

National Report on the State of Plant Genetic Resources in Armenia

MINISTRY OF AGRICULTURE OF THE REPUBLIC OF ARMENIA

Y E R E V A N – 2008

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List of Acronyms and Abbreviations

Acronyms	Full name
ACIAR	Australian Centre for International Agricultural Research
CAC	Central Asia and the Caucasus
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CWR	Crop wild relatives
CHM	Clearing House Mechanism
GEF	Global Environmental Facilities
ICARDA	International Center for on Agricultural Researches in Dry Areas
MNP	Ministry of Nature Protection of the Republic of Armenia
MoA	Ministry of Agriculture of the Republic of Armenia
NAS	National Academy of Sciences
NBSAP	National Biodiversity Strategy and Action Plan
NSPA	Nature Specially Protected Area
PGR	Plant Genetic Resources
PGRFA	Plant Genetic Resources for food and agriculture
RA	Republic of Armenia
SC	Scientific Center
SNCO	State non –commercial organization
SNSPAAP	Strategy on the development of Natural Specially Protected Areas in Armenia» and Action Plan
UNEP	United Nations Environment Programme
USDA	United States Department of Agriculture
VIR	N.I.Vavilov Institute of Plant Industry, St. Petersburg, Russia
WB	World Bank

INTRODUCTION

1. General Information

- **Geographical Location and Borders**

The territory of Republic of Armenia is located in the verge of Southern Caucasus and Asia Minor, occupying about 10 percent of north-eastern part of Armenian plateau.

The territory of RA is situated between 35° 50" – 40° 15" of north latitude and 43° 27" – 46° 37" of eastern longitude. Armenia borders Georgia in the North, Azerbaijan in the East, Iran in the South and Turkey in the West.

- **Natural Climatic Conditions**

The republic of Armenia is a typical mountainous country. It has complicated geographical structure and various relief. The total space of the country is 29,740 square kilometers. The highest peak is Mount Aragatz (4090m above sea level) and the lowest point is the banks of Debed River (375m). Relative altitude fluctuates from 1500-2000 to 3700 meter. The average altitude of the territory is 1850 meters. Such altitudinal variation results in a great diversity in climates and landscapes.

Water resources of RA are quite limited. The largest lake is Lake Sevan, it's a natural source of drinking water for the region. Rivers are mountainous, small and shallow.

Armenia is characterized by mountainous continental climate, peculiar for its dryness. Average highest annual temperature is 14⁰, and the lowest is – 2,7⁰. The hottest average temperature is observed in July – August in Ararat valley and pre-mountain zone is 24⁰C – 26⁰C; in a mountain zones is 15⁰C – 20⁰C; in high altitude regions is 10⁰C – 15⁰C and lower.

Average lowest temperature in January fluctuates between -18,9⁰C and -3,1⁰C. The amount of annual precipitations on the territory of RA is about 600-1000mm. High altitude zoning is demonstrably obvious. In winter the long-lasting snows cover exists on 1300 m high mountain areas.

- **Population**

The population of Armenia is 3.2mln. people. Urban population is 2062,2 thousand, rural – 1148,2. 1112.0 people live in the capital.

- **Administrative units**

The administrative units of the republic are marzes and communities. Marzes consist of rural and urban communities. Armenia is divided into 11 marzes. The town of Yerevan has a status of a marz. There are 48 urban and 866 rural communities in the republic.

2. Brief Outline of Agriculture

The agro-food system is one of the most important sectors in the economy of the Republic of Armenia, contributing about 30% to GDP where the share of agriculture is about 17% (2007).

According to the last five years data the share of agriculture in gross domestic product comprised about 20%, which creates favorable conditions for the gradual increase of the level of the country's food security. These challenges are prior for the country's economic policy.

After declaration of independence (1991) the radical changes were taken, privatization policy was initiated. A market based economy system was formed, which at present includes about 340 000 private peasant farms, trade organizations, a great number of privately owned services, agricultural produce marketing and processing organizations. 71,7% of arable land, 78,3% of perennial, 48,4% of grassland has been privatized by farms. Now the prevailing (more than 98%) part of the agricultural gross product is produced by the private sector.

3. General Description of Plant Production Sector

About 40% of the territory of the republic is unfit for agriculture. According to 2007 land balance the used land types makes 2122,1 thousand ha including 452,1 thousand ha of arable lands, 29,6

thousand ha of perennials, 127,5 of grassland, 118,3 thousand ha of pastures and other (not cultivated) – 394,6 thousand ha (*Diagram 1.*).

