: strong -Spike density: strong -Plant height:70 cm -Awn colour: white -Spike attitude: inclined -Kernel colour:white	Susceptible t
Tembo					-Leaf glaucosity: weak -Growth habit:upright -Flag leaf altitude: -Culm glaucosity: mod+pubscence -Steam node pubescence: absent -Auricle pubescence: weak -Sheath glaucosity: strong -Spike shape: fusform -Spike density: mid-dense -Spike glaucosity: strong -Awns: awned -Glume pubescence:absent -Glume colour:bluish green -Plant height: 104 cm -Spike attitude: nodding -Kernel colour:medium red	
14.Selian 87	1987	ARI Selian	1200-1800	1.8-3.0	-Leaf glaucosity: strong -Growth habit: erect -Flag leaf altitude: erect -Culm glaucosity: strong -Spike density: medium -Awns: medium -Plant height: 92 cm -Awn colour: white	Highly resista rusts

					-Spike attitude: inclined -Kernel colour:pale red -Kernel shape: ovoid	
15.Juhudi No:1	1987	TANWAT	1700-2200	3.0-4.0	-Days to maturity: 90-110	Resistant to a rusts. Resista
16.Njombe 6	1987	TANWAT	1500-2400	2.1-4.1	- Days to maturity:110-120	Highly resista rusts
17.Njombe 7	1987	TANWAT	1500-2400	3.0-4.2	- Days to maturity: 110-120	Highly resista and root fung Resistant to S
18.Kware	1989	ARI Selian	1300-1400	2.0-3.0	-Growth habit:erect -Flag leaf altitude: straight -Culm glaucosity: strong -Auricle pubescence: absent -Spike shape: straight inclined -Spike density: mid-dense -Awns: present -Glume colour:white at maturity -Awn colour: -blue green before, maturity white maturity Spike attitude: nodding -Kernel colour:white -Kernel shape: ovate	Moderately re stem rusts. M *Septoria*, leaf
19.Chiriku	2002	ARI Selian	1300-2400	2.2		Slow rusting
20. Sifa	2004	ARI Uyole	1700-2300	4.5 – 5.0	-Growth habit:erect -Culm glaucosity:present-whitish -Auricle pubescence: hairs present -Spike density: dense -Awns: awned -Glume pubescence: very weak or absent -Glume colour:whitish green -Kernelcolour:yellow -Kernel shape: ovate -Plant height: 83 cm	Moderate res and Stripe ru
21. Riziki –C_2	2006	ARI Selian	1000 - 1500	2.7	-Leaf glaucosity: present (medium) -Growth habit:erect -Culm glaucosity:weak -Auricle pubescence: medium -Sheath glaucosity: medium -Spike shape: parallel -Spike density: medium -Spike glaucosity: medium -Awns: awned -Glume pubescence: absent	Moderate res and Leaf rust

					-Glume colour:straw white -Plant height:86 cm -Awn colour: -white -Spike attitude: straight -Kernel colour:brown -Kernel shape: semi elongated	
22. RIZIKI – C_1	2006	ARI Selian	1000-2000	3.5	-Leaf glaucosity: absent -Growth habit: erect -Culm glaucosity: absent -Auricle pubescence: weak -Sheath glaucosity: absent -Spike shape: parallel -Spike density: medium -Spike glaucosity: absent -Awns: awned -Glume colour:white -Plant height: 99 cm -Awn colour: white -Spike attitude: straight -Kernel colour:brown -Kernel shape: semi elongated	Moderate res and Leaf rust
23. Lumbesa	2006	ARI Selian	1000-2000	3.5	-Leaf glaucosity: absent/weak -Growth habit: erect -Culm glaucosity: absent -Auricle pubescence: weak -Sheath glaucosity: absent/weak -Spike shape: parallel -Spike density: medium -Spike glaucosity: absent/weak -Awns: awned -Glume pubescence:medium -Glume colour:straw white -Plant height: 80 cm -Awn colour: white -Spike attitude: straight -Kernel colour:brown -Kernel shape: semi elongated	Moderate res and Leaf rust

Species: Barley (*Hordeum vulgare* L.)

Variety	**Year of release**	**Owner(s)/Maintainer and seed source**	**Optimal production altitude range (Masl)**	**Grain yield (Tons/Ha)**	**Distinctive Characters**	**Special attril**

1.Makete-I Naked barley)	1987	ARI Uyole	1850-2500	2.0-3.5	-Ear glaucosity: weak -Flag leaf altitude: drooping -Culm glaucosity: strong -Plant height : 80 cm	Resistant to l
2.Kibo	1991	ARI Serian	1300-1900	3.5-4.0	Growth type: erect -Colour of leaves : green -Tillering capacity: moderate -Spike: spikelets have long awns -Colour of spike at grain filling: light green -Awns colour: light green -Hairiness of awns: rough	Moderate malt Resistant to po smut. Resistant to le
3.Subira	1995	TBL	1300-200	2.6	-Growth type: erect -Spike density: long very lax -Colour of spike at grain filling: pinkish -Leaf colour: green -Length and shape of basal rachis internode: short, curved -Degree of awning: moderate -Plant height: 60 cm -Awns colour: pinkish -Hairiness of awns: rough	Moderate malt Resistant to po smut Resistant to le Tolerant to net
4. 8519	1996	TBL	1000-1200	2.0-3.5	-Growth type: erect -Colour of leaves : pale green -Size of leaves: large -Tillering: fair -Spike density: long very lax -Colour of spike at grain filling: green -Colour of spike at grain filling: pinkish -Awns colour: pinkish -Hairiness of awns:	Moderate malt content. Resistant to po smut. Resistant to le Tolerant to net
5.Bima	1998	TBL	1500-2200	1.0-2.1	-Growth type: semi-erect -Colour of leaves: pale green -Size of leaves: small -Tillering: heavy -Spike density: medium lax -Colour of spike at grain filling: pinkish -Plant height: medium -Awns colour: pinkish	Very good mal Resistant to po smut. Resistant to le net and spot b

