SYRIA:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCE

(Leipzig, 1996)

Damascus, 1995

Note by FAO

This Country Report has been prepared by the national authorities in the context of the preparatory process for the FAO International Technical Conference on Plant Genetic Resources, Leipzig, Germany, 17-23 June 1996.

The Report is being made available by FAO as requested by the International Technical Conference. However, the report is solely the responsibility of the national authorities. The information in this report has not been verified by FAO, and the opinions expressed do not necessarily represent the views or policy of FAO.

The designations employed and the presentation of the material and maps in this document do not imply the expression of any option whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Table of Contents

CHAPTER 1
Status of the Plant Genetic Resources in Syria

The Syrian Arab Republic is located in the Mediterranean region between longitude 35° and 42° and latitude 32° and 37°. It is bordered by Turkey to the north, Iraq to the east, the Mediterranean and Lebanon to the west and Jordan and Palestine to the south.

It has a population of 12 million (according to the statistics of 1990). Its surface area is 185,000 km^2. Geographically, it is divided into four areas, namely:

1. The coastal area: encompassed between the Mediterranean and the Coastal Mountains Range. It is plain, fertile and rich in terms of agriculture. It is about 180 km long.
2. The mountainous area: contains mountains and hills extending from the north to the south along the coastal line of the Mediterranean. Such mountains vary in altitude:
   - **a.** The coastal mountains: 1,539 m ,
   - **b.** Al Arab Mountain (Sweda, South Syria): 1,800 m,
   - **c.** El Sheikh Mountain (west Damascus): 2,814 m,
   - **d.** Kalamoun Mountains (north Damascus): 1,884 m,
   - **e.** Tadmor Mountains (steppe): 1,406 m and
   - **f.** Sinjar mountain (Hasakeh, north-east Syria):1,460 m.
3. The Inland or the plain area: contains the plains of Jezireh (north-east Syria), Aleppo, Homs, Hama, Damascus and Dara'. This area lies east of the mountainous area.
4. The steppe: It is plain and located to the east of the inland plains. It is very dry.
   - **a.** This area is good, with moderate rainfall: It has an area of 2,698,000 ha, and makes up 14.6% of the total area of Syria. Its annual average rainfall ranges between 350-600 mm. It may reach up to 800 mm/year in the coastal area, and more than 1000 mm/year in the mountains and the coastal high-elevated areas. This area is located to the west Syria and contains the coastal plains and mountains, Al Malkieh in (north-east Syria), the mountainous area to the west of Damascus stretching

from the Lebanese borders and Jabal Al Arab area to the south of Syria. This area grows wheat, food legumes, summer crops and fruit tree. Natural forests are found in the mountainous area in this region.

b. The Moderate-rainfall area: Its surface area is 2,473,000 ha, and makes up 13.4% of the total area of Syria. Its annual average rainfall ranges between 250-350 mm. It stretches over a strip in the inland area plains surrounding the high-rainfall area towards the inland.Wheat, barley, food legumes and forage legumes are grown in this area as well as some fruit trees particularly olives and vines when supplemental irrigation is provided.

c. The Little-rainfall area: its area is 1,306,000 ha making up 7.1% of the total area of Syria. Barley, wheat and forage legumes are grown in this area. Annual average rainfall is about 250 mm. Agriculture in this area is risky due to the scarcity of rainfall and the frequent drought spells. This area is located to the east or to the south of the moderate-rainfall area.

d. The Dry Area: its area is 1,823,000 ha, and makes up 9.8% of the total area of Syria. It is only good for barley cultivation, or is left as permanent pastures. Its annual average rainfall ranges between 200-250 mm.

e. The very Dry Area(the steppe): Its surface area is 10,218,000 ha and makes up 55.1% of the total area of Syria. It is only used for permanent grazing due to the scarcity of its annual rainfall which range between 150 - 200 mm. The government is implementing projects aiming at the rehabilitation of the degraded vegetation due to over-grazing, through sowing pasture seeds, planting pasture bushes and digging wells to water the sheep flocks.

Land use in Syria is as follows (statistics of 1991)

- The arable area: 5,045,000 ha making up 32,6% of the area of Syria.
- The cultivated area: 5,554,000 ha making up 29,9% of the total area of Syria.
- The irrigated area: 906,000 ha making up 16,3% of the cultivated area.
- The rainfed area: 4,215,000 ha making up 75,9% of the cultivated land.
- The rangelands: 8,059,000 ha making up 43,5 of the total area of Syria.
- Forests: 655,000 ha making up 3,5% of the total area of Syria.

Syria is of limited water resources. Water resources are as follows:

46 billion m^3(rainfall), 30 billion m^3 (rivers), 2 billion m^3 (springs) and 3 billion m^3 (underground water).

To a large degree, Syria depends on rainfall in its non-sedimentary agriculture either in terms of the annual rainfall or each one season. The government is making great efforts to build dams to impound the available water in winter (the rainfall season) to utilize it for irrigation in summer. At present the number of dams is 95 with storage capacity of 15378 million m^3.

The following table gives an idea of the annual rainfall averages (mm):

The Coastal Area	The Mountainous Area	The inland Area	The Steppe
Lattkaia: 674 Tartous: 776 Banias: 619	Hifeh: 880 Wadi Ouyoun: 1,194 Misyaf: 929 Zabadani: 377 Sweda: 326 Salkhad: 349	Homs: 367 Hama: 337 Idleb: 489 Aleppo: 315 Ariha: 460 Ezzra: 248 Nawa: 410 Dirbaseih: 322 Amouda: 389 Kamishly: 382	Nabek: 108 Douma: 198 Damascus: 174 Palmyra: 126 Riqa: 179 Deir Ezzor: 143 Bu Kamal: 128

There is a number of artificial lakes used for agricultural and irrigation purposes, the most important of which are Al Assad Lake (area 674 km2), Al Baath lake (km2) and Kittina Lake (61 km2). Such efforts aim to avoid the irregular and frequent drought spells, which cause big losses to the farmers and livestock due to shortage of pasture. Such projects will alleviate the pressure on rangelands and indirectly reduce their degradation.