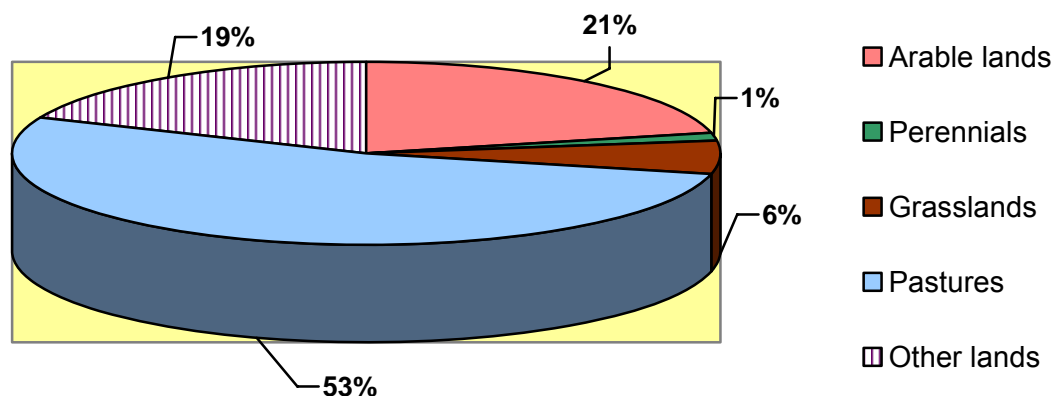


Diagram 1. Land resources of Armenia and their structure

Cultivated lands have been fragmented fractured into more than 1,2mln land plots. At present on average each farm has a share of 1,4 ha of land, including 1,1ha of arable lands.

Land partition of plant production structure is mainly conditioned by relative altitude of the area and temperature conditions. On the base of these factors three main agricultural zones are determined – Ararat Valley-up to 1200m, pre-mountain zone -1200-1800m and mountain zone – higher than 1800m. The space occupied by cultivated plants takes start from the lowest areas and spreads up to 2300-2400m high above the sea level.

In the conditions of the republic, taking into account the economic blockade of the country, cereal crops (wheat, barley, emmer wheat) are of strategic significance as the prior source of food security. At present they occupy a major part of the areas sown by agricultural crops. Winter wheat is the most spread one among cereals, which is conditioned by a more sustainable and higher yield comparing to other cereal crops (spring wheat, winter and spring barley, emmer wheat).

Potato is considered a second important crop in Armenia; its high food significance ensures high profitability as well.

Vegetable plants (tomato, egg-plant, cucumber, pepper, cabbage), grape and fruits (mainly apricot, apple, peach) are considered dominating and their production also serves as a raw material for processing. The assortment of vegetable crops is strictly differentiated according to vertical zoning. Thus, tomato, pepper, cucumber, egg-plant, early ripening cabbage are mainly cultivated in low-altitude zones; cabbage, partly carrot and radish – in mountain zones. As far as vegetable crops are concerned (melon, water-melon, squash), they are mainly cultivated in Ararat valley.

Fruit growing is the oldest and profitable branch of the country's agriculture. Various fruit species are cultivated in the republic – apricot, peach, plum, cherry, apple, pear, quince, nut, almond, fig, pomegranate, etc., eastern persimmon and kiwi – in the last years.

After land privatization the radical changes, threatening fruit and grape existence, occurred. Only 60% of vineyards and about 5% of fruit orchards kept their existence in post-soviet period. Instead of them the size of a land sown by cereal crops (especially wheat) 30% increased.

It is encouraging to note recently occurred changes. Analyzes of statistical data on sown lands of main cereal crops reveal (1998-2006) shrinking of cereal crop sown lands. Fruit orchards from 22 474ha (1999) increased to 38.0 thousand ha (2007) (*Diagram 2.*).