6.Kusini	2001	TBL	1000-1200	2.0-3.0	-Growth type: erect -Colour of leaves: pale green -Size of leaves: small -Tillering: medium -Spike density: medium lax -Number of fertile rows in spike: 2 -Colour of spike at grain filling: pinkish -Plant height: medium -Awns colour: green	Good malting Resistant to po smut. Resistant to le Tolerant to net lodging in more
7. 9831	2004	TBL	1000-1200	80 - 90	-Growth type: erect -Colour of leaves: pale green -Spike density: medium lax -Colour of spike at grain filling: strongly pink -Plant height: medium -Awns colour: strongly pink -Grain length: medium long -Days to 50 % ear emergency: early, about 50 DAP	Disease React

Species: Oats (*Avena sativa* L.)

Variety	**Year of release**	**Owner(s)/ Maintainer and seed source**	**Optimal production altitude range (Masl)**	**Grain yield (t/Ha)**	**Distinctive Characters**	**Special att**
1. Kudu	1987	ARI Uyole	1770-2350	7.0	-Standability at late tillering:erect -Plant height: 121 (cm) -Culmglaucosity:medium -Flag leaf attitude at booting:droopping -Flag leaf sheath glaucosity:strong -Flag leaf hairiness:weak -Leaf blade glaucosity:weak -Mature ear colour:white -Ear glaucosity:very weak -Ear density:loose -Degree of awning:slight -Grain brush hairs:heavy -Days to spike emergence:65-70	Forage crop Resistant to spot

Species: Triticale

Variety	Year of release	Owner(s)/ Maintainer and seed source	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Distinctive Characters	Special att
1.T. Tembo	1982/3	ARI Uyole	1000-2400	3.4	-Leaf glaucosity: weak -Growth habit: upright -Culm glaucosity: medium -Sheath glaucosity: strong -Spike density: mid dense -Spike glaucosity: strong -Awns: awned -Plant height: 104 cm -Awn colour: white -Kernel colour:medium red -Kernel shape:elliptical and shrived	Resistant to spot blotch
2. Uyole Sangara	1986/7	ARI Uyole	1500-2400	>4.0	-Leaf glaucosity: weak Growth habit: erect -Days to 50 % flowering: 68-76 days -Culm glaucosity: medium -Sheath glaucosity: strong -Spike density: weak -Spike glaucosity: weak -Awns: awned medium -Plant height: 107 cm -Awn colour: white -Kernel colour:white -Kernel shape:elliptical	Resistant t
3.TANWAT T.87	1987	TANWAT	1500-2400	4.0	-Leaf glaucosity: weak -Growth habit: semi prostate -Culm glaucosity: medium -Sheath glaucosity: medium -Spike glaucosity: medium -Awns: awned -Plant height: 127 cm -Awn colour: brown -Kernel colour: ambercolour	Resistant to and *Fusariu*

					-Kernel shape:elliptical	

Species: Sorghum (*Sorghum bicolor* (L.,) Moench

Variety	Year of release	Owner(s)/ Maintainer and seed source	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Distinctive Characters	Special attril
1.Serena	1960	EAC	600-1500	3.0-3.5	Grain colour: red	Tolerant to *S* and S. *Forbe*
2.Tegemeo	1978	ARI Ilonga	600-1500	2.5-3.0	-Hairiness: absent -Plant colour: tan -Leaf colour: light green, some plants have puplish pigments on lower leaves -Plant height: 1.5-1.8 m -Days to 50 % flowering: 70-72 -Awn at maturity: absent -Head shape: bell -Grain colour: white (pearl), -Glume colour: straw,	Susceptible t *asiatica* and S
3.Pato	1997	ARI Ilonga	600-1500	1.6-3.3	-Leaf colour:green medium leafy, drooping -Plant height: 190 -240 cm -Days to 50 % flowering: 67-72 days, -Head shape: medium sized semi open, short bulky heads -Grain colour: creamy white with purple specks -Glume colour: black, very conspicuous -Grain form: elliptic	Susceptible t *asiatica* and S
4. Macia	1998	ARI Ilonga	600-1500	2.5-3.0	-Plant colour: tan -Plant height: 120-150 cm (semi-dwarf) -Days to 50 % flowering: 60-65 -Awn at maturity: absent -Head shape: symmetric, semi-compact, large and	Moderately re *S. asiatica* an

					bulbous with good exertion (10-15 cm) -Grain colour: creamy white -Grain form: elliptic	
5. Wahi	2002	ARI Ilonga	600-1500	3.5	-Stem diameter of lower third (at maturity): large -Glume colour at maturity: reddish brown -Glume length at maturity: short -Cariopsis colour after threshing: straw yellow -Grain shape in dorsal view: circular -Grain shape in profile view: circular - Leaf width: broad	Highly tolerar *asiatica* and S Resistant to l Susceptible t
6. Hakika	2002	ARI Ilonga	600-1500	3.5	Stem diameter of lower third (at maturity): small -Glume colour at maturity: reddish brown -Short -Glume length at maturity: short -Cariopsis colour after threshing:orange -Grain shape in dorsal view: elliptic -Grain shape in profile view: elliptic - Leaf width: narrow -Rooting ability : has high power of rooting	Resistant to S and S. *forbes*

Species: Pearl Millet (*Pennisetum glaucum* L.)

