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

AFGHANISTAN

Second Report
on

the State of Genetic Resource Conservation
in Afghanistan

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Note by FAO

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ACRONYMS AND ABBREVIATIONS

AYT	Advanced experience
CIAT	Centro International de Agriculture Tropical
CIMMYT	Centro International de Mejoramiento de Maize Y Trigo
CIP	International Potato Center
FAO	Food and Agricultural Organization
FGP	Forst Gruppe Paktia
FHCRAA	Future Harvest Conservation Consortium to Rebuild Agriculture in Afghanistan
ICARDA	International Center for Agriculture Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
JICA	Japan International Cooperation Agency
NUT	National experience
PGRFA	Plant Genetic Research for Food and Agriculture
PHDP	Perennial Horticultural Development Projects
PYT	Preliminary experience
RAMP	Rebuilding Agricultural Market Project
UNCCD	United Nation Convention to Combat Desertification
UNEP	United Nation Environmental Program

PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE IN AFGHANISTAN

CHAPTER 1

PREFACE

The present report attempts to identify the key agricultural and plant genetic resource problems, facing Afghanistan and to determine the measures that the government, communities and aid agencies (based on participatory approach) could adopt to alleviate them. The data and information used in this report are based entirely on a study of updated published works and on face to face meetings and discussions with relevant specialists, officials and farmers in the different sectors involved.

Unfortunately, Afghanistan's resource base has been negatively affected over the last three decades of conflict coupled with long periods of severe drought.

Due to the total lack of enforcement, the whole natural ecosystem, which once was regarded as one of diverse genetic area, has almost completely been deteriorated. The results have been that agricultural research stations have been destroyed, gene banks have been looted, rangelands and forest along with their vital components (wild life) have been depleted. Based on these facts, the people have lost their household assets, income generating opportunities and finally, the control over normal living conditions.

After all, due to the absence of active institutions of plant genetic resource management, the present submission is the preliminary document on which in future the report on PGRFA will be best.

CHAPTER 2

EXECUTIVE SUMMARY

Afghanistan is a landlocked country of 652 225 sq km. it has a mountainous landscape, one of its famous mountain with the longest ranges is Hindu Kush.

This mountain range covers a major part of the country. The average elevation of its peaks from the sea level is about 3 000 m; however the highest peak of Safed koh reaches an elevation of more than 6 000 m from the sea level. One sixth of the country landscape is comprised of deserts. The Northern parts of Hindi Kush with an elevation of 300-400m form most of the flat surface in this area. Over 80% of the country water resource has their origin in the Hindu Kush Mountain. It functions as a natural water reservoir, storing snow during winter and supporting perennial flows in all the major rivers during summer by snow melt. In the South East of the country there is a vast desert called Marji, joining the Lota deserts of Iran to the west side of the country.

The climate of the country is continental and sub tropical. The Marji desert of the South West and the desert of the Northern parts continuing to the banks of the Amu darya have sub tropical climate, while the remaining areas of the country have continental climate.

Topography is considered to be one of the factors, affecting the climate of Afghanistan. The south eastern parts of the country which is influenced by the Indian monsoon, supports dense vegetation of Oak and conifers forests. The rainfall happens during the winter and spring seasons, often in form of snow and rain. The total annual precipitation of the major parts of the country is less than 300 mm.

By 2002 the total population was estimated to be 22 million, of which 1.5 millions are nomads and around 4 million are refugees or displaced persons.

Agriculture and natural resource sector is the major production sector in Afghanistan, upon which more than 80% of the population depends for livelihood. Agricultural land is estimated to be 7.8 million ha of which 3.3 million ha is irrigated in 4.5 million ha is rain fed cropping.

Wheat is the main staple food crop throughout the country. On average per capita consumption of wheat is 152kg/ year. It is among the highest in the world. Other cereal and high value crops such as rice, maize, barley, cumin, sesame, cotton, sugar beet etc are cultivated where appropriate.

Afghanistan's economy is largely supported by sales of fresh and dry fruits. In the 1970 dried fruits. Raisins and nut contributed more than 40% of the country's foreign exchange earning.

Livestock use to be a major source of income in the country. According to a survey about 64% of the household in the country participate in livestock or poultry rearing. Incomes are generated through sale of milk products, live animal, wool etc.

According to a natural forest inventory in 1971 the only surviving natural forests were some 1 313 000 ha of mixed forests in the southeast and some 450 000 ha of pistachio forests in the north. Rangeland covered 70% of the total land area.

Due to the past long period of war and drought the agriculture sector in Afghanistan has been greatly damaged and its products are decreased by 50%. Parallel to that due to lack of enforcement the rural people have started to utilize the free natural resources.

The incentive for the people was to use the resources to maximum extent in the short term, regardless of the impact on the resource base.

Smuggling of the timbers, cutting of the forests and woodland, overgrazing, uprooting of the valuable wild plants and conversion of pastures to rain fed cropping become the daily business of the people. Forests and rangelands decreased by 50-70% and because of that many valuable wild plants have been endangered. Some plants species whose wild ancestors are found in Afghanistan are in the state of extinction.

2.1 The state of the genetic diversity of Afghanistan

The genetic variation of Afghanistan is well known. Therefore it is proposed as the main place of many kind of cultivated plants; apple, grapes, almond, pistachio, bean, check bean, cotton, garlic, onion etc.

2.2 *In situ* conservation

There was not any program for *in situ* crop conservation in Afghanistan. Recently some habitats of particular importance have been selected and proposed as protected areas/nature reserves, aiming conservation biology (*in situ* conservation of plant genetic resources). It is foreseen that the national parks will save those varieties which are in the state of extinction.