1.1 PROFILE OF THE CLIMATE AND SOILS IN SYRIA

In terms of geology, Syria is located on a piece o different kinds of calcareous rocks, where very old calcareous rocks spread to the western part, while they become more recent to the east. Some Basalt lava dating from modern ages are scattered in the north, west and south.

The climate in Syria is characterized by cold and rainy winter and hot and dry summers (the Mediterranean climate). Rainfall distribution greatly vary. While it reaches more than 1000 mm/year in the coastal area, it becomes 500-600 mm/year on its eastern valleys and 400-500 mm/year in the inland and the eastern valleys and 300-400 mm/year in the middle of these valleys to the east. It is gradually reduced to become less than 200 mm/year in the very dry plains of the steppe. Rains fall usually during November, December, January and February (late autumn, winter and early spring). Some rains fall in October, March and

April. In winter, temperature reaches -5°C and down to -10°C in some areas for short periods. Normal range of temperature in winter is within 5° - 10°C, and in summer 25°C - 30°C. In some areas it may reach up to 40°C.

The impact of rainfall is clearly manifested on the plant distribution. In the mountainous areas coniferae and oak trees and some foliar trees dominate. In the remaining parts of the country such trees do not exist, and weeds, bushes and some thorny plants prevail.

In general, Syrian lands are divided into the following:

- The Wet Area: The annual rainfall in this area is more than 800 mm. It is divided into two sub-groups:
    - Calcareous Soils: Called the red Mediterranean soil. It covers the most part of the coastal mountainous areas and the coastal valley. Such soil is brown and has a high level of calcium carbonates with little organic content (about 2%) with basic interaction.
    - Volcanic Soil: This soil is found in some parts of the coastal mountains stretching from the southern part of Safita to Homs, and over the green rocks scattered in the northern part of Lattakia. It is also found in Qunetra area and some parts of Banyas and Tartous. Such soils are called the Red mediterranean Soil. It is dark brown in color, and may be close to black. Almost free from calcium carbonates; its pH is almost equivalent. In the high-rainfall areas, it may become acidic with little organic rate (1.5- 3%).
- Semi-wet Area: Usually located to the east of the wet area. It is bounded to the west by the Coastal Mountain Ranges and ends to the east by an illusory line passing though Homs and Hama, and stretches to the north up to Tourous mountains. There is also another semi-wet area situated in the extreme north-east of Syria (Ras Al Batta). These soils are yellowish brown, brown or dark brown in color depending on the quantity of rainfall. They contain different rates of calcium carbonates, either originated from calcareous or volcanic rocks, with basic pH and little organic matter content.
- Semi-Arid Area: This area stretches along a narrow strip from southern to northern Syria passing through the eastern part of Homs and Hama. This strip curves near Aleppo up to Meskaneh, then stretches to the east. The color of the soil in this area is reddish brown or light brown, containing calcium carbonates. Its interaction is basic and the organic matter is little.
- Dry Area: It forms the lands of the Syrian steppe. It is very stony and its color is light brown. Its sand rate is has and have high rate of calcium carbonates.

- Gypseferous Lands: They spread sparsely in the dry area. The mother rock is gypsiferous. Its color is light due to the high rate of gypsum and calcium carbonates.

1.2 SYRIAN AGRICULTURAL PRODUCTION

The share of the agricultural production in Syria is about 20% of the value of the national product. The agricultural sector has witnessed great developments over the past few years due to the high attention given to agriculture with the aim of providing self-sufficiency and a surplus for exportation. The following table shows the production of the most important crops in Syria.

Crop	Production (1000 tons)		Area (1000 ha)	
	1985	1992	1985	1992
Wheat	1,714	3,045	1,265	1,380
Cotton	487	640	170	200
Barley	740	1,091	1,387	2,277
Chick pea	50	74	79	82
Lentil	48	75	22	88
Sugar beet	412	1,375	15	20
Maize	80	215	68	47
Potato	284	412	18	24
Tomato	778	418	40	40
Vine	482	462	110	109
Citrus	93	318	9	25
Apple	125	270	53	32
Olive	175	519	296	415

Population growth rate in Syria is more than 3% /year, which is a high rate and requires actual agricultural development to meet the needs of such high figure. Syria does not have industrial or other resources to meet the needs of foodstuff and clothing to this growing number of people. Boosting agricultural and live-stock production has become an imperative. Since the natural resources in Syria are rather limited, particularly the availability of water which is the limiting factor in the eastern regions of the Mediterranean in general. It is feared that such resources are depleted, particularly the underground water, soil and the plant cover. The concept of sustainable development is quite clear and under-stood by the agricultural planners and decision-makers. There is still contradic-tions, and the real challenge facing the agricultural development in Syria is to maintain the annual growth required for the agricultural production on one hand, and on the other, to preserve the environment and vegetation from degra-dation and extinction which have already started some years ago. The dangerous stage has started to unveil by comparing the diversity and intensity of the plant

cover between the steppe and the mountains, which prevailed over the past twenty years and at present. International cooperation with the developing countries in this field is of great importance, particularly Syria which is an important center of the origin of plant species especially wheat and barley. Studies and research show that Syria is one of the principal habitats of the following species; *Triticum boeoticum, Triticum dicoccoides, Triticum turgidum, Triticum durum, Triticum turaricum, Triticum polorricum, Triticum aestivum, Triticum monococcum and Hordeum Sp.*

In addition to many feed and forage legume species. Which are invaluable fortunes. Maintaining and utilizing such species require national and international efforts.