Variety	Year of release	Owner(s)/Maintainer and seed source	Optimal production altitude range	Grain yield (t/Ha)	Distinctive characters	Special attributes/ Disease r

			(Masl)			
1. Shibe	1994	ARI Ilonga	0-1200	1.8-2.0	-Tillering attitude at head emergency: erect -Spike shape:cylindrical -Bristle length :absent -Days to flowering: 90-95 -Spike shape:cylindrical -Seed colour:grey -Seed shape:obovate -Plant height (m):1.5-2.5	Resistant to *Striga hermonthi*
2. Okoa	1994	ARI Ilonga	0-1300	2.0-2.5	-Tillering attitude at head emergency: erect -Spike shape:cylindrical -Bristle length :absent -Days to flowering: 87-92 -Spike shape:cylindrical -Spike density at maturity: compact -Seed colour:grey -Seed shape:obovate -Plant height (m):1.8-2.8	Resistant to *Striga hermonthic* Moderately tolerant to ergot di

Species: Bean (*Phaseolus vulgaris* L.)

Variety	Year of release	Owner(s)/ Maintainer and seed source	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Distinctive characters	Spec
1. Canadian wonder	1977	ARI Selian	1000-1800	1.1-2.4	-Anthocyanin colouration:present - Leaf colour:green -Growth habbit:upright erect -Twining tendency: absent -Plant height (cm):46 -Days to flowering:33 -Flower colour:purple -Pod colour at maturity:yellow -Seed shape:kidney -Testa texture:smooth -Testa colour:dark red -Seed size:large	Mode bean
2. Kabanima	1980	ARI Uyole	1200-1800	1.5-1.8	-Anthocyanin colouration:present -Leaf colour:green -Growth habbit:upright erect -Twining tendency: absent	Resis

					-Plant height (cm):40 -Days to flowering:39 -Flower colour:white -Pod colour at maturity:cream -Seed shape:kidney -Testa texture:smooth -Testa colour:mottled red -Seed size:large	
3. Uyole 84	1984	ARI Uyole	900-2000	1.5-2.0 (non staked) 2.5-4.0 (staked)	-Anthocyanin colouration:absent -Leaf colour:light green -Growth habbit:climber (aggressive) -Twining tendency: present -Plant height (cm): up to 200 -Days to flowering:42-46 days -Flower colour:white -Pod colour at maturity:cream yellow -Seed shape:round and semi -Testa texture:smooth -Seed size:medium	Resis
4. Uyole 90	1990	ARI Uyole	1500-2000	1.5-2.0	-Days to maturity: 60-62 -Days to 50 % flowering: 30-32	It is t leaf s
5. Uyole 94	1994	ARI Uyole	1000-1800	1.0-1.8	Days to maturity: 90-92 -Days to 50 % flowering: 40	Resis to Be Angu
6. Uyole 96	1996	ARI Uyole	1000-1800	1.0-1.8	Days to maturity: 85 -Days to 50 % flowering: 38	Toler Comm
7. Uyole 98	1998	ARI Uyole	1000-2000	1.2-2.0	-Days to maturity: 85 -Days to 50 % flowering: 38	Resis spot Toler
8. Ilomba	1990	ARI Uyole	1200-2000	1.5-2.5	-Days to maturity: 88 -Days to 50 % flowering: 40	Resis rust, Toler
9. Lyamungu 85	1985	ARI Lyamungu	900-1800	1.2-1.5	-Anthocyanin colouration:present - Leaf colour:green -Growth habbit:upright erect -Twining tendency: absent -Plant height (cm):46 -Days to flowering:33 -Flower colour:purple	Resis spot, interm

					-Pod colour at maturity:yellow -Seed shape:kidney -Testa texture:smooth -Seed size:large	
10. Lyamungu 90	1990	ARI Lyamungu	900-1800	1.2-1.6	-Days to maturity: 80-85	Has l rust a
11. Selian 94	1994	ARI Selian	900-1500	2.5-3.5	-Anthocyanin colouration:weak -Leaf colour:dark green -Growth habbit: erect -Twining tendency: present -Plant height (cm):50-60 -Days to flowering:42 -Flower colour:pink -Pod colour at maturity:light yellow -Seed shape:oval -Testa texture:smooth -Testa colour:light pink with red speckles -Seed size:medium	Mode and a
12. JESCA	1997	ARI Selian	1000-1500	2.0-3.4	-Days to maturity: 80-85 -Days to 50 % flowering: 35	Resis Mosa resis comr
13. Selian 97	1997	ARI Selian	1000-1500	2.0-2.8	-Leaf colour:dark green -Growth habbit:strong erect stem with braches -Twining tendency: absent -Plant height (cm):40 -Days to flowering:40 -Flower colour:pink -Pod colour at maturity:light yellow -Seed shape:kidney -Testa texture:smooth Testa colour: red (but lighter than Canadian wonder) -Seed size:large	Resis Mosa resis comr
14. Rojo	1997	SUA	<1000	2.2	-Days to maturity: 67-74 -Days to 50 % flowering: 32-37	Resis Virus bacte are fa
15. Wanja	2002	ARI Uyole	800-1800	1.5	-Anthocyanin colouration:green -Leaf colour:green -Growth habbit:upright	Early khaki