In 2006 PHDP has started to collect all varieties of fruits and nuts that are produced by commercial nurseries in the country. Additional varieties imported by various organizations have also been added to the collection. Numbers of accession registered with the *in situ* collection are:

- Apple (104),
- Apricot (64),
- Cherry (140),
- Citron (25),
- Fig (3),
- Grape (142),
- Lemon (6),
- Mulberry (7),
- Orange (29),
- Peach (96),
- Pear (23), etc.

In 2007 planting of cutting and budding of trees with each accession have been carried out.

2.3 *Ex situ* conservation

Prior to the war a variety development and improvement was initiated within the Ministry of Agriculture. There were around 21 research stations located in various regions of the country. Multiple location tests were conducted.

At that time a number of 1 770 samples were collected and conserved. Because of social disorder along with research stations have been looted and destroyed.

Since 2002 when Afghanistan obtained somewhat political stability a large number of international agencies started to contribute towards improvement of crop production in the country. ICARDA, CIMMYT, ICRISAT, RAMP, FHCRAA, PHDP are the lead agencies active and maintaining genetic diversity through provision and distribution of relevant germplasm. Through joint effort a large number of different high yielding varieties have been developed and distributed among rural communities throughout the country. The detail of germplasm collection and preservation is given in the *ex situ* conservation chapter of the report.

2.4 Uses for collection

At 2009 the PHDP will establish demonstration orchards using the clones obtained from the original exemplar trees. The performance of the outstanding clones will be demonstrated and subsequently will be used for propagation and cultivation. Several international nurseries were planted for testing yield, drought, and cold and disease tolerance in a variety of crops. This program will identify adapted germplasm for Afghanistan varied agro-ecological zones. Demonstration plots are also used for the same purpose.

2.5 The state of national program training and registration

There is not any national program of genetic resource conservation, however it is planted to restore germplasm conservation program. In 2005 MAIL publicized national seed policy of Afghanistan. It focuses on crop and seed research, seed multiplication system, variety development, quality control, introduction of new research development etc.

Government will look for introduction of new research development, training courses and publications. If these opportunities are lacking locally, government will rely on the assistance of its partners.

It is believed that the policy will provide the enabling environment for sustaining and enhancing growth of the Afghanistan seed industry.

2.6 The state of regional and international collaboration

The ministry of agriculture irrigation and livestock has different programs of international collaboration for genetic resource conservation and utilization. FAO, ICARDA, JICA, RAMP, FHCRAA, CIMMYT and PHDP are the main agencies active in plant genetic resource management in Afghanistan.

2.7 Access to plant genetic resources for food and agriculture (PGRFA), sharing of benefits arising out of their use and farmers' rights

The item 10.5 of the national seed policy states that the government will consult with institutional credit agencies with a view to encouraging crop production credit for farmers. When farmers have access to adequate credit, patronage for improved seed is enhanced thus promoting the growth of the seed industry availability of credit for seed industry firms will be also facilitated.

The policy/strategy framework for the rehabilitation and development of the agriculture and natural resource management of Afghanistan and community based forestry and rangeland policy and strategy recognize protection the traditional knowledge of community (farmers) relevant to plant protection and management and the right to participate in sharing benefits arising from the utilization of plant genetic resources. The community right to participate and making decisions is the main objectives of the above mentioned policy/strategy.

2.8 The contribution of PGRFA management to food security and sustainable development

The food security is one of the great challenges faces Afghanistan. The government of Afghanistan is trying to create a system for plant genetic resources for food and agriculture management. Many national and international agencies have been conducting such as PHDP, FAO, CIMMYT, and ICARDA, JICA, RAMP etc.

CHAPTER 3

COUNTRY CONTEXT

Situated in central Asia, Afghanistan is a landlocked country of 652 225 sq km, that shares borders with Iran, Tajikistan, Uzbekistan, Turkmenistan, China and Pakistan.The country rises gradually from the hot , arid plains along the Amu Darya and the systan Busin (400 m altitude), through mountain, to mount Zebak, the highest point in the Pamirs at 7 484 meters. Great mountains ranges of Pamir and Hindukush divide the country with high area of plains in the north, a mountainous area in the central part, mountain and foot hills in the East and Southwest and lowlands in the South and West of the country. These mountain ranges cover a major part of the country with the average peak elevation being about 3 000 meters above sea level. The Hindukush mountainous terrain, with little or no vegetation, typical of arid regions occupies two thirds of the landscape of Afghanistan. The north and the northwestern extension of Hidukush, support either scattered vegetation of trees and shrubs or are bare, rocky mountains and hills with very sparse or no vegetation.[1]

One – sixth of the country landscape is comprised of deserts. To the southeast of the country, there is a vast desert, called Marji, joining the Lot a desert of Iran to the west side of the country. In Afghanistan all flat surface areas represent a part of deserts located in Iran, Middle Asia, India and China.

The geographical features of the country, including its landlocked nature, rugged mountainous terrain, large desert areas, limited cultivated land, shortage of water resources and scattered, often isolated human settlements, make economic development of the country costly and difficult.

3.1 Climate

Afghanistan has a variety of deferent climates, resulting from its geographical latitude (29°33-35°40 north latitude). The climate is continental in nature, with cold winters and hot summers. The Marji desert of the South West and the desert of the Northern parts which continues to the banks of Amu Darya, have subtropical climate. Most of the country is arid and semi- arid, with low amounts of precipitation.[2]

The rainfall happens during the winter and spring seasons, in form of snow and rain. Snowfall is concentrated in the central and North – Eastern mountains of the country. This form of precipitation supplies the basic source of water for the growth season. The total annual precipitation of the Southern, Northern and Western parts of the country is less than 300 mm, which makes these regions susceptible to periodic drought.