1.3 PRESENT STATUS OF THE PLANT GENETIC RESOURCES

Plant genetic resources in Syria is vulnerable to degradation due to:

1. The spread of cultivation to new areas and the need to grow economic crops, particularly cereals, forage and food legumes.
2. The expansion of barley cultivation to the dry and very dry (steppe) areas and the surrounding areas has led to the deterioration and the removal of vegetation, and which will result in soil the erosion of the soil. All this is taking place in spite of the measures enforced by the government to prevent such cultivations, and deter the transgressors. At the present, laws are enacted to prevent cultivation in the steppe in order to maintain the vegetation.
3. Increasing the pressure on the steppe because of its limited area, frequent droughts and the surrounding dry areas. Presently, the number of sheep in Syria exceed 12 million heads. This number is exceeds the grazing capacity in the steppe.
4. Logging. The Bedouins cut the wood trees and bushes to use them as source of energy (cooking and heating). One can rarely see pistachio trees which were present in the steppe till the early century.
5. The use of cars and tractors by the Bedouins and abandoning camels and other farming animals. Such vehicles have contributed, with their speed, heaviness and easy movement, to destroy the upper layer of the soil, and loosened it to small particles. They also partly contributed to the degradation of vegetation which accelerates desertification in many parts of the steppe.

6 Setting fire illegally to some parts of the forests to establish in their place orchards of fruit trees. It is to be taken into account that the Syrian laws impose heavy and deterrent penalties on those who burn the forests or remove them with the purpose of utilizing the land to plant fruit trees.

7 The spread of goats in the mountainous areas has contributed to the destruction of its trees.

8 Forest fires which are set un-deliberately.

Awareness of the importance of the environment and maintaining the cover plant and forests in Syria is growing by both the official departments and individuals. Many legislations and laws have been enacted which impose various penalties on transgressors, which are very sever in cases like setting fire to forests. The population pressure and the need for plant and animal products have become real problems. Practically, there is a conflict, as in other countries, between agriculture and grazing as human activities to provide food and meet the economic needs of the population on one hand, and the limited natural resources under such dry natural circumstances, where the need for water, green matter and feed is urgent, on the other.

The governmental and official departments as well as other people organizations and syndicates raise the awareness on protecting the environment in general, and the preserving the vegetation in particular. Such departments try to help the inhabitants of the steppe dig wells and provide educational and medical services in addition to providing water and electricity to them, and to rely on the wetter areas to provide feed to alleviate the pressure on the steppe, which requires further technical efforts, and investing more money in these endangered areas to protect them. Many official departments have potential solutions, but all need large amounts of money and technical skills more than those presently available for effective implementation. Afforestation campaigns in the bare mountainous areas and the burnt forests, re-sowing pasture plants, plantation of forage bushes, planting palm trees and oases and establishing natural reserves in the steppe carried out by the ministry of Agriculture and Agrarian Reform and the Higher Council for Afforestation as planned. It seems, however, that the need for more investment is imperative.

Practically, the Ministry of Agriculture and Agrarian Reform, through its directorates in the provinces along with the Directorate of Scientific agricultural Research, the Steppe Directorate, the Soils Directorate and the Directorate of Irrigation and Water Use are conducting studies and research in order to come up with solutions to the existing problems.

It seems that the following are required:

1. To provide feed from the high-rainfall areas to alleviate the pressure on the steppe.
2. To provide fuel sources (solar energy - gas) to replace logging of trees and bushes in the steppe.
3. To enforce the laws which prevent the cultivation of the steppe as well as the Forests Protection Laws, and find a mechanism for closer control.
4. To establish reserves in the steppe and forest areas.
5. To provide fire extinguishing equipment in the forests, road building, communication and control systems as well as water cisterns to irrigate plantations.
6. Provide more financial and technical support to conduct further scientific and socio-economic studies to forest areas and the steppe in the aim of maintaining and developing the plant species there.

Therefore, the concerned departments in the Ministry of Agriculture and Agrarian Reform conduct the required studies (even implement some of them) to combat desertification, rehabilitate on the vegetation, rationalize water use and transfer the suitable agricultural technology to the dry areas and to establish forest and pasture nurseries.

Presently, there are 13 nurseries in the steppe producing about 9 million plantations annually. There are also seven seed production centers. Fifty tons of such seeds are broadcast annually over an area of 2000 ha. Sand dune-fixing projects are being implemented in 3 sites over an area of 600 ha, in which about 863,000 pasture plantations and 65,000 forest plantations were planted . Four oases on the Damascus-Deir Ezzor high-way were established over an area of 225 ha, in which 57,000 forest and fruit plantations were established. 123 wells were dug in the steppe to provide water to the inhabitants of the steppe and their flocks. 28 natural reserves were established in different parts of the steppe over more than 50,000 ha where forage plants are being preserved.

25-30 million plantations are annually produced to re-habilitate the burnt forests and to increase the area of forests in the suitable areas.

The Directorate of Scientific Agricultural Research of the Ministry of Agriculture and Agrarian Reform is exerting great efforts in collecting, evaluating and maintaining plant genetic resources.

Currently, there are about 8,750 accessions kept in the cold stores of the Genetic Resources Unit of Directorate of Scientific Agricultural Research. They are as follows:

Accession	Quantity
Wild wheat (*Triticum sp, Aegilops sp*)	855
Wild barley (*Hordeum spontaneum*)	176
Wild wheat (*Avena sp.*)	5
Different species of wild food and feed forage	1,350
Wild vegetables	15
Cultivated wheat (*Triticum sp.*)	115
Cultivated barley (*Hordeum vulgare*)	665
Lentils (*Lens esculentus*)	580
Chick peas (*Cicer arietinum*)	257
Faba bean (*Vicia faba*)	186
Biter vetch (*Vicia ervilia*)	52
Common vetch (*Vicia sativa*)	58
Chickling vetch (*Lathyrus sativus*)	85
Maize (*Zea mays*)	205
Cultivated vegetables	1,720
Safflower (*Carthamus*)	27
Sesame (*Sesamum indicum*)	24
Sunflower (*Helianthus annus*)	120
Sorghum (*Sorghum vulgar*)	50
brooms (*Sorghum*)	70
Different crops	100

Some of these samples have duplicates held in the following institutions and centers

1. The International Center for Agricultural Research in the Dry Areas (ICARDA)
2. Wales Port Center for the Preservation of Vegetable Seeds, England.
3. Crop Research Institute, St. Petersburg, Russia.