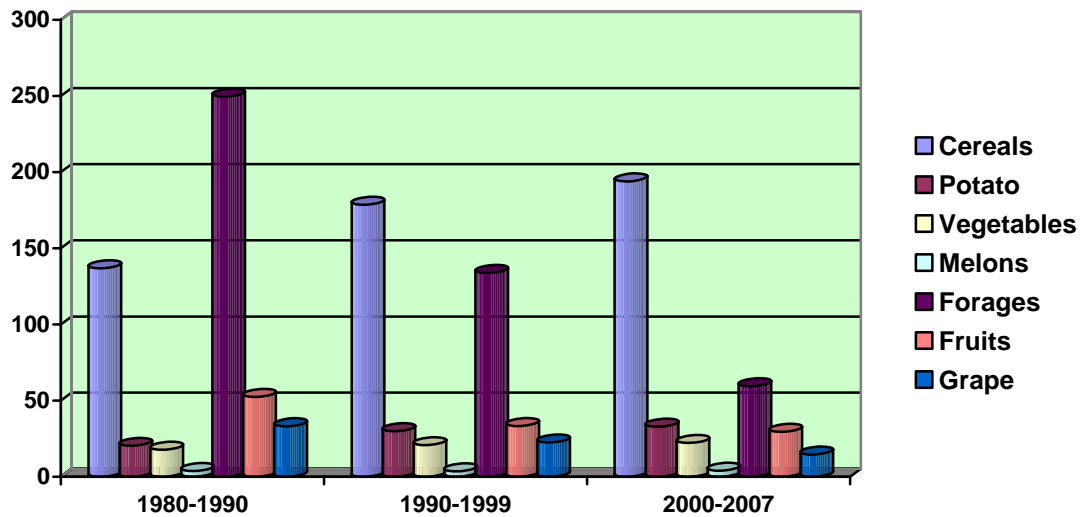


Diagram 2. Crops sown area (hectar)

As a rule crop productivity varies because of climate conditions fluctuations. Yield capacity is still low, conditioned by a number of factors, which include lacks in seed-production system, fertilizers and plant protection products insufficiency, wrong application of agrotechnical rules. Crop-rotation is not applied in practice, which led to reasons for the decrease of soil fertility and activation of soil surface washing processes. The RA government policy of recent years and the implementation of some important projects, such as land reclamation, development of irrigation system, watering of natural pastures, centralized pests control of agricultural crops, etc., enhanced positive tendencies in the field of cereal, potato, vegetable production and horticulture as well. The increase of gross yield of cereals, vegetables and potato has occurred mainly due to the increase of sown area. The growth rate of horticulture is conditioned by some intensive activities (*Diagram 3.*).

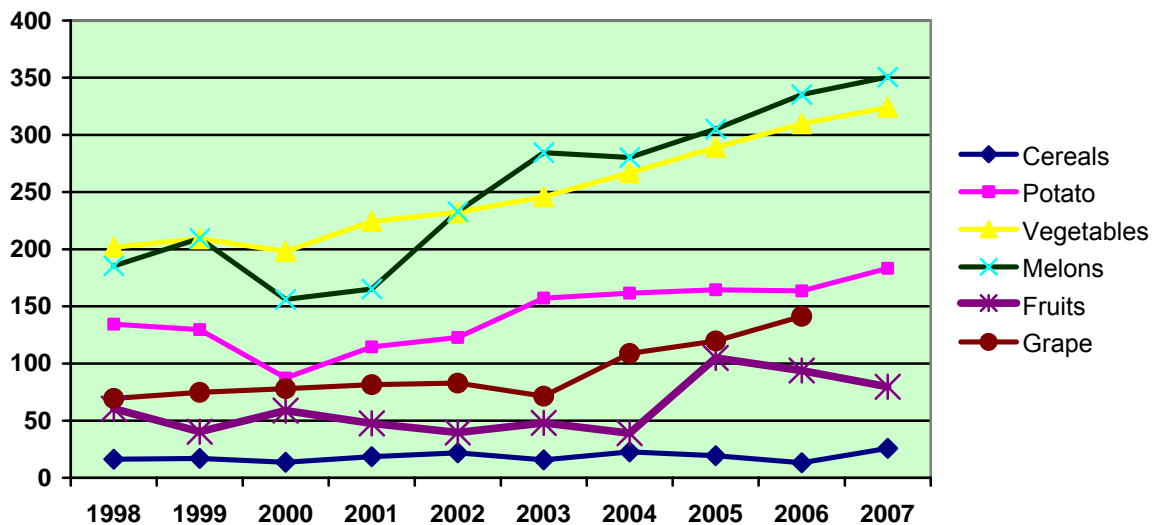


Diagram 3. Agricultural crops average yield in 1998-2007

Small sizes of agricultural plots and their fragmentation hamper the rapid development of agriculture. That restrict to the application of intensive technologies and running of profitable farming. Low level of intensification of agriculture, insufficient use of fertilizers and plant protection products, limited range of produced seeds of high reproduction impede rise of crops yield.