Rain fall increases from West to East. The Southeastern high mountains where the precipitation is effected by the Indian monsoon have up to 1100 mm of rainfall in summer. These mountain ranges situated in Paktia, Nangarhar, laghman, Kunar and Noorestan provinces, support the existed valuable conifer and oak forest of Afghanistan. The other part of these mountain ranges, located in Laghman province form a major obstacle against transportation of the Indian monsoon water vapors to other parts of the country. This has caused these parts to be dry.

3.2 Water resources

Over 80% of the country's water resources have their origin in the Hidukush mountain range at altitudes above 2 000 m. The Hindukush functions as a natural water reservoir, storing snow during winter and supporting perennial flows in all the major rivers during summer by snow melt.[3] On the basis of that, Afghanistan is divided into 3 main river basins, the Helemand ,the Kabul and, the Amu Darya (17 billion cubic meters and 242 000 sq m).The Helemand river originate on the

[1] MAIL. (2006). Report on the Implementation of UNCCD. Kabul Afghanistan
[2] UNEP. (2003). Afghanistan Post Conflict Environmental Assessment. Switzerland
[3] UNEP (2003). Afghanistan Post Conflict Environmental Assessment. Switzerland

Southern slopes of the Hindukush and flows South ward to Iran, the Kabul orginates in the South Eastern Hindukush and flows South through Kabul towards Pakistan and the Amu Darya originates on the Northern slopes of the Hindukush and from Wahkhan and shares its resources with the Central Asian states (Tajikistan , Uzbekistan and Turkmenistan).

Groundwater is usually abundant in quaternary aquifers along major rivers where infiltration of surface water is high. Russian studies estimated total groundwater resources in Northern Afghanistan at 49 cubic meters per second, or 1.5 billion cubic meters per year.

3.3 Demography and ethnic composition

There are no reliable data about population figures. Considering the national growth rate of 2.8%, by 2002 the total population was estimated to be 22 million, of which 1.5 million are nomads and around four millions are refugees or displaced persons.

Afghanistan is a country with around 20 distinct ethnic groups. The main ethnic groups are Pashtuns, Tajiks, Hazara, Turkmans, Uzbek, Baluch, Noorestani, and Pasha-i-. Of these the Pashtuns and Tajiks form the largest group of the country respectively. Each of these ethnic groups has its own language, of which only two languages (Pashtu and Dari) are officially used.

There are 34 provinces in Afghanistan, with Kabul as the largest province and the administrative capital. In 1998 illiteracy among women was 80 percent compared with 50 percent for men. Now because of high rate of enrolment, these figures might largely be declined. Afghanistan is a Muslim country with the majority of Suni and most of the remainder Shi-a-.

3.4 Agriculture

Over 80 percent of the population is dependent on the agricultural and livestock management sector[4].

Agricultural land is estimated to be 7.8 million hectare (12 percent of the total land area) of which 3.3 million ha is irrigated and 4.5 million ha is rain fed cropping. There is two farming systems exist:

- A mixed crop and livestock
- Migratory pastoral system

Wheat is the main staple food crop in Afghanistan cultivated by almost all farmers using both irrigated and rain fed land. All farming activities (farming areas and yields) are susceptible to seasonal conditions (availability of rainfall and irrigation water) shows the difference of wheat yields and areas between the years 2002 (drought year) and 2003 (year of sufficient precipitation).

On average, per capita consumption of wheat is 152 kg per year. It is estimated to be among the highest in the world.

Rice, Maize and Barley as the main cereal grains and some other high – value crops such as cumin, sesame, linseed, sugar cane, cotton and sugar beet are cultivated where appropriate.

It is to be noted that wheat, cereals and high – value crop production is largely focused on home and somewhat local markets consumption rather than export.

Opium poppy has bee cultivated from olden time in Afghanistan, but now (since 3 decades) because of war condition increased its production and became the largest opium producer of the world.

Afghanistan's economy is largely supported by sales of quality fresh and dry fruits. The main fruits and nuts such as grapes, mulberry, pomegranates, apples, apricots, cherry, almonds, walnuts and wild pistachio are found in Afghanistan.

According to FAO survey of the Horticulture sector the total orchards /vineyards areas by years 1996 and 2003 are shown around 109 900 and 79 800 hectare respectively. In the 1970s dried fruit, raisins and nut contributed more than 40 percent of the country's foreign exchange earnings, but recently because of prolonged war and conflict, the country has lost some of its former market niches. A wide variety of vegetables including potatoes and onions are cultivated throughout the country. The different varieties of melons are also famous.

[4] Technical Annex (2004). Securing Afghanistan's Future. Kabul Afghanistan.

3.5 Livestock

Afghanistan has been known for extensive livestock production since prehistoric times. Livestock used to be a major source of income in the country. According to the 2005 assessment of vulnerability, about 64% of the households in the country participates in livestock or poultry rearing. Income has been generated through sale of milk, milk products, live animal, wool etc.

It is to be noted that curlier about 35 % of all exports from Afghanistan were on account of livestock products. Presently, Afghanistan is meeting its requirements of livestock products through imports from various countries.