The Genetic Resources Unit exchange samples with various countries.

In addition, *in situ* gene banks of fruit trees (commercial cultivars and landraces) are grown in the Agricultural Research Centers as follows:

1.4 LOCAL PLANT VARIETIES

Field Crops

Wheat

- Hourani, Hamari, Jidouri, Zedi, Gharbi, Joulani, Jabali and Siklawi.
- Baladi (local): These varieties are durum, heat and drought tolerant and disease resistant. Their seeds have excellent technological characteristics for pasta making.
- Nab El Jamal : A Heat and drought tolerant variety. Have excellent technological characteristics. It belongs to the species *T. polorricum.*
- Bayadi: *T. durum*. Drought, poor soil and calcareous deficiency resistant with many shoots.
- Yabroudi: Of T. durum. Frost-resistant.

Barley

- Arabi Abyad and Arabi Aswad: Two resistant varieties to drought heat and poor soil. Its hay is of excellent palatability quality.

Lentil

- Hourani Ahmar: Drought-resistant, small-seeded with red cotyledon.
- Kurdi: Drought-resistant, large-seeded with creme cotyledon.

There are also different local maize, chickpea, faba bean, vetch and chickling varieties .

Vegetables

There are local varieties of tomato, cucumber, pepper, marrow, garlic and onion etc.. They have excellent characteristics, but are not high-producing varieties compared with the commercial ones.

Fruit Trees

- Apple: There are 8 local varieties.
- Pear: There are 3 local varieties.
- Pistachios: There are 11 local varieties.

- Apricot: There are various local varieties.
- Plum: There are 3 local varieties.
- Cherry: There is one local variety.
- Almond: There are 4 local varieties.
- Olive: There are 16 local varieties.
- Peanut: There are different varieties.
- Pomegranate: There are 4 varsities.
- Fig: There are more than 5 local varieties.
- Vine: There are 13 local varieties.
- Quinces: There are 4 local varieties.

The local varieties of crops, vegetables and fruit trees are of high importance. Research work has been conducted to transfer their genes to the commercial varieties for the following characteristics:

1. Drought and heat-resistance, and the good technological characteristics of the crops.
2. The good taste of the vegetables and fruit trees.

In addition to some other characteristics specific to certain varieties such as calcareous, diseases or pests resistance.

Therefore, it is of high importance to conduct detailed studies to define their characteristics and utilize them in plant breeding programs. Almost all these varieties are threatened to become extinct, particularly wheat, vegetables and fruit trees. As indicated above, there are no clear policies to protect them from the competition of commercial varieties, either those locally developed (wheat, barley, lentil and chickpea) or introduced (vegetables and fruit trees).

CHAPTER 2
National Activities on Genetic Resources Preservation

The Directorate of Scientific Agricultural Research, the Steppe Directorate and the Directorate of Forestation have plans to establish natural reserves of wild genetic resources of crops, pasture and forests:

- The Directorate of Scientific Agricultural Research has *in situ* 15 gene banks of fruit trees (local landraces and exotic varieties). It has also a natural reserve in Aleppo (the Agricultural Research Center, Yahmoul) established in collaboration with ICARDA to preserve crops genetic resources. Plans are underway to establish two other reserves at Serghaya Research Center (near Damascus), and Sweda Research Center for the conservation of crop genetic resources in 1996.
- The Steppe Directorate has 28 natural reserves in the steppe. Average area of each reserve is 3,000 ha. They aim to protect the genetic resources of forage crops and to re-habilitate vegetation through preservation , artificial seeding and plantation.
- The Forestation Directorate has the following reserves:

1. Jabal Abdel Aziz reserve at Hasakeh province (4,220 ha) which aims to preserve wild pistachio from becoming extinct, restore the ecological balance and to re-habilitate vegetation.
2. Jaziret Al Thawra Reserve, Reqa (590 ha) to re-habilitate the plant cover and introduce forest species.
3. Cedar and Fir Reserve at Slenfeh/Lattakia (1,350 ha) to preserve the existing forest species from becoming extinct, particularly, cedar, fir and coniferae.

The Directorate of Scientific Agricultural Research has a medium-term cooling store, (90 m^3 , temperature 0 - 4°C and humidity 45-55%) It has been working since 1987 with technical assistance from IBPGR.

It also has a new mid-term cooling store whose building was completed in 195 (108 m^3, temperature 0-4°C, and humidity 25-35%). Plants are underway to equip a long-term cooling store (60 m^3), within the context of a project to establish a new genetic resources financed by the Ministry of Agriculture and Agrarian

Reform. The Syrian genebank holds seeds of 8,750 accessions (whose details have been mentioned earlier in this report). The most important holdings of this bank are probably cereals wild species (wheat) and wheat, barley, chickpea, lentil and maize landraces. These accessions are being renovated in accordance with annual plans. Such accessions are evaluated. Landraces are given special importance in order to provide them to plant breeders in Syria.

Although collection missions have been implemented on regular basis since 1970s, there is a need to conduct more collection missions and further studies on such accessions environmental stresses such as drought, heat and salinity.