CHAPTER 1.

THE STATE OF BIODIVERSITY

1.1. Basic Main Value of the Plant Genetic Resources

Landscape diversity of Armenia and its relief peculiarities are a decisive factor for plant diversity. Almost the half of the entire flora of Caucuses and all main formations of the area are presented on a territory of about 30 000 km² (with the exception of subtropical vegetation. Armenian flora comprises about 3600 species of vascular plants, which makes about 50% of Caucasian flora.

Armenia is one of the centers of cultivated plants origin, which is proved by the fact that the age of Armenian ethno-botanical material should have been recorded since 8 millennium B.C. Armenia is famous for numerous species of cereals, vegetable-melons and oil-bearing plants, there is also a diversity of fruit crops (wheat, barley, rye, oat, pea, melon, water-melon, apricot, grapes, pomegranate, quince, etc.). According to the paleontological studies they have been cultivated in Armenia since the most ancient period. Plant genetic resources for food and agriculture are presented in the Republic by different plant species of economic value, crop wild relatives, old local varieties and wild edible plants. PGRFA is a valuable initial material in plant breeding, contributing to economical growth, national sovereignty and food security. At the same time PGRFA play a great role in maintenance of environmental balance.

However, some elements of agrobiodiversity are under the threat of extinction for the reasons of lack of awareness, increased human impact, climate changes, environmental disorders and other factors. Effective conservation of agrobiodiversity and sustainable use is a primary objective for Armenia as it intends to reinforce its economic power through sustainable development of agriculture.

The role of PGRFA, the significance of conservation and sustainable use is getting increasingly important. It is one of the most essential components in agricultural and environment protection policy.

1.2. Diversity Within and Between Crops

1.2.1. The State of Diversity of Major Crops

Agrobiodiversity of Armenia affords cereal crops, grain legumes, fodder crops, vegetable-melon and oil-bearing groups. *Poaceae* L. family, one of the most important for human use, is presented by 336 species and 106 genera.

Cereals group includes:

- ♦ 13 species and about 360 varieties of wheat. Wild one-grain, urartu and wild \square ujube species, growing in Armenia, are 3 out of 4 world famous wild wheat species which are characterized by large intra-specific diversity (about more than 110 varieties)
- ♦ *Aegilops* genus – presented by 9 species and a large intra-specific diversity
- ♦ rye (*Secale*)– presented by cultivated, field-weed and wild annual and wild biennial species
- ♦ barley (*Hordeum*) – presented by 8 wild species with high intra-specific diversity and by two-row, intermediate and multirow cultivated species
- ♦ oat (*Avena*) – 7 species are registered; it is not widely spread and cultivated in separate peasant farms
- ♦ millet (*Panicum*) – 2 species are found in wild nature. It is not cultivated in large scale
- ♦ sorghum (*Sorghum*) – 2 species are registered, cultivated in separate peasant farms
- ♦ maize (*Zea maize*) – local and imported species of modern breeding, are cultivated

in the conditions of the Republic of Armenia, taking into account the country's economic blockade, cereal crops (wheat, barley, emmer wheat) are of strategic importance as a primary source for food security. They occupy a prevailing part in the structure of areas sown by agricultural crops. Among

cereal crops winter wheat is one of the most spread out, which is conditioned by higher and more sustainable yield comparing to other crops (spring wheat, winter and spring barley, emmer wheat).

Grain legumes are presented by lentil, wild species of chick-pea and pea.

Fodder crops are presented by *Poaceae* and *Fabaceae* families growing in numerous species, ecotypes and forms. 346 plant species of *Fabaceae* family are registered in Armenia, among them meadow (*Lathyrus*) – 23 species, alfalfa (*Medicago*) – 14 species, sainfoin (*Onobrychis*) – 24 species, etc. Mainly aborigine species and forms are cultivated.

Vegetable-melons in Armenian flora are presented by numerous species of *Solanaceae*, *Brassicaceae*, *Liliaceae*, *Chenopodiaceae*, *Cucurbitaceae*, *Apiaceae*, *Asteraceae*, *Portulacaceae*, *Lamiaceae*, *Malvaceae* families.