CHAPTER 4

LAND COVER AND BIODIVERSITY

The plant cover of Afghanistan has been influenced highly by diverse ecological conditions, ranging from barren deserts (sand dune areas), to sub-tropical regions to steppes (the most important grazing areas), to the river valleys (areas of tugai vegetation and cultivated fruit orchards), to the higher mountains including areas of semi desert[5].

Thus, the precipitation and altitude are the main factors resulting in the diversity of the country's flora. A limited part in the south east which belong to the sub- tropical zone, receive the impact of the Indian monsoons.[6]

The divers ecological conditions in Afghanistan have favored the establishment of a complex and varied floral compositions.

Groombridge (1992) give an estimate of 3500 species of vascular plants and 30-35% of endemic.

Some other estimation shows the number of plant species to be about 5000[7].

[5] Nancy (1991). Opportunity for Improved Environmental Management in Afghanistan. Switzerland.
[6] Breckle. W.S.(2007) Flora and Vegetation of Afghanistan. Germany
[7] Freitag, H (1971). Studies in the Natural Vegetation of Afghanistan. Germany

CHAPTER 5

IN SITU CONSERVATION OF PLANT GENETIC RESOURCES

Due to the last three decades of war condition coupled with a six year long drought the agriculture sector in Afghanistan has been greatly damaged and that way its products have decreased by 50 percent (US Bereau of the Census, 1998). To compensate for this loss, rural people have started to utilize the free natural resources. Smuggling of timber deliberate burning of forests, overgrazing, cutting of woodland, uprooting of medicinal plants and conversion of rangeland to rain-fed cropping became the daily business of the people. This is an excessive removal or extermination of some species indigenous or endemic to Afghanistan. The coniferous and Oak forest in the south east, and pistachio forests in the north which covered 1.3 million (FGP1971) and 450 000 ha of land (UNCCD Report, 2006) decreased by 50%) and 50-70 percent respectively (UNEP2002).

Vegetation of deserts, steppes and mountainous areas, covering 70 percent of the total land area, because of extraordinarily strong exploitation decreased by 45 percent (UNCCD 2006). If the situation continues in the same way, Afghanistan will lose some of its valuable wild plant genetic resources in the near future.[8] In their natural habitat even now the following plant species are endangered:

1. *Cedrus deodara*
2. *Taxus baccata,*
3. *Pistcia vera*,
4. *Pinus gerardiana,*
5. *Glycyrrhiza globra*,
6. *Ferula asafetida,*
7. *Carum carviet*.

Prior to the war some of these wild tree species such as pistacia vera and Pinus gerardiana stands were consciously protected because their seeds were used by the local people but even exported in remarkable quantities.

In the late 1970s, due to the food requirements, Afghanistan was almost self-sufficient. This country has imported only 2500 tons of improved seeds for research purposes. There were several agricultural research stations in the different agro ecological zones, which provided farmers with high- yielding and disease resistance varieties of seeds and saplings. During the civil war, there already existed eleven research stations and gene bank, where about 1770 samples were stored and these have been completely looted. Nothing of the farmer research programs remained. In addition; in that time there has been greater interest to protect forest, wetlands and habitat rich in biodiversity. Some habitat of particular importance have been selected and proposed as protected areas/ nature reserves.

Some steps forward have been taken to be officially recognized, but because of political instability and social disorders through those years this work could not be completed. Recently once again some sites designated as national parks/ protected areas, aiming conservation biology (*in situ* conservation of plant genetic resources). The ecological characteristic of these sites are summarized as fallows.[9]

- **Big Pamir:** gazette as protected area/ nature reserve.This is a mountainous area with many glaciers and lakes, covering an area of 67 938 ha. It supports alpine vegetation such as different species of the family of *Ericaceae*, many grasses and an outstanding vegetation of *Premula marcophyla*.
- **Ab-i- Estada:** a large lake of 27 000 ha. It is surrounded by arid highland steppes, which are dominated by vegetation of A*mygdalis spp, Cousinia spp, Tamarix spp and Artemisia* spp.
- **Ajar Valley:** Proposed as National Park/Nature reserve, covering an area of 40 000 ha. This valley support different vegetation of *Salix spp*, *Tamarix spp*, Herbaceous plants, *Ephedra spp, Zygophylum, Acantholimon steppe*, and *Carex stenophylla* meadows communities. This is an important grazing area for ibex and urial.

[8] Naseri, Gh, N. (2003) Natural Woodland and Forest of Afghanistan. Kabul, Afghanistan
[9] FAO (1981) National Parks and Wildlife Management Afghanistan. Rome, Italy

- **Bande Amir:** Designated as National Park. A chine of 6 lakes, interconnected by calcium carbonate dams, occupies an area of 41 000 ha. Its surrounding area have vegetation of *Salix spp, Mentha longifolia, Acantholimon community, Tulipa spp, Alliums pp, Gagea spp*,and *Ranunculus* sp.
- **Hamun-i- Puzak:** Designated as Nature Reserve, large permanent lake, in the flat Seistan basin, covering an area of 35 000ha. The lake is covered with reed beds (*Phrogmites australis*) and algae, which is used by a large number of migratory waterfowl. In its surrounding areas different vegetation of *Artemisia* and *Tamarix* occur.
- **Nurestan:** Designated as National Park/Nature Reserve. This is a mountainous area with elevation up to 6 300 m, supporting various plant species of *Juglans, Betula, Quercus, Cedrus, Pinus, Juniperus* and Alpine shrub land.
- **Dashte Nawar:** Designated as Flamingo and waterfowl sanctuary/Nature Reserve. It covers and area of 7 500 ha. The plain is covered with a highland steppe, rich in grasses such as *Bromus, Puccinellia, Aeluropus, Herbaceus* plant and *Acanthelimon* community (G*laux maritima, Crypsis aculeate,Polygonum sibericum)*. The lake itself has a dense cover of algae.