All preserved accessions are documented and registered on special cards. Documentation is computerized. Large numbers of accessions of different cultivated crops have been evaluated as follows:

Species	No. of Evaluated Accessions
Cultivated wheat	100
Cultivated barley	500
Cultivated Vegetables	700
Wheat	300
Maize	200
Wild Forages	30
Food legumes	500
Forage legumes	150
Oats	12
Sesame	20
Safflower	25
Sunflower	90
Peanuts	60

The Genetic Resources Unit will soon publish a catalogue of the samples evaluated in line with the international descriptors. Evaluation is conducted under the supervision of agricultural engineers, experienced in plant breeding and genetics. Most often evaluation is carried out at the Scientific Agricultural Research Center in Ezzra, (southern Syria, annual average rainfall 330 mm) for drought resistance trait in cereals, food and forage legumes and maize.

Evaluation of the wild genetic resources is carried out in a plastic house in collaboration with ICARDA. Evaluation of the cultivated irrigated crops is carried out at the Irrigated Agricultural Research Center. Isolation of cross-pollinated crops is also considered.

CHAPTER 3
Utilization of Plant Genetic Resources in Syria

The relationship between the genetic resources and specialists the plant breeders to utilize the genetic resources (often landraces) is ever developing. Those two groups working in the Directorate of Scientific Agricultural Research are always advised to develop such relationship for better utilization of local varieties of crops, since these local varieties are plant populations, each of which comprise dozens of pure races.

Wheat, barley chickpea, lentil and maize breeders are annually supplied with samples of pure races resulting from local varieties after conducting preliminary evaluations, particularly or drought resistance by the Genetic Resources unit. Plant breeders are annually supplied with 20-30 accessions of the above-mentioned crops to be used in plant breeding programmes.

The Genetic Resources Unit also propagates the accessions to renovate them once every many years. There are no special multiplication programmes to export certain crops. The Directorate of Scientific Agricultural Research has plant breeding programmes of wheat, barley, chickpea, lentil and faba bean, using the different breeding methods:

- Introducing exotic cultivars from ICARDA, CIMMYT and other countries.
- Introducing isolated generations from ICARDA and CIMMYT.
- Crossing of wheat and barley conducted in Syria.
- Inducing artificial mutants in wheat, barley, chickpea and soya beans.

Plant breeding programmes give special importance to traits such as drought resistance, earliness, disease resistance and high yielding.

As a result of breeding work since early 1970s, 12 wheat varieties, 3 barley, 3 chickpea, 1 lentil, 2 maize and one faba bean have been released.

Plant breeding work at the stations and centers of the Directorate of Scientific Agricultural Research. Neither foreign companies nor the private sector conduct plant breeding activities in Syria. There is, however, close collaboration with

ICARDA and ACSAD in developing the above varieties. Plant breeders also collaborate closely with farmers to conduct on-farm trials under the different farmers conditions before officially releasing such varieties.

Those new varieties helped boost the yield per unit area. There is a good demand on them by farmers who easily obtain their seeds from the General Organization of Seed Multiplication (GOSM), whose branches are spread in different provinces. GOSM has an economic nature and is related to the Ministry of Agriculture and Agrarian Reform.

The Steppe Directorate obtains its pasture seeds from the steppe, and the Directorate of Forestation obtains seeds from forest trees which are collected by skilled workers. Such directorates have their own plantations production nurseries which are distributed to farmers for plantation. They also plant these plantations annually in accordance with annual plants.

As mentioned earlier, the relationship between the genetic resources programmes, and the plant breeding programmes should develop for the following reasons.

1 Syria has a set of crops, vegetables and fruit trees landraces with excellent traits, particularly drought resistance and high quality. Such characteristics must be utilized, and some of their genes must be transferred to the new commercial varieties.

2 In Syria, there are sets of pasture wild plants and wild genetic resources of cereals and legumes with high drought or salinity resistance, and are palatable to animals.

Therefore, it is imperative to take the following measures into consideration.

1. The required agronomic evaluation on the components of the local varieties and pure landraces (productivity, drought-resistance, salinity-resistance, heat-resistance and the chemical components etc..) should be conducted.
2. To introduced these landraces to the plant breeding programmes.
3. To adopt the genetic resources methods to utilize the characteristics of such varieties and the wild genetic resources.
4. To adopt tissue-culture methods to accelerate the propagation of trees and bushes.

In order to fulfill this objective, the technical potentialities should be met, particularly, making skilled personnel available through providing training courses, academic fellowships and establishing laboratories for genetic engineering and tissue culture.

CHAPTER 4
National Objectives, Policies, Programmes and Legislation of the Genetic Resources

The Genetic Resources Unit of the Directorate of Scientific Agricultural Research of the Ministry of Agriculture and Agrarian Reform, is the official department mandated to implement the different genetic resources activities. A plan is underway to re-structure this unit so that to become an independent section in the directorate when the skilled staff become available. The necessary building for this unit has been completed now, in spite of some shortages in equipment which are not available in the local market. There are other plant genetic resources activities conducted by other parties, namely:

The Horticulture Department of the Directorate of Scientific Agricultural Research: This Department supervises the collections of fruit trees genetic (landraces and commercial varieties) present at the agricultural research centers in different provinces (information about such reserves and the numbers of varieties they hold have been mentioned earlier in this report). The Department holds weed and seed samples of different medicinal, indoor and aromatic plants existing in Syria.

The Directorate of the Steppe of the Ministry of Agriculture and Agrarian Reform: Studies on the forage plant species distribution in the Syrian steppe are being conducted. Studies on the evaluation of such species are also conducted for feeding traits (feeding value and palatability) and degradation rate of such species. The Directorate annually conducts plans for the re-habilitation of vegetation in the Syrian steppe through of seeding, plantation and pastures protection.

The Directorate of Forestation of the Ministry of Agriculture and Agrarian Reform: This Directorate conducts studies on the distribution of forest trees and their species in Syria and their degradation rate. It also propagates such species and have them planted in the deteriorate forest areas due to over-grazing, fires and soil erosion. The private sector conducts no activities whatsoever in genetic resources. The popular and official awareness is growing, and all demand to pay due attention to the issues of the environment and vegetation. However, some individuals play negative role in destroying the plant cover, despite the severe laws in force, by cultivating parts of the Syrian steppe to barley or by arson in some parts of the forests to plant fruit trees instead.