					-Twining tendency: absent -Plant height (cm):35-45 Days to flowering:38-38 -Flower colour:pink -Pod colour at maturity:cream -Seed shape:larege kidney -Testa texture:smooth -Testa colour: greenish Khaki -Seed size:large	
16. BILFA 16	2004	ARI Uyole	1000-1900	1.5-2.5	-Anthocyanin colouration:green -Leaf colour:green -Growth habbit:bushy with many branches -Twining tendency: absent -Plant height (cm):40-44 -Days to flowering:30-38 -Flower colour:pink -Pod colour at maturity:yellow -Seed shape:plumb -Testa texture:smooth -Testa colour: broken white stripes on dark red background -Seed size:medium	Tolera Resis
17. Uyole 04	2004	ARI Uyole	1200-2000	2.0 – 2.5	-Leaf colour:green -Growth habbit: many branches and tendency to tail -Twining tendency: semi climber -Plant height (cm):45-60 -Days to flowering:30-38 -Flower colour:pink -Pod colour at maturity:pale cream/whitish -Seed shape:kidney -Testa texture:smooth -Seed size:large	Resis Tolera
18. Pesa	2006	SUA	Low to medium	0.9-1.5	-Growth habbit:bush -Twining tendency: none -Plant height (cm):44 -Days to flowering:28-32 -Flower colour:pink - Pod colour at maturity:light brown -Seed shape:kidney -Testa texture:smooth -Testa colour: dark red	Mode Resis and s

19. Mshindi	2006	SUA	Low to medium	0.9-1.5	- Anthocyanincolouration:present -Leaf colour:green -Growth habbit:bush -Twining tendency: none -Plant height (cm):48 -Days to flowering:28-32 -Flower colour:pink -Pod colour at maturity:light brown -Seed shape:roundish -Testa colour:grey mottled -Seed size:medium	Mode Resis Has s
20. Selian 05	2005	ARI Selian	1000-1500	1.0-1.6	-Days to flowering:43 -Flower colour:white -Pod colour at maturity:yellow -Seed shape:oval -Testa colour: khaki -Seed size:large	Resis Virus
21. SELIAN 06	2007	ARI Selian	>1500	2.5-3.0	-Days to flowering:40 -Flower colour:white -Pod colour at maturity: light brown -Seed shape:oval -Testa colour: white -Seed size:medium	Resis Virus
22. CHEUPE	2007	ARI Selian	>1500	2.5-3.0	-Days to flowering:42 -Flower colour:white -Pod colour at maturity: light brown -Seed shape:oval -Testa colour: white -Seed size:medium	Resis Virus

Species: Cow pea (*Vigna unguiculata* (L.) Walp.)

Variety	**Year of release**	**Owner(s)/Maintainer and seed source**	**Optimal production altitude range (Masl)**	**Grain yield (t/Ha)**	**Distinctive characters**	**Spec**
1. Tumaini	1978	ARI Ilonga	0-1500	2.4	-Leaf colour:darkness Leaf texture: smooth -Growth habbit:indeterminate -Twining tendency: slight -Days to flowering:48	Resis interr bligh

					-Flower colour:purple -Seed colour: tan -Seed shape:kidney -Seed size:medium	
2. Fahari	1978	ARI Ilonga	0-1500	2.4	-Growth habbit:indeterminate -Twining tendency: semi-erect -Days to flowering:50 -Flower colour:purple -Seed colour: cream -Seed shape:kidney	Resis
3. Vuli -I	1984	ARI Ilonga	0-1500	1.8-2.0	-Leaf texture: smooth -Growth habbit:determinate -Twining tendency: erect -Flower colour:purple -Seed colour: red -Seed shape:kidney	Resis interm bligh
4. Vuli-2	2003	ARI Ilonga	Below 1500	2.0-2.5	-Growth habbit:determinate -Twining tendency: semi-trailing -Flower colour:purple -Seed colour: white/cream -Seed shape:kidney	Mode Resis Mosa

Species: Green gram (Phaseolus *aureus* Roxb)

Variety	**Year of release**	**Owner(s)/Maintainer and seed source**	**Optimal production altitude range (Masl)**	**Grain yield (t/Ha)**	**Distinctive characters**	**Specia**
1. Nuru	1978	ARI Ilonga	0-1350	1.5	-Growth habbit: determinate -Plant height (cm): 14-66 -Days to flowering:50 -Flower colour:purple -Pod colour at maturity: black -Seed shape:rhomboid -Testa texture:smooth	Resista interme
2. Imara	1982	ARI Ilonga	0-1350	1.5	-Growth habbit: semi-prostate -Plant height (cm): 42 -Flower colour:purple -Pod colour at maturity: brown -Seed shape:rhomboid -Testa texture:smooth -Seed size: Large than Nuru	Resista resistan adapta

Species: Pigeon pea (*Cajanus cajan*

Variety	Year of release	Owner(s)/Maintainer and seed source	Optimal production altitude range (Masl)	Grain yield (Tons/Ha)	Distinctive characters	Spec
1. Komboa	1999	ARI Ilonga	<1500	4.0 (grain) and 10.0 (green pods)	-Growth habbit:compact -Plant height (cm): 100 -Days to flowering:65 (under optimum temp. 20-24^{0}C) -Base flower colour: red (exterior) -Second flower colour:orange (interior) -Duration of flowering: sychronous -Pod colour: green with slight striples -Seed colour pattern: mottled -Seed eye colour:brown -Base seed colour: white (cream) -Seed second colour: brown	Early
2. Mali	2002	ARI Ilonga	500-1500	1.0 – 3.0	-Growth habbit:compact to semi-erect -Growth habbit:compact -Leaf: large and green -Plant height (cm): 100 -Days to flowering:113-130 -Flower: ivory-coloured and do not open fully -Pods: green with purple streaks and are borne in clusters at the branch terminals	Resis seed Toler
3. Tumia	2003	ARI Ilonga	Below 1500		-Growth habbit:compact and semi erect - Leaf colour large green leaf Flower colour: ivory coloured. - Pod colour:the pods are green and very broad, and are borne in clusters at the branch terminals	It is s

Species: Ground nut (*Arachis hypogeae* L.)