Selection of these areas was based on uniqueness, richness in species and type of ecosystems etc. the environment law (gazette-2007) support the establishment of protected areas for conservation of genetic resources.

It should be noted that a number of crops used in Afghanistan include a range of primitive varieties, which yield less, but are adaptable to the harsh ecological condition of the country. *In situ* conservation (National parks) means that they may provide valuable material for the genetic improvement of their subsequent generation.

Some plant species whose wild ancestors are found in Afghanistan are *pistacia spp, pyrus spp, Malus spp, prunus spp, Amygdalis spp* and cereals- *Triticum , Oryza* etc. These species grow in different places and are in the state of extinction. It is foreseen that the National Parks and Reserves will save all varieties (fruits, nuts, cereals and important genotypes of wild plants species), which have medicinal, nutritious and economical worth. Furthermore in the rural areas many of these wild plant species are cooked and used for eating.

The Ministry of Agriculture, Irrigation and Livestock (MAIL) manage the above mentioned national parks and natural reserves. It is foreseen that the management of some national parks and nature reserves such as Big Pamir, Dara –e- Ajar, Band-e- Amir and Norestan will be assisted by an International Agency called Wild Life Conservation Society (WCS).

The Perennial Horticulture Development Project (PHDP) which is funded by the European Union began the germ plasm collection programmed in July 2006, with a review of location of germ plasm resources. The objectives of the programme are collection of varieties of fruits and nuts that are produced by commercial nurseries in the country. The objective of the program is :

- The preservation, promotion and the use of the most relevant local genotypes,
- Reducing the risk of erosion by establishing *in situ* collection (original sites of the plant) and *ex situ* collection or field gene bank.

In situ collection covering all the most important fruit growing areas such as Kabul, Herat, Kandahar, Balkh and Nangrahar Provinces.

It is to be noted that the registration of *In situ* fruit trees – vines is executed by PHDP staff and managed by the farmers.

Additional varieties imported by various organizations have also been added to the collection. Based on the principle that the suitable genotypes should be collected, resulted in the field registration of 840 *in situ* accession (Table-4)

TABLE 4

Varieties and accession in the *in situ* collection

Species	Number of accession registered with *in situ* collection	Number of unique varieties registered with *in situ* collection
Almond	104	42
Apple	64	51
Apricot	140	60
Cherry	25	20
Citron	3	1
Fig	6	4
Grape	142	96
Lemon	6	2

Species	Number of accession registered with *in situ* collection	Number of unique varieties registered with *in situ* collection
Lime	2	2
Loquat	6	2
Mandarin	4	2
Mulberry	7	6
Orange	29	15
Peach	96	60
Pear	23	20
Persimmon	14	13
Plum	95	59
Pomegranate	48	32
Rough lemon	1	1
Sour cherry	14	5

Source: PHDP, 2008

The origin of trees, included in the *in situ* collection is generally unknown, but the varieties imported by the different organizations (exotic varieties) are estimated as follows:

- Grape 10%,
- Almond 10%,
- Apple 36%,
- Apricot 7%,
- Peach 11%,
- Cherry 25%,
- Pear 26%,
- Persimmon 26%,
- Sour cherry 21%,
- Plum 74%,
- Citrus 100%.

(source: Horticulture Dep., 2008)

CHAPTER 6

EX SITU CONSERVATION

Prior to the initiation of conflict a variety development and improvement was maintained within the Ministry of Agriculture, in the AARI. In that time all experimental work was conducted on a chain of 21 research stations, located in various regions of the country. Multiple - location test was conducted. On the government research forms and in trials, imported varieties, existing varieties and landraces were compared under different conditions, many through the work of outstanding specialists, involved in the Ministry Research Dep. Breeding programs on the major crops included screening of introduced varieties, local landraces and breeding programs. Breeding work included selection and crossing activities.

Between 1964-1970 and 1970-1976 government of Afghanistan has started to conduct collection and conservation of Afghanistan local varieties of cereals, vegetables and legumes. At that time around 1770 samples were collected and conserved, which because of social disorder have been looted and destroyed completely.

To restore conservation of plant genetic resources imitative in 2002, when Afghanistan obtained somewhat political stability, ICARDA brought together 74 experts from 34 organizations at a meeting in Uzbekestan. The result was the creation of the Future Harvest Consortium to Rebuild Agriculture in Afghanistan (FHCRAA). Beside the consortium some other agencies or also contributed in crop production, the activity of which will be described as follows:

6.1 Contribution of International Agencies towards Plant Genetic Resource Management

6.1.1 ICARDA/CONSORTIUM Projects

The main objectives of the consortium were:

1. Multiply and promote the use of quality seed varieties.
2. Develop a system sustainable agricultural production.
3. Building the capacity of farmers through awareness raising programs and establishment of experimental plots of improved verities.