The Directorate of statistics and Planning of the Ministry of Agriculture and Agrarian Reform coordinates the efforts of such directorates, and allocates the required budgets from the general budget of the Ministry of Agriculture and Agrarian Reform. The director of each of the above directorates (agricultural research, the steppe and forestation), in collaboration with the head of the departments, develop the annual technical plans. Costs of implementation are spent from the budgets allocated to each directorate.

The aim of the genetic resources activities conducted by the Ministry of Agriculture and Agrarian Reform:

- To study the existing plant genetic resources (species, species distribution, agronomic, pasture and environmental evaluation of such species and the evaluation of the deterioration rate of such species).
- To re-habilitate the plant cover by plantation, seeding and afforestation.
- To protect the vegetation by enacting the necessary laws (there are already sever laws to protect the forests from acts such as arson and logging. There are also laws protecting the vegetation of the steppe from cultivation so that no to be vulnerable to erosion and desertification).
- To establish natural reserves of forests (in the mountains), pasture (in the steppe) and wild genetic resources and landraces of different crops (in the agricultural zones).
- To utilize the wild genetic resources and landraces in plant breeding programmes.
- To maintain and improve the local landraces and utilize their genetic characteristics.

Fulfilling such objectives faces funding and technical difficulties. The needed machinery and the trained and qualified personnel are not yet available, despite the courses (mostly short-term) provided by ICARDA, ACSAD and IPGRI. The current personnel working in the genetic resources unit are agricultural engineers without specific specialization. As indicated earlier, they received some training in ICARDA and ACSAD. Through their personal efforts and interaction with ICARDA scientists in the collecting missions they developed their scientific skills the main task is to collect and evaluate landraces of the different crops and collect wild genetic resources propagate and maintain them in mid-term cooling store till potentialities to utilize them become available. Such accessions are documented on the computer, and plant breeders are supplied with plant of specific characteristics such as drought-resistance, earliness etc.

Since in-house training capacities are limited, two appendixes have been developed in this report showing the needs of the genetic resources programs for external training courses as well as academic fellowships.

There are laws restricting the entry of exotic germplasm to Syria. They should be examined by the Seed Health Laboratory (to ensure that they are free from diseases). This laboratory is related to the Directorate of Agriculture and Agrarian. There are no complicated measures or banning on sending plant genetic resources abroad.

It is necessary to utilize the genetic characteristics of the landraces. There is no support to grow a particular landrace. Some of them seem more appropriate than other introduced variety to be grown in Syria, particularly barley, vetch, chickling, chickpea and lentils. Landraces and local varieties seem better and more resistant to drought conditions and they give the highest yields. Their is no encouragement on the part of the government not to grow the local varieties seem better and more resistant to drought conditions and they give the highest yields. Their is no encouragement on the part of the government not to grow the local varieties. The decision is in the hands of the farmer, and many farmers still grow the old local varieties.

The General Organization of Seed Multiplication propagates seeds of the good local varieties or those developed by the Syrian research centers and get them distributed to farmers. Farmers also multiply and grow some self-crossed varieties, particularly barley, chickpea, lentil, vetch chickling and maize. In fact, those local varieties are plant populations. Each variety contains many pure landraces. There is a big scope to select high-yielding plants or have certain characteristics. Most of the vegetable crops are imported, and Syrian has excellent olives, apricots, vine varieties.

CHAPTER 5
International Collaboration on Genetic Resources

The Ministry of Agriculture and Agrarian Reform supports the exchange of genetic resources and landraces with different countries, institutions and international and regional scientific centers. The Ministry of Agriculture has signed scientific collaboration agreements with many with many ministries of agriculture in other countries under which genetic resources, landraces and plant varieties can be exchanged.

Syria has also signed the agreement on the establishment of the International Plant Genetic Resources Institute (IPGRI) in 1993. The Genetic Resources unit of the Directorate of Scientific Agricultural Research usually responds to the requests submitted by others centers to obtain samples of the Syrian germplasm. This Unit has already sent more than 200 samples comprising wild genetic resources and land races of some crops and vegetables to Hungary, USA, Japan, France, Italy and Russia. The Unit has also received about 130 samples from the USA, Egypt, Hungary, Japan, Italy, Iran, Australia, Greece, Cyprus and Pakistan.

Many projects have been implemented to collect and maintain genetic resources in collaboration with various international organizations, namely

1. The Regional Project on Genetic Resources in collaboration with IBPGR from 1974-1984. Through this project, the Genetic Resources Unit was established, and equipped with storage, maintenance and collecting facilities.
2. Collection and Maintenance of Wild Genetic the Vegetables Project from 1985-1990 in collaboration with IBPGR in which about 800 samples of local wild and cultivated vegetable varieties were collected.
3. Collecting and Monitoring Wild Germplasm and landraces of legume and forage crops in 1986, in collaboration with ICARDA and Southampton university, England, where 1100 samples of faba bean, lentil, chickpea, vetch and chickling were collected and maintained. 600 wild weed accessions of such species of such specie were prepared.

4 Collection and Maintenance of the Cultivated Species in collaboration with IPGRI Regional WANA Office from 1993-1995. 380 local vegetable accessions were evaluated at research centers. This project has provided the opportunity to have external training in stored seed physiology.

5 The Syrian Genetic Resources Unit has been collaborating with ICARDA since 1987 on the collection, maintenance, identification and evaluation of different wild genetic resources and landraces of different crops (cereals; food legumes; forage legumes). ICARDA provides training courses; most of which are short-term. Genetic resources are widely exchanged annually between the Genetic Resources Unit and ICARDA.