The list of primarily significant for the country needs vegetable plants includes tomato, cabbage, cucumbers, bulb onion, egg-plant, pepper. They make 61, 9% of general vegetable plants. Besides the above-mentioned plants beet, carrot, garlic, vegetable marrow and green pea are also cultivated.

Vegetable crops are grown in almost all regions and their assortment changes according to vertical zoning. Thus, tomato, pepper, cucumber, egg-plant, early-ripening cabbage are mostly cultivated in low attitude zones, cabbage, partly carrot, beet and reddish are cultivated in mountainous zones. As regards melons, water-melon, melon, squash are mainly cultivated in Ararat valley.

In Armenia one part of largely spread vegetable-melons is presented by their wild relatives: beet, carrot, melon, onion, garlic, pieplant, asparagus, wild horse radish, artichoke and many leavy vegetables (prickly lettuce, spinach), spicy vegetable plants (coriander, curled «ujube», hoary cress, basil, wild mustard, bladdery pimpinella, mint, etc.) which are represented by different botanical species and ecotypes.

Oil-bearing plants are presented of cultivated and wild flax, glabrus fals flax, hemp, oriental poppy and many other species, ecotypes and forms.

Fruit-berries have wild spread in Armenian flora. Cultivated crops primarily belong to Rosacea family: pear (*Pyrus*) – 32 species, 12 of them are Armenian endemic plants; almond (*Amygdalus*) – 2 species, apple (*Malus*) – 1 specie, medlar (*Mespilus*) – 1 species, plums (*Prunus*) – 17 species, hawthorn (*Sorbus*) – 15 species. Besides, Armenian flora comprises pomegranate (*Punica granatum*), fig (*Ficus carica*), currant (*Ribes*) – 5 species, goose berries (*Grossularia reclinata*), date plum (*Diospyros lotus*), dogwood (*Cornus mas*), Elaeagnus (*Elaeagnus*) – 2 species, mulberry (*Morus*) – 2 species, grape (*Vitis sylvestris*) and others.

In Armenia flora the nuts is introduced mainly by walnut (*Juglans regia*), hazel (*Corylus avellana*, *C. columna*) and chestnut (*Castanea sativa*) species. The population uses also the fruits of beech (*Fagus orientalis*). Wild species of almond (*Amygdalus nairica*, *A. fenzliana*, *A. urartu*) and pistachio (*Pistacia mutica*) are also growth in the country.

Fruit-growing is an old and profitable branch of country's agriculture. Soil-climatic diversity conditioned by vertical zoning of the republic's territory created a favorable environment for multiple fruit spices cultivation – apricot, peach, plum, cherry, sweet cherry, apple, pear, quince, walnut, almond, pomegranate, figs and in recent years – eastern date plum and kiwi.

1.2.2. Diversity of Minor Crops and Underutilized Species

Though crop diversity in Armenia is very wide, not all species are used in large size. The plants of local, community, traditional and habitual significance make a great part. They are used by the population in more limited way (among fruits – medlar, holly; out of vegetables – rhubarb, some condiments, fodder crops, etc.)

1.2.3. Wild Crop Relatives and Wild Plans for Food Production

Due to abundance of wild relatives of cultivated plants the territory of republic was selected by N.I.Vavilov as center of cultivated plants diversity. At present territory of country is considered as Western Asia center of cultivated plants origin (soft and durum wheat, pea, lentil, grape). High concentration of wild progenitors of cultivated plants represents very rich gene pool for creation new crop varieties resistant to diseases, drought, cold and possessing other adaptive characteristics.

First of all Western Asian gene center is distinguished in the whole world by the diversity of wheat species and ecotypes. Out of four known four wild wheat species three occur in Armenia – *Triticum boeoticum* Boiss., *T.urartu* Thum.ex Gandil. and *T.araraticum* Jakubz. Diploid self-pollinated wild wheat *T.urartu* possessing the genomic similarity with tetraploid hard wheat *T.turgidum* and hexaploid bread wheat *T.aestivum* is identified as the closest diploid sources of the A genome of these polyploid wheat. This wild wheat species is growing on tertiary red clays and on basalts in altitudes within the bounds of 1300-1400 m above sea level as a component of the semi-arid, herbaceous vegetation. Wild einkorn wheat *T.boeoticum* due to fully inter-fertility and homology of chromosomes is considered as the direct progenitor of *T.monococcum*. This species is often met in mixed populations with other wild wheat (*T.urartu*, *T.araraticum*) and several species of *Aegilops*. Tetraploid self-pollinated wild wheat *T.araraticum* grown in semi-desert and mountain steppe conditions has been identified as a progenitor of cultivated *T.timofeevii* Zhuk. wheat. Along with other wild wheat species it is protected in the Erebuni state reserve (Gabrielian and Zohary, 2004).