To achieve these activities the following steps have been taken:

- In April 2002 the consortium provided 3 500 tons of improved wheat seed and distributed among 70 000 farmers in need.
- The consortium has organized collection trips to collect seed, landraces and wild relatives of important crop species. Some 60 almonds, 47 pistachios, 14 pomegranates and 16 melon samples where collected.
- Several international nurseries were established for testing yield, drought and disease resistance in a variety of crops. ICARDA produced 171 771 fruit saplings and 13 134 non-fruit sapling in four research stations- Kabul, Baghlan, Takhar, and Kundus provinces for distributing to farmers in the area.
- Around 354 771 grafted saplings of different fruit threes have been produced and distributed to farmers for the establishment of orchards.
- In 2003, experimental plots of wheat, barley, chickpea, lentils, been, tomato, onion, and paper were harvested for the first time in many years.
- To ensure that marketed seeds are of desirable quality, ICARDA one of the members of the consortium has established, three seed quality testing laboratories in Kabul, Heart and Nangrahar and several satellite testing stations in Kunduz Mazar and Baghlan provices. Parallel to that a number of metrology stations were installed in six provinces and metrology Dep. staff were trained. ICARDA distributed paddy, mung bean, flac,sesame, chickpea, tentil, and vetch to farmers.

- The consortium through ICARDA staff provided training in seed production for farmers in different provinces and contracted them to produce their own seed for fall distribution (2002). The program featured interviews with farmers and extension people and provided information technologies for improved agricultural production. Farmers, who identify closely with the program have been selected for project implementation. A rigorous control program, which included field inspection, removal of off-type plants, post harvest treatment and proper packaging techniques.
- Based on above mentioned program, Afghan farmers produced around 5 000 tons of wheat seed, which was distributed to 90 000 farmers in 11 provinces. These seeds yielded more than 100 000 tons in 2003.

ICARDA rebuilt five agricultural research stations in five provinces such as Kabul, Baghlan, Kunduz, Takhar and Nangrahar. The stations develop and evaluate new crop genotypes for distribution throughout the region.

- In 2005, ICARDA established 95 orchards in Northern Afghanistan.
- The FHCRAA started to repatriate a part of the already looted seed from duplicate collection around the world. So far seed samples of 41 barley, landraces and 250 Kg seed of cereals and legume have been sent back to Afghanistan.
- Preserved in the gene bank of the consortium members of CGIAR is shown in table 5.

TABLE 5
Germplasm preserved in the gene bank of consortium members

Centers	Crop collection	Numbers of accessions
CIAT	Beans	73
CIMMYT	Maize, wheat	21
ICARDA	Genetic resources collection Wheat, barley, lentil, chickpea forage legumes.	2 217
ICRISAT	Chickpea, small millets, sorghum	723
IITA	Genetic resources collection	77
ILRI	Genetic resources collection	23
IRRI	Rice collection	69

Source: Afghanistan and ICARDA, 2005

Other projects of ICARDA are:

- Rebuilding Agricultural Market Project.
- Demonstrating new Technology in Farmers Field.
- Development of Village Based Enterprises.
- Clean Seed Production, Multiplication and Marketing for Increased Potato Production in Afghanistan.
- Strengthening Seed System for Food Security.
- Community Based Research on Agricultural Development.
- Human Resource Development.

6.1.2 Joint projects on maintaining genetic diversity

Some other agencies are also active in maintaining genetic diversity through provision and distribution of relevant germplasm. Their collaborative efforts are summarized as fallows:

- Maintaining genetic diversity through acquisition and distribution of relevant germplasm.
- Testing and release of verities through NUYTs (National Experience).
- Joint planning and monitoring.
- Crop improvement and management research.

Through these programs, the following germplasms have been obtained and evaluated (table 6).

TABLE 6
Germplasm obtained and distributed during:

SOURCE	Number of Trails/Nurseries				
	2002-03	2003-04	2004-05	2005-06	2006-07
CIMMYT	24	34	58	41	29
TURKEY/CIMMYT/ICARDA	12	9	18	15	15
TURKEY (NATIONAL)	2				
IRAN/PAKISTAN	3	3	4		6
PYT*, AYT* and NUT*					35
TOTAL	41	46	80	56	85

Source: CIMMUT, Presentation 2007

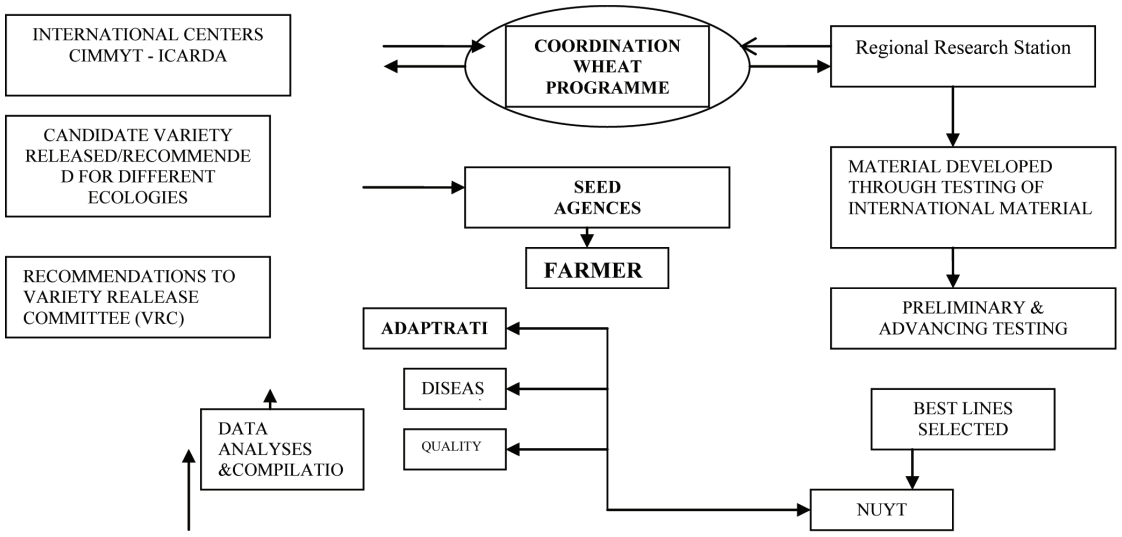
* PYT Preliminary Experience

AUT Advanced Experience

NUT National Experience

Mechanism of wheat germplasm flow is given below:

MECHANISM OF WHEAT GERMPLASM FLOW



Note: the germplasm is from the collections maintained by the above mentioned collaborators.