The International Vegetables Center, Wales born, England, presently holds 600 accessions of the Syrian local landraces of vegetables sent during 1986-1988. Eighty accessions of cereals and vegetables are also held at Vavilov Institute in 1987.

It is not worthy to mention the role played by IBPGR in establishing the Syrian Genetic Resources Unit, and ICARDA's role in extending technical assistance for collecting wild genetic resources and provide training opportunities.

Yet, there are possibilities to further develop collaboration, particularly with ICARDA and IPGRI Regional WANA Office. The Syrian government has established, with entire local funding, a new genetic resources unit at the headquarters of the Directorate of Scientific Agricultural Research, Douma (near Damascus) comprising offices, different laboratories, and a mid-term cooling store in addition to the existing one). A long-term cooling store will be provided whenever capabilities are available.

Therefore, there is possibility to develop collaboration. We should focus on the following points.

- Provide long-term training opportunities in different fields of genetic resources.
- Provide academic postgraduate fellowships (M.Sc. and Ph.D.). In genetic resources.
- Provide some of the equipment required by the Syrian Genetic resources unit which are not available in the local markets.

CHAPTER 6
The Syrian National Needs

The Ministry of Agriculture and Agrarian Reform conducts the following projects Which need technical and financial support

6.1 TO STRENGTHEN THE CAPABILITIES OF MINISTRY OF AGRICULTURE AND AGRARIAN REFORM (DIRECTORATE OF SCIENTIFIC AGRICULTURAL RESEARCH) ON THE COLLECTION, MAINTENANCE AND EVALUATION OF GENETIC RESOURCES OF CROPS, FRUITS TREES, VEGETABLES, MEDICINAL AND AROMATIC PLANTS.

Justifications of the project

The Ministry of Agriculture intends to continue the study of the genetic resources existing in Syria, which started in the mid 1970 s. The national program has mad considerable success in this field. It collected, evaluated and maintained about 8.000 accessions of landraces and wild genetic resources. There are still certain points which need further study and follow up, especially to complete the collection of the genetic resources of various field crops, fruit trees and vegetables. It is also required to cover the whole Syrian areas, and evaluate all the already collected accessions and these which will be collected, and to utilize them in plant breeding programs. In situ conservation is also required, since much of these species are threatened to become extinct.

Objectives of the projects

- To cover all areas in Syria Through surveys and collecting mission of genetic resources.
- To identify and evaluate the Syrian genetic resources.
- To store the collected genetic resources in mid and log - term cooling stores.
- To utilize the genetic resources in plant breeding Programs.
- To establish in situ reserves for fruit trees and forests.

Period of the project: 5 years

Initial budget of the project: US$ 3 millions.

Components of the project

- The conduct long term training courses on genetic resources for 5 persons.
- To provide 5 post graduate fellowships (M.Sc. and Ph.D.) on genetic resources.
- To establish 4 fruit trees reserves.
- To establish 3 genetic reserves of crops and medicinal and aromatic plants.
- To establish a genetic reserve of forest trees at Kasab, Lattakia.
- To set up a greenhouse to propagate the genetic resources.
- To provide equipment and transport means to the newly established genetic resources in Damascus.
- To provide different field equipment to serve the reserves and *in situ* reserves.
- To provide a long -term cooling unit.
- To equip a genetic -cytological studies laboratory.

6.2 PROTECTING AND DEVELOPMENT OF THE PASTURE RESERVES IN THE SYRIAN STEPPE

Justifications of the project

The Syrian steppe suffers from the degradation of the plant cover. Many plant species are vulnerable to become extinct due to overgrazing, logging and the frequent dry years. Therefore, it is necessary to take the appropriate measures to solve this problem, including setting up *in situ* reserves. Since the Ministry of Agriculture and Agrarian Reform has already established 28 pasture reserves in different Parts of the steppe. Each reserve has an area of about 3000 ha. However, the available financial and technical potentialities do not allow to develop and increase these reserves in terms of number and area. Providing support to develop and protect such reserves will be the new orientation in solving the problems of the Syrian steppe. Even, It may introduce new and more effective concepts to the existing methods for protecting the Syrian steppe and rehabilitate its vegetation.

Project objectives

- To maintain the plant species endangered to become extinct in the very dry Syrian Steppe (the annual rainfall average is less than 200 mm). Those species are rare and highly resistant to drought and heat and have high grazing value. This can be achieved through equipping the 28 natural reserves spread throughout the steppe.
- To reseed the rare plant species or those which become instinct in some sites.
- To plant some fodder shrubs.
- To study the rehabilitation and dynamics of vegetation.

Components of the project

- To dig tranche to protect the present reserves and make earth barricades.
- To erect fences.
- To dig wells and build roads.
- To provide all the necessities to serve, follow-up and control the reserves, and to study the dynamics of vegetation rehabilitation.
- To provide field machinery: 5 bulldozers - 5 trucks - 10 tractors - 10 cistern vehicles 10 field vehicles.

Period of the project: 3 years.

Budget of the project: US$ 15 millions.

6.3 DEVELOPMENT OF CEDAR, FIR AND NATURAL FOREST RESERVES

Justifications of the project

At the top of the coastal mountains at altitude 1500 m, there is in Slenfch (Lattakia) a cedar and fir forest. those trees are threatened to become extinct as a result of human activities and transgressions. This is the only site in Suriaz where cedar

and fir exist. The Government makes big efforts to maintain these trees, but there is an urgent need to develop such efforts and allocate the required budget for that purpose.

Objectives of the project

- To protect the cedar and fir trees in Syria from becoming extinct.
- To introduce other rare species to the site such as black pine, Canari pine and Radyata pine.
- To make the reserve a nucleus to other forest reserves.
- To maintain other grass and tree plant species.

Period of the project: 3 years.

Budget of the project: US$ 2 millions.