Variety	Year of release	Owner(s)/ Maintainer	Optimal production	Grain yield (t/Ha)	Distinctive characters	Special attril

		and seed source	altitude range (Masl)			
1. Red Mwitunde	1976	ARI Naliendele	< 1500	0.1-1.7	-Days to maturity: 120	May suffer fro harvest or if li
2. Nyota (Span cross)	1983	ARI Naliendele	< 1500	1.2	-Stem branching:sequential -Stem hairiness:scarce -Laateral branches habbit:non distichous -Leaf colour:light green -Leaflet shape:cunoate -Leaflet hairiness:sparce and short -Length of reproductive branch:short -Flower colour: yellow -Days to 50 % flowering:38 -Pod break:slight -Pod constriction:slight -Seed colour:small -Growth habbit: small seeds light	Tolerant to *C*
3. Johari	1985	ARI Naliendele	< 1500	1.3	-Leaf colour:dark green -Leaflet shape:cunoate -Flower colour: yellow -Days to 50 % flowering:45 -Pod break:deep -Pod constriction: moderate -Seed colour: tan -Growth habbit:decumbent -Plant colour:darkgreen	Resistant to C dormancy.
4. Pendo 98 (Spanish)	1998	ARI Naliendele	< 1500	1.5	-Lateral branches habbit: erect -Leaf colour: light green -Days to 50 % flowering: 27-30 -Pod break: incnspicuous -Pod constriction:not marked -Seed colour: tan (monochrome) -Growth habbit: erect	The seed exh shelling % an (Virginia)
5. Sawia 98 (Virginia)	1998	ARI Naliendele	< 1500	1.5	-Lateral branches habbit: erect -Leaf colour: dark green -Length of reproductive branch:- -Flower colour: -Days to 50 % flowering: 30-32 -Pod break: absent or very incnspicuous -Pod constriction:absent or very shallow -Seed colour: tan (monochrome) -Growth habbit: semi-erect	The seed exh Has less shel compared to

Species: Sesame (*Sesamum indicum* L.)

Variety	Year of release	Owner(s)/ Maintainer and seed source	Optimal production altitude range (Masl)	Grain yield (Tons/Ha)	Distinctive characters	Special attril
1. Naliendele 92	1992	ARI Naliendele	< 1500	1.2	-Has basal, compact branching -Heavy leaf shedding at maturity	Susceptible t
2. Zawadi 94	1994	ARI Naliendele	Up to 1500	1.0	-Has basal, profuse branching -Capsules turn from green to purple at maturity -Dull white seed, however if harvested during prolonged rains the colour changes to brown	Tolerant to le stem rot and
3. Ziada 94	1994	ARI Naliendele	Up 1500	1.0	-Late maturing plant (120-130 days) - Plant colour:light green -Branching: has profuse branching -Seed colur:white-brown bold seeds but change to cream white if harvested in prolonged rains	Tolerant to le Good oil cont
4. Lindi 02	2006	ARI Naliendele	Up to 1500	1.2	- Branching:has basal, compact branching -Capsules size: long capsules, 2-3 carpels within the same plant - Seed colour:very white seeds	Tolerant to le stem rot, and Susceptible t *bimaculate*) Good oil cont

Species: Soya Bean [*Glycine* max (L.) Merr.]

Variety	Year of release	Owner(s)/ Maintainer seed source	Optimal production altitude range (Masl)	Grain yield (Tons/Ha)	Distinctive characters	Special attril
1. Soya Uyole-1	2002	ARI Uyole	1000-1800	1.5-3.0	- Growth habit:plant has up-right growth habit -Leaf colour: has green leaf colour with hairy texture -Pod colour:pod has cream/brownish colour at maturity - Seed shape:seed has short plump shape, -Testa colour: cream -Helium colour: brown	Does not lodg

Species: Sweet potatoes [*Ipomea batatas* (L.) Poir.,]

Variety	Year of release	Owner(s)/ Maintainer seed source	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Distinctive characters	Specia
1. Simama	2000	ARI Ukiriguru	0-2000	10.0-20.0	-Plant type: Semi-compact -Vine predominant mature colour: Green -Vine tip pubescence: None -Mature leaf shape: Lobed -Leaf shape of mature lobe: Elliptic -Storage root shape: Elliptic -Storage root skin colour (predominant): cream Storage root flesh colour (predominant): cream -Storage root arrangements: closed cluster	Modera feather vein vir virus. Modera
2. Vumilia	2000	ARI Ukiriguru	800-2000	10.0-20.0	-Plant type: Spreading -Vine predominant mature colour: Green -Vine tip pubescence: Sparsed -Mature leaf shape: Lobed - Leaf shape of mature lobe: Elliptic -Storage root shape: Oblong -Storage root skin colour (predominant): Cream -Storage root flesh colour (predominant): Cream -Storage root arrangements: Closed cluster	Modera feather vein vir virus. Moder
3. Sinia	2000	ARI Ukiriguru	800-2000	10.0-20.0	-Plant type: Spreading -Vine predominant mature colour: Mostly purple -Vine tip pubescence: Sparse -Mature leaf shape: Lobed -Mature leaf shape of mature lobe: Semi-elliptic -Storage root shape: Long elliptic -Storage root skin colour (predominant): Purple - -Storage root flesh colour (predominant): Orange -Storage root arrangements: Open cluster	Modera feather vein vir virus. Moder
4. Mavuno	2000	ARI Ukiriguru	800-2000	10.0-25.0	-Plant type: Spreading Vine predominant mature colour: Green -Vine tip pubescence: None -Mature leaf shape: Cordate -Leaf shape of mature lobe: Teeth -Storage root shape: Elliptic -Storage root skin colour (predominant): Cream - -Storage root flesh colour (predominant): Cream -Storage root arrangements: Closed cluster	Modera feather vein vir virus. Modera
5. Jitihada	2000	ARI Ukiriguru	0-2000		-Plant type: Semi-compact -Vine predominant mature colour: Green -Vine tip pubescence: Moderate	Modera feather vein vir