6.1.3 Conservation of Germplasm in national and foreign organization

The genetic variation of Afghanistan is well known, therefore many botanical expedition teams from different countries have been arrived and tried to keep and conserve the collected accessions. Table 7 shows number of common accessions conserved in national and international organization.

TABLE 7
Wheat germplasm conserved in foreign organization:

Country	National organization		Russia	USA	Australia	Japan
	ICARDA	CIMMYT				
Number of accession conserved	902		1 721	1 510	3 620	517

Source: www.icarda.org

6.1.4 FAO Crop Production and Seed Industry Development

Beside various involvement FAO have also program of crop production and seed industry in Afghanistan[10].

Since 1996 FAO has reinitiated a seed and crop improvement programme to develop high yielding varieties in order to mitigate the destructive effects of war and drought, its task were to:

- Select suitable crop variety testing location.
- Conducted variety trials at different centers.
- Select proper experimental designs for trails.
- Analyze the experimental data and interpret the results.
- Purity existing and new varieties through pure line selection.
- Collect and conserve germplasm.
- Evolution and release of varieties.

Under this programme, FAO has released 29 new varieties of crops (17 wheat, seven food legumes, three rice, tow barely) , which are adapted to the country's agro-ecological conditions. The location and centers of the trials where in Baghlan , Balkh, Kunduz , Ghazni , Jalalabad, Herat and Kandahar provinces. FAO could produce annually up to 10 000 tons of Quality Declared Seed. In 2003 – 2005 almost 50% of wheat production areas where sown with new varieties.

FAO assisted the MAIL in finalization of a national seed policy, which was adopted in 2005 and is now in force.

4.1.5 PHDP Perennial Horticulture Development Project

The PHDP collected bud wood of peach, plums, almonds and apricots in Sep. 2007, and budded numbers of trees with each accession. In that time some Citrus species were also budded with new varieties from Italy. Cutting of grape, fig and pomegranate accession were collected in 2007/8, and apples, pears and cherries were budded in 2008. Table 8 and 9 shows success of budding, number of available sapling and clone multiplied.

TABLE 8
Average number of available saplings per clone*

Percentage success budding rooting							
Plum on almond	75	62	81	47	72	X	70
Plum on apricot	69	X	X	46	X	85	70
Total plum	69	62	81	46	72	85	70
Apricot	52	58	73	48	65	89	70
Almond	56	50	83	32	64	82	61
Peach	52	83	56	55	47	94	56
Fig	X	X	X	20	X	44	32
Pomegranate	46	X	X	X	X	65	55
Grape	X	X	X	X	55	X	53
Grape rootstocks	X	23	X	X	X	52	38
Average	55	55	73	40	61	73	54

[10] FAO (2006). FAO Afghanistan brief. FAO Afghanistan

Final available saplings							
Plum on almond	262	2 200	1 294	283	5 301	0	9 340
Plum on apricot	5 057	0	0	292	0	1 468	6 817
Plum	5 319	2 200	1 294	575	5 301	1 498	16 157
Apricot	2 184	1 318	6 913	1 404	9 761	1 240	22 820
Almond	7 728	1 661	6 663	752	969	395	18 168
Peach	1 101	1 681	1 259	2 378	2 490	309	9 218
Fig	0	0	0	29	0	64	93
Pomegranate	484	0	0	0	0	579	1 063
Grape	0	0	0	0	1 649	1 115	2 764
Grape rootstocks	0	59	0	0	0	131	190
Total	**16 816**	**6 919**	**16 129**	**5 138**	**20 170**	**5 301**	**70 473**

Average unumber of available saplings per clone							
Plum on almond	19	85	324	40	151		619
Plum on apricot	297			42		113	452
Total plum	313	85	324	82	151	113	178
Apricot	156	32	266	128	287	124	165
Almond	594	59	333	40	138	33	200
Peach	110	88	140	183	78	28	105
Fig	X	X	X	5	X	6	6
Pomegranate	11	X	X	X	X	13	12
Grape	X	X	X	X	12	9	11
Grape rootstocks	X	12		X	X	26	19
Average	**168**	**58**	**273**	**92**	**88**	**23**	**117**

Source*: PHDP 2008

TABLE 9

Clone multiplication programme 2007-2008 (excluding citrus)

	PHD Center						Total/Average
SPECIES	**JAL**	**KAB**	**KUN**	**MAZ**	**HER**	**KAN**	
Total number of clones multiplied							
Plum on almond	14	26	4	7	35	0	86
Plum on apricot	17	0	0	7	0	13	37
Total plum	17	26	4	7	35	13	102
Apricot	14	41	26	11	34	10	136
Almond	13	28	20	19	7	12	99
Peach	10	19	9	13	32	11	94
Fig	0	0	0	6	0	10	10
Pomegranate	46	0	0	0	0	46	46
Grape	0	0	0	0	134	121	136
Grape rootstocks	0	5	0	0	0	5	5
Total	**100**	**119**	**59**	**56**	**242**	**228**	**628**
Total seedlings graftted							
Plum on almond	350	3 550	1 600	600	7 327	0	13 427
Plum on apricot	7332	0	0	640	0	1 730	9 702
Total plum	7682	3 550	1 600	1 240	7 327	1 730	23 129