Components of the project

- The appropriation of about 20 ha owned by the inhabitants of the area to be annexed to the State owned area of about 1000 ha.
- To erect a barbed wire fence along the reserve (23 km).
- To build control towers, a police station and offices.
- To provide transportation means, tractors, water cisterns and fire - extinguishing equipment.

6.4 ESTABLISHMENT OF A BIG PARK NEAR DAMASCUS

Justifications of the project

The different plant species, particularly forests and vegetation in the steppe and rangelands are vulnerable to degradation and extinction due to droughts, intensified agricultural and grazing activities and the lack of an appropriate ecological awareness. Such awareness must be raised by all means in order to maintain the genetic resources. Therefore, the establishment of a big plant park near Damascus will contribute to raising such ecological awareness by the people towards genetic resources. In addition, this park will be an *in situ* site to conserve the

different plant species. The park will also be a place where specialists, students and those interested can study these species, due to existing many scientific institutions and universities in Damascus.

Objectives of the project

- To raise the ecological awareness to the people.
- To maintain the genetic resources.
- To study the genetic resources (crops, indoor-plants, medicinal plants, fruit trees and forest trees).

Period of the project: 3 years.

Budget of the project: US$ 3 millions.

Components of the project

- To grow different genetic resources of crops, fruit and forest trees, medicinal, and aromatic plants over an area of 200 ha.
- To construct service buildings, offices and workshops.
- To dig wells and lay irrigation networks.

6.5 ESTABLISHING A GENETIC ENGINEERING LABORATORY

Objective of the project

- To utilize the genes present in the wild genetic resources and landraces, and transfer them to the commercial varieties, particularly those which possess drought, heat and salinity tolerance traits.

Components of the project

- To establish a laboratory near Damascus.
- To hold long-term training courses (10 persons).

- To provide post graduate fellowships to get M.Sc. and Ph.D. to work in the laboratory (10 persons).
- To provide the necessary equipment.

Period of the project: 3 years.

Budget of the project: US$ 4 millions.

CHAPTER 7
Proposals for the International Work Plan

7.1 AT THE NATIONAL LEVEL

The international community should offer technical and financial support to the Syrian efforts as follows:

1. To complete equipping the natural resources in the Syrian steppe.
2. To complete equipping the cedar and fir reserves at Slenfeh, Lattakia, located at the top of the coastal mountains in Syria.
3. To develop the Syrian agricultural research work on genetic resources in the following fields:
   - **a.** To train specialists.
   - **b.** To offer M.Sc.. and Ph.D.. fellowships.
   - **c.** To provide the newly established genetic resources in Syria with the required equipment and tools.
   - **d** To set up a greenhouse where temperature, humidity and light are controlled to grow the rare genetic resources.
4. To establish a plant breeding program with a view to utilize the genes of the wild crop genetic resources through transferring these genes to the commercial varieties, particularly those possessing drought, salinity and heat tolerance.
5. To establish a genetic engineering laboratory to utilize the genetic components of the wild genetic resources.

7.2 AT THE INTERNATIONAL LEVEL

1. The international community should assume its responsibilities through establishing a special fund for the following purposes.
   a. To provide the national agricultural research centers with the required training and grand fellowships for M.Sc. and Ph.D. studies.
   b. To support NARS by providing them with the required equipment.
2. The international scientific centers should focus their efforts on:
   - Developing varieties and landraces.
   - Transferring the appropriate genes from landraces and genetic resources to the commercial cultivars, particularly those possessing drought, heat and salinity tolerance, and as suit the dry areas in general.
   - Developing varieties of different crops that suit the environment of the developing countries.
3. To establish international gene bank which all countries can benefit from their holdings.
4. To include vegetables, fruit trees, cotton, sugar beet and other crops in the activities of the international centers. And establish international centers specialized in the genetic improvement of different field crops, fruit trees and vegetables.
5. To share the scientific information with NARS.
6. To conduct internationally funded regional mission to collect genetic resources in which the countries of the region take part.

APPENDIX 1
Equipment and Tools Required for the Newly Established Genetic Resources Unit

Description	Qty
1. Field transportation means (double-cabin, diesel car)	4
2. Electrophoresis system	1
3. Electronic seed counter	4
4. Weed samples dryer	2
5. Seed cleaner	3
6. Single spike thresher	4
7. Electric legume thresher	3
8. PC. with printer	2
9. Growth chamber	2
10. Binoculars	2
11. Microscope	2
12. Infra-red protein analysis system	1
13. Deep freezer	10
14. Long term cooling system for a chamber (5 x 4 x 3 m)	1

APPENDIX 2
Scholarships required for the Genetic Resources Activities in Syria

Title of Scholarship	N•	Degree	Place of study
1. Plant breeding (cereals, legumes, vegetables)	4	Ph.D.	Abroad
2. Taxonomy	3	Ph.D.	Abroad
3. Genetic Engineering	2	Ph.D.	Abroad
4. Pasture	2	Ph.D.	Abroad
5. Tissue culture	2	Ph.D.	Abroad
6. Genetics	2	Ph.D.	Abroad
7. Data Management	2	MSc	Abroad
8. Seed storing Management	2	MSc	Abroad
9. Medicinal and aromatic plants	2	MSc	Abroad
10. Seed pathology	2	MSc	Abroad

APPENDIX 3

Training courses Required for the Genetic Resources Activities in Syria

Title	N• of participants	Period	Place
1. Plant Taxonomy	4	6 months	Abroad
2. Genetic Resources collection	4	6 months	Abroad
3. Genetic Resources Evaluation (Cereals, Legumes, Vegetables)	4	On year	Abroad
4. Genetic Resources Documentation	2	6 Months	Abroad
5. Seed Health	2	6 Months	Abroad
6. Seed Storage	2	6 Months	Abroad
7. Plant Breeding (Cereals, Legumes, Vegetables)	4	One year	Abroad
8. Genetic Resources Programs Management	2	6 Months	Abroad