					-Mature leaf shape: Lobed - Leaf shape of mature lobe: Linear (narrow) -Storage root shape: Oblong -Storage root skin colour (predominant): White -- -Storage root flesh colour (predominant): white -Storage root arrangements: open cluster	virus. Modera
6. Ukerewe	2002	ARI Kibaha	< 1000	9.0	-Plant type: Spreading -Vine predominant mature colour: Green -Vine tip pubescence: None -Mature leaf shape: Lobed -Mature leaf shape of mature lobe:Semi- elliptic -Storage root shape: Long elliptic -Storage root skin colour (predominant): Purple - -Storage root flesh colour (predominant): Cream -Storage root arrangements: very dispersed	Modera feather vein vir virus. Modera

Species: Cassava (*Manihot* spp.)

Variety	Year of release	Owner(s)/ Maintainer and seed source	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Distinctive characters	Special attril
1. Kibaha	2003	SRI Kibaha		30.0	- Outer skin root colour: dark brown -Inner skin root colour: cream - Ground storability: 12-15 months -Time of root biodegradation: starts after 6 day from harvesting	Resistant to c Cassava Mot diseases Resistant to C Ecological ad (coastal area
2. Naliendele	2003	SRI Kibaha		12.0	-Outer skin root colour: Brown -Inner skin root colour: purple -Ground storability: 12-15 months -Time to root biodegradation: starts after 3 day from harvesting	Ecological ad (coastal area
3. Mumba	2003	SRI Kibaha		29.0	-Outer skin root colour: brown -Inner skin root colour: cream -Ground storability: 12-15 months -Time to root biodegradation: starts after 4 day from harvesting	Moderate resistant to d and Cassava Resistant to C Ecological ad tested for 6 y
4. Kiroba	2004	SRI Kibaha		26.0	-Outer skin root colour: dark brown -Inner skin root colour: purple -Ground storability: 10-12 months -Time to root biodegradation: starts after 4 day from harvesting	Ecological ad (coastal area
Hombolo 95	2004	SRI Kibaha		39.0	-Outer skin root colour: brown -Inner skin root colour:cream	Resistant to C Ecological ad

					-Ground storability:12-15 months -Time to root biodegradation: starts after 6 days from harvesting	tested for 5 y

Species: Sunflower (*Helianthus annus* L.)

Variety	Year of release	Owner(s)/ Maintainer and seed source	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Distinctive characters	Special attril
1. Record	Before 1950's	ARI Ilonga	0-2000	1.0-2.0	-Days to maturity: 110-130 -Days to 50 % flowering: 35-45	Susceptible t and sunflowe Oil content: 5
2. CRN 1435	1999	Monsanto South Africa	900-1500	2.0-2.5	-Leaf shape: Cordate -Depth of margin indentations: Intermediate -Blade altitude: Descending -Corolla colour: Yellow -Anther colour: Brown -Pericarp main colour: Black -Stripe colour: Gray -Has wide adaptation, good lodging resistance and stress tolerance	Resistant to S rugose mosa ringspot
3. PAN 7352	2002	Pannar Seed Co.	500-1500	1.5-2.5	-Leaf shape: Cordate -Depth of margin indentations: Medium -Blade altitude: Flat -Corolla colour: Yellow -Anther colour: Black -Pericarp main colour: Black -Stripe colour: White	Moderately re sunflower rug yellow ringsp Has excellent good lodging
4. K.Fedha	2006	Kenya Seed Co.Ltd	1500 - 2250	3.0 – 3.5	-Leaf shape: Flat -Depth of margin indentations: --- Deep to medium -Blade altitude: Scabrous -Corolla colour: Yellowish -Anther colour: Yellow -Pericarp main colour: Black -Stripe colour: Gray	Moderately re Altenaria spp -Has wide ad good lodging

Species: Tomato (*Lycopersicon lycopersicum* Mill.)

Variety	Year of release	Owner(s)/ Maintainer seed source	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Distinctive characters	Special attril
1. Tengeru 97	1997	HORTI-Tengeru	400-1500	60-80	-Growth habit: indeterminate -Day to 50 % flowering: 31 days from transplating -Days to 50 % fruiting: 47 days from transplating -Leaf shape: ovate to lanceolate in outline interrupted-pinnate to twice pinnate -Fruit colour:red -Firmness:very firm -Plant height: 95-100	Resistant to r mosaic virus to Tomato Yello
2. Tanya	1997	HORTI-Tengeru	400-1500	40-60	-Growth habit: Determinate -Day to 50 % flowering: 30 days from transplating -Days to 50 % fruiting: 45 days from transplating -Leaf shape: ovate to lanceolate in outline interrupted-pinnate -Fruit colour:red -Firmness:very firm -Plant height: 45-50	Susceptible t tomatoes
3. MERU	2007	HORTI-Tengeru	500-1500	60-100	-Growth habit: Indeterminate -Day to 50 % flowering: 24-27 days from transplating -Days to 50 % fruiting: -Leaf shape: -Fruit colour:red -Firmness:firm -Plant height: 45-50	Resistant to *I* Powdery mild