SPECIES	PHD Center						Total/Average
	JAL	KAB	KUN	MAZ	HER	KAN	
Almond	13 903	3 300	8 030	2 380	1 509	480	29 602
Peach	2 089	2 037	2 250	4 350	5 264	330	16 329
Total	**27 883**	**11 179**	**21 380**	**10 920**	**29 047**	**3 940**	**101 891**
Total cuttings to root							
Fig	0	0	0	146	0	147	293
Pomegranate	1 050	0	0	0	0	890	1 940
Grape	0	0	0	0	2 987	2 227	5 214
Grape rootstocks	0	255	0	0	0	250	505
Total	**1 050**	**255**	**0**	**146**	**2 987**	**3 514**	**7 952**

6.1.6 Botanical Garden Project (*Ex situ* Conservation)

As mentioned above Afghanistan has undergone a great deal of unrest and civil war over the past three decades. In this time overgrazing, over- exploitation of forests and wood lands and subsequently soil erosion has reached partially irreversible stages. Flora of the country which was estimated between 3 000-5 000 species of vascular plants with about one- fourth endemics (partially important for food and agriculture), face genetic erosion. Lack of information makes it difficult to monitor the state of erosion in these species.

As Afghanistan is now on crossroad of political stability and this will help to develop sustainable agriculture system as well as a system of conservation of high biodiversity and mountainous vegetation. To realize it, in 2008 establishment of a botanic garden is anticipated. The master plans for establishment of botanic garden in Paghaman district and Kabul University have been prepared and finalized by International center for Integrated Mountain Development Agency (ICIMOD). The main parts of this project will be implemented in the course of the coming 10 years. The most important objectives are:[11]

- Conservation (*ex situ*)
- Preservation and maintenance of endangered and useful gene pools. In the process of *ex situ* collection priority will be given to those plants which are at the state of threat and extinction.
- Plant species having economic values (food crops, medicinal plant) will be introduced, acclimatized ad conserved. Environmental education, skill development and scientific researches are alls included in the master plan of proposed Botanic Gardens.

[11] Malla.K.J.(2008) Medicinal Plant Garden in Kabul University

CHAPTER 7

USES FOR COLLECTION

Utilization program of conservation accessions has not been conducted, although the conserved tree cuttings will be grown as mother trees for propagation and cultivation. As from the beginning of 2009, the PHDP will distribute trees derived from the individual exemplar trees in *in situ* collection (other wise known as clones) to registered mother stock nursery growers. These trees will form the basis of a certification system that guarantees trees that are true to type and of known origin are supplied to the orchard or vine yard grower.

At 2009 the PHDP will establish demonstration orchards either itself or in conjunction with its partners, using the clones obtained from the original exemplar trees. The performance of the outstanding clones will be demonstrated and subsequently will be used for propagation and cultivation. Eventually, it is expected that the grower will concentrate on a limited number of varieties. The variety collection will still maintain the genetic diversity and offer opportunities to plant breeders to find plant showing the traits that might be needed in the future. Several international nurseries were planted for testing yield, drought, and cold and disease tolerance in a variety of crops. This program will identify adapted germplasm for Afghanistan varied agro-ecological zones. Demonstration plots are also used for the same purpose.

CHAPTER 8

THE STATE OF NATIONAL PROGRAM, TRAINING AND REGISTRATION

There is not any national program of genetic resource conservation, however it is planted to restore germplasm conservation program. In 2005 MAIL publicized national seed policy of Afghanistan. It focuses on administration system (national seed committee, variety release committee), crop and seed research (priority crops, variety development, testing, registration, and control and farmers rights), seed production (seed multiplication system seed maintenance and supply), seed quality control, seed distribution and seed sector development.

Government will look for introduction of new research development, training courses and publications. If these opportunities are lacking locally, government will rely on the assistance of its partners.

It is believed that the policy will provide the enabling environment for sustaining and enhancing growth of the Afghanistan seed industry.

CHAPTER 9

THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

The ministry of agriculture irrigation and livestock has different programs of international collaboration for genetic resource conservation and utilization. FAO, ICARDA, JICA, RAMP, FHCRAA, CIMMYT and PHDP are the main agencies active in plant genetic resource management in Afghanistan.

CHAPTER 10

ACCESS TO PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE, SHARING OF BENEFITS ARISING OUT OF THEIR USE AND FARMERS' RIGHTS

The item 10.5 of the national seed policy states that the government will consult with institutional credit agencies with a view to encouraging crop production credit for farmers. When farmers have access to adequate credit, patronage for improved seed is enhanced thus promoting the growth of the seed industry availability of credit for seed industry firms will be also facilitated.

The policy/strategy framework for the rehabilitation and development of the agriculture and natural resource management of Afghanistan and community based forestry and rangeland policy and strategy recognize protection the traditional knowledge of community (farmers) relevant to plant protection and management and the right to participate in sharing benefits arising from the utilization of plant genetic resources. The community right to participate and making decisions is the main objectives of the above mentioned policy/strategy.

CHAPTER 11

THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

The food security is one of the great challenges faces Afghanistan. The government of Afghanistan is trying to create a system for plant genetic resources for food and agriculture management. Many national and international agencies have been conducting such as PHDP, FAO, CIMMYT, and ICARDA, JICA, RAMP etc.