Nine *Aegilops* species with wide interspecific diversity have been discovered in the republic. The great breeding interest to *A. tauschii* Cosson (*A. squarrosa* L.) has been caused by the point that this annual diploid self-pollinated species is the donor of D genome of modern hexaploid wheat. Having been widely distributed in the republic, *A.tauschii* can be met in semi-desert and steppe environment on the altitude from 700 to 1300 m above sea level. Other eight species of goatgrass (*A. // ujube// // cal* Host, *A. triuncialis* L., *A. triaristata* Willd., *A. crassa* Boiss, *A. biuncialis* Vis., *A.columnaris* Zhuk., *A. mutica* (Boiss.) Eig. /*Amblyopyrum muticum* Boiss./, *A. umbellulata* Zhuk.) can be considered as a rich reservoir of genes for drought-resistance, poor soil tolerance and pest and disease resistance as well.

As for other cereals, two species of wild rye: annual *Secale vavilovii* Grosch. and perennial *S.montanum* Guss. (36 varieties of them have been defined) and eight species of wild barley have been found. Wild two-rowed *H. spontaneum* C.Koch and *H. bulbosum* L. are of special interest for breeding practice.

Numerous indigenous forms of cultivated legumes have been also identified, though there are also wild forms, such as:

- lentil species – annual diploid wild lentil *Lens orientalis* (Boiss.) Hand., which is closely related to crop and rare and distant form the crop lentil species *L. ervoides* Grande.
- two widely distributed wild forms of pea *Pisum sativum* L. – *P. elatius* M. Bieb. [= *P. sativum* L. subsp. *elatius* (M. Bieb.) Aschers.& Graebn.] and *P. sativum* L. subsp. *humile* (Holmb.) Greut., Matthäs & Risse [= *P.sativum* L. subsp *siriacum* Berger], and one more distant from crop alpine perennial pea *Vavilovia // ujube//* (Steven) Fed., which is rare and insufficiently studied
- widely distributed in six floristic regions of Armenia at altitude ranging from 1300 to 2000 m wild forms of bitter vetch *Vicia ervilia* (L.) Willd.
- two species of liquorices – widely distributed *Glycyrrhiza glabra* L. occupied mainly swampy, sometimes saline places, and comparatively rare species *G. echinata* L.

Armenia is represented as a primary and secondary center of origin for many vegetable plants, 280 species are registered on the territory of the republic, such as beet (widely distributed wild and weedy forms of *Beta vulgaris* subsp. *// ujube// //* (L.) Arcang [= *B. perennis* (L.) Freyn.], diploid *B.*

Iomatogona Fisch. et C.A.Mey and *B. macrorrhiza* Steven, tetraploid wild species *B. corolliflora* Zoss. ex Battler), carrot, purslane, watermelon, melon, species of lettuce, asparagus and sorrel.

Some wild species of oil-bearing plants occur in Armenia, including:

- different wild and weedy forms of flax (*Linum L.*) usually referred to as *L. bienne* Mill.[= *L.usitatissimum L.* subsp. *angustifolium* (Huds) Thell.]
- wild and weedy forms of hemp (*Cannabis sativa L.*) identified for eight floristic regions within bounds of 700 -2000 m above sea level
- locally grown in few places wild and weedy forms of gold of pleasure (*Camelina sativa L.*),
- weedy forms of turnip (*Brassica rapa L.* [= *B. campestris L.*])
- species of safflower: growing in five floristic regions and infesting crop sowings *Carthamus oxyacanthus* M. Bieb. and *C. gypsicola* Iljin occupying clays rich in gypsum, as well as saline places and dry stony slopes.
- wild-growing weedy rape forms (*Brassica napus L.*) etc.

Eighteen species of condiments are distributed in Armenia. Most of them are used for aromatic leaves or seeds that serve to "ujubel" foods and drinks (caraway, summer savory, tarragon, sumac, brown mustard, hop, coriander), as well as for medicinal purposes (thymus, mints, lemon balm) or extraction of essential oils (oregano, wormwood).