Species: Coffee (*Coffea arabica*)

Variety	Year of release	Owner(s)/ Maintainer seed source	Optimal production altitude range (Masl)	Dry bean yield (t/Ha)	Distinctive characters	Special attril
1. N 39-1	2005	TaCRI	900-1800	2.5-3.0	-Plant habit: shrub -Plant height: tall >170 cm	Resistant to C (*Colletotrichu*

					-Overall appearance: pyramidal -Vegetable development: sympodial -Branching habit (primary): many with many secondary and tertiary -Angle of insertion of primary branches: semi-erect -Young leaf colour: bronze -Inflorescence position: axillary -Number of flowers per axil: 17 -Fruit colour: red -Fruit shape: oblong -Seed colour: cream -Seed shape: elliptic	*vastatrix*), Added advan
2. N 39-2	2005	TaCRI	900-1800	2.5-3.0	-Plant habit: shrub -Plant height: tall >165 cm -Overall appearance: pyramidal -Vegetable development: sympodial -Branching habit (primary): many with many secondary and tertiary -Angle of insertion of primary branches: semi-erect -Young leaf colour: bronze -Inflorescence position: axillary -Number of flowers per axil: 16 -Fruit colour: red -Fruit shape: roundish -Seed colour: cream -Seed shape: elliptic	Resistant to C (*Colletotrichu* *vastatrix*), Added advan
3. N 39-3	2005	TaCRI	900-1800	2.5-3.0	-Plant habit: shrub (distinct trunk) -Plant height: tall >170 cm -Overall appearance: pyramidal -Vegetable development: sympodial -Branching habit (primary): many with many secondary and tertiary -Angle of insertion of primary branches: semi-erect -Young leaf colour: bronze -Inflorescence position: axillary -Number of flowers per axil: absent -Fruit colour: red -Fruit shape: oblong -Seed colour: cream -Seed shape: elliptic	Resistant to C (*Colletotrichu* *vastatrix*), Added advan
4. N 39-4	2005	TaCRI	900-1800	2.5-3.0	-Plant habit: shrub -Plant height: tall >170 cm -Overall appearance: bushy	Resistant to C (*Colletotrichu* *vastatrix*),

					-Vegetable development: sympodial -Branching habit (primary): many with many secondary and tertiary -Angle of insertion of primary branches: semi-erect -Young leaf colour: bronze -Inflorescence position: axillary -Number of flowers per axil: absent -Fruit colour: red -Fruit shape: roundish -Seed colour: cream -Seed shape: elliptic	Added advan
5. N 39-5	2005	TaCRI	900-1800	2.5-3.0	Vegetable development: sympodial -Branching habit (primary): MMS &T -Angle of insertion of primary branches: semi-erect -Young leaf colour: greenish -Inflorescence position: axillary -Number of flowers per axil: 15 -Fruit colour: red -Fruit shape: obovate -Seed colour: cream -Seed shape: oblong	Resistant to C (*Colletotrichu* *vastatrix*), Added advan
6. N 39-6	2005	TaCRI	900-1800	2.5-3.0	Vegetable development: sympodial -Branching habit (primary): MMS &T -Angle of insertion of primary branches: horizontal -Young leaf colour: brownish -Inflorescence position: axillary -Number of flowers per axil: 19 -Fruit colour: red -Fruit shape: oblong -Seed colour: cream -Seed shape: oblong	Resistant to C (*Colletotrichu* *vastatrix*), Added advan
7. N 39-7	2005	TaCRI	900-1800	2.5-3.0	Vegetable development: sympodial -Branching habit (primary): MMS &T -Angle of insertion of primary branches: semi-erect -Young leaf colour: bronze -Inflorescence position: axillary -Number of flowers per axil: 9 -Fruit colour: red purple -Fruit shape: roundish -Seed colour: cream -Seed shape: oblong	Resistant to C (*Colletotrichu* *vastatrix*), Added advan
8. KP 423-1	2005	TaCRI	900-1800	2.5-3.0	Vegetable development: sympodial	Resistant to C

					-Branching habit (primary): MMS &T -Angle of insertion of primary branches: horizontal -Young leaf colour: brownish -Inflorescence position: axillary -Number of flowers per axil: 14 -Fruit colour: red -Fruit shape: roundish -Seed colour: cream -Seed shape: oblong	(*Colletotrichu* *vastatrix*), Added advan
9. KP 423-3	2005	TaCRI	900-1800	2.5-3.0	Vegetable development: sympodial -Branching habit (primary): MMS &T -Angle of insertion of primary branches: horizontal -Young leaf colour: greenish -Inflorescence position: axillary -Number of flowers per axil: 9 -Fruit colour: red -Fruit shape: oblong -Seed colour: cream -Seed shape: eliptic	Resistant to C (*Colletotrichu* *vastatrix*), Added advan

Species: Tobacco (*Nicotiana tabacum* L.)