Western Asia is the native land of such fruit species as grape, pear, cherry plum, sweet cherry, pomegranate, walnut, almond, and fig. Species of *Pyrus* with remarkable diversity and variety of forms constitute mixed pear-groves on the territory of Armenia. Having been drought and cold resistant plants possessing pool soil tolerance wild species of pears can be used in breeding as an initial material for hybridization and as matrix for grafting. Genus *Sorbus* is represented by about 13 polymorphic species with a great diversity of forms. A special emphasis should be given also to the genus *Crataegus* with its extremely polymorphic species with breeding, ornamental and medicinal importance.

The list of principal CWR, the most important from economical and conservation point of view of Armenia is presented in the *Annex 1*.

Agrobiodiversity in Armenia is notable for a diversity of economically valuable species, which can be divided into following groups according to their significance in use:

- Edible plants are presented by more than 200 species and 10 species of mushrooms.
- Forage – more than 2000 species
- Medicinal plants make more than 10% of the entire flora
- Melliferous plants – about 350 species
- Volatile-oil-bearing plants – 120 species
- Vitamin plants – 30 species
- Resin plants – 60 species, etc.

1.3. Diversity of Modern Selection Varieties

Due to country's different soil-climatic conditions reason for the cultivation of a large amount of crops. Both full-scale and adaptive breeding activities are carried out in the Republic. At present both foreign breeding varieties and local breeding ones, as well as limited number of old traditional varieties are cultivated in the country.

List of crops varieties included in the official register (2008) by the "Seed Agency", which is responsible in the Republic for variety testing and releasing, is presented in the *Table 1*.

Table 1.

List of the main crop species and number of registered varieties

Crop name	Number of registered varieties		Crop name	Number of registered varieties	
	total	in last 10 years (1998-2008)		total	in last 10 years (1998-2008)
1	2	3	4	5	6
Wheat (<i>winter, spring soft wheat</i>)	23	15	Radish	2	-
Rye (<i>winter</i>)	1	1	Pepper	10	8
Emmer wheat	3	1	Cucumber	7	5
Triticale	1	-	Cabbage	3	2
Barley (<i>winter and spring</i>)	14	7	Cauliflower	1	-
Sorghum	1	-	Onion	2	-
Pea	3	-	Beet	2	-
Lentil	2	-	Water-melon	5	4
Haricot	7	5	Melon	3	2
Soybean	2	2	Pumpkin	3	1
Chick pea	5	4	Quince	6	1
Vetch	2	-	Pear	9	-
Clover	3	-	Apple	12	-
Alfalfa	5	2	Apricot	7	5
Sainfoin	3	1	Cherry-plum	5	-
Fodder beet	2	1	Cherry	2	-
Ground nut	1	-	Peach	17	2
Flax	2	-	Plum	7	-
Tobacco	5	1	Sweet cherry	4	-
Potato	42	41	Sugar beet	3	2
Tomato	31	24	Pomegranate	2	-
Egg-plant	7	5	Fig	2	-
Marrow	1	-	Kaki	2	-
Onion	1	-	Raspberry	2	-
Patison	1	-	Strawberry	3	-
Okra	1	-	Currant	2	-
Grape (<i>table, technical, universal</i>)	71	17	Almond	2	-

Besides registered varieties there is a number of introduced varieties of crops which are cultivated, but not officially registered. Their exact number is unknown.

1.4. Diversity of local varieties

More than 20 local varieties of wheat were cultivated in Armenia before 1950. At present only 2-3 varieties of wheat are preserved, the other, because of low productivity, are out of use. Local varieties of wheat are notable for a series of important features, which makes them valuable initial breeding material. For example, "Spitakahat", "Galgalos", "Deghnazard", "Tavtukhi" local varieties are significant for their draught-resistance: "Deghnazarda", "Grnani" – for their resistance to fungus related diseases; "Giulgan", "Alti-aghaj" – for cold resistance. Unfortunately, the majority of local varieties is on the edge of extinction. They are almost not preserved in seed collections.

"Nutans" local variety of barley is in cultivation now; it is drought resistant with low demand to soil conditions.

Among perennial fodder crops (*Fabaceae*) the following varieties are widely distributed: “Aparan local” variety-population of alfalfa, “Sisian local” variety-population of sainfoin, “Stepanavan local” variety-population of clover.

A limited amount of variety-populations of vegetable-melon crops such as cucumber, bulb onion