Variety	Year of release	Owner(s)/ Maintainer and seed source	Optimal production altitude range (Masl)	Grain yield (t/Ha)	Distinctive characters	Special attril
1. PD4	1992	ARI Tumbi	1050-1500	2.5	-Coleoptile hairiness: present -Leaf colour at maturity: dark green -Leaf colour at curing: greenish yellow -Leaf hairiness: present -Stem colour: dark green -Stem strength: strong -Plant hairiness: present -Plant height: 90-130 cm -Days to flowering: 59-69 -Flower colour: pink -Capsule colour at maturity: light brow -Seed colour: light brown	Moderately su Slightly susce (TMV), frog –
2. RG 17	2006	Tanzania Leaf Tobacco Company	900-1500	0.112	-Coleoptile hairiness: present -Leaf colour at maturity: green -Leaf colour at curing: deep lemon -Leaf hairiness: 50 %	Moderately su Slightly susce (TMV), frog –

					-Stem colour: pale green -Stem strength: not very strong -Plant hairiness: 50 % -Plant height: 60 cm -Days to flowering: 70 days -Flower colour: white-pink or pinkish -Capsule colour at maturity: dark brown -Seed colour: dark brown	
3. ULT F 10	2006	Tanzania Leaf Tobacco Company	900-1500	0.154	-Coleoptile hairiness: present -Leaf colour at maturity: green -Leaf colour at curing: deep orange -Leaf hairiness: 80 % -Stem colour: pale green -Stem strength: not very strong -Plant hairiness: 80 % -Plant height: 70 cm -Days to flowering: 70 % -Flower colour: white-pink or pink -Capsule colour at maturity: dark brown -Seed colour: dark brown	Moderately su Slightly susce (TMV), frog –
4. K 326	2006	Tanzania Leaf Tobacco Company	900-1500	0.125	-Coleoptile hairiness: present -Leaf colour at maturity: green -Leaf colour at curing: deep orange -Leaf hairiness: 80 % -Stem colour: pale green -Stem strength: not very strong -Plant hairiness: 80 % -Plant height: 70 cm -Days to flowering: 70 % -Flower colour: white-pink or pink -Capsule colour at maturity: dark brown -Seed colour: dark brown	Moderately su Slightly susce (TMV), frog –

Species: Cashew (*Anacardium occidentale* L.)

Variety	**Year of release**	**Ownner/Maintainance and seed source**	**Optimal production altitude range (Masl)**	**Grain yield (t/Ha)**	**Distinctive characters**	**Special alttribu**
AC 1	2006	ARI Naliendele	0-800	36	-Brown flush -Apple shape: cylindrical -Apple coulur: orange -Nut shape: kidney	Resistant to Po Die back

					-Flower colour: pink	
AC 4	2006	ARI Naliendele	0-800	59	-Red flush -Apple shape: cylindrical -Apple coulur: orange -Nut size: Large -Nut apex orientation: slightly tend to bend (on either the left or right side) away from direction of suture	Resistant to Po Die back
AC 4/17	2006	ARI Naliendele	0-800	16	-Nut apex: thin and relatively small-flattened -Dominantly thick bulging flanks starting from just near the lower end of the stylar scar and extend up to the upper shoulders, behind their side of suture -One side of the flank protrudes more than other side	Resistant to Po Die back
AC 10	2006	ARI Naliendele	0-800	39	-Aged leaves turn reddish, the aged leaves colour resembles mature apple colour -Very loose nut attachment to cashew apples, some nuts detach when or before falling on ground	Resistant to Po Die back
AC 10/129	2006	ARI Naliendele	0-800	67	-Brown flushes -Apple shape: cylindrical -Apple colour: yellow	Resistant to Po Die back
AC 10/220	2006	ARI Naliendele	0-800	53	-Green flushes relatively broad and large -Apple colour:yellow -Apple shape: conical	Resistant to Po Die back
AC 14	2006	ARI Naliendele	0-800	41	-Apple shape: long conical -Apple colour: orange -Pink/purple colouration that remain on nuts up to maturity	Resistant to Po Die back
AC 22	2006	ARI Naliendele	0-800	36	-Growth habit:natural tendency of the stem to grow relatively upright, even in the case of grafted plant	Resistant to Po Die back
AC 34	2006	ARI Naliendele	0-800	47	-Green flushes, which are relatiuvely narrow -Apple colour: yellow -Apple shape: round	Resistant to Po Die back
AC 43	2006	ARI Naliendele	0-800	55	-Apple shape: cylindrical -Apple colour: red with entire dark red strips at harvesting maturity	Resistant to Po Die back
AZA 2	2006	ARI Naliendele	0-800	49	-Growth habit: semi dwarf tree -Apple shape:conical	Resistant to Po Die back

					-Apple colour: greenish yellow at harvesting maturity	
AZA 17	2006	ARI Naliendele	0-800	47	-Apple shape: conical -Apple colour: yellow -Nut shape: elongated	Resistant to Po Die back
AZA 17/79	2006	ARI Naliendele	0-800	14	-Apple colour:yellow -Apples shape: conical -Nut shape: flattened -Nut apex shape: round	
AZA 17/156	2006	ARI Naliendele	0-800	62	-Apple colour:orange -Apple shape: round	Resistant to Po Die back
AZA 17/158	2006	ARI Naliendele	0-800	14	-Dark brown flushes -Apples shape: Conical -Apple colour: yellow	Resistant to Po Die back
AC 4/285	2006	ARI Naliendele	0-800	29	-Red (bright red) flushes, -Leaf shape: Obovate leaves -Apple colour: orange apples -Apple shape: Cylindrical	Resistant to Po Die back

Species: Grape vine (*Vitis venifera L.)*

Variety	**Year of release**	**Ownner/Maintainance and seed source**	**Optimal production altitude range (Masl)**	**Grain yield (t/Ha)**	**Distinctive characters**	**Special alt**
Makutupora Red	2007	Viticulture Research and Training Centre Makutupora	1050	10-15	Red colour when ripped	Adaptability Transportal Uses: Red
Chenin Nyeupe	2007	Viticulture Research and Training Centre Makutupora	1050	10-30	Produce green grapes when ripped	Fairly droug Uses: White

www.pgrfa.org/gpa/tza/

Tanzania

SECOND REPORT
ON THE STATE OF PLANT GENETIC RESOURCES
FOR FOOD AND AGRICULTURE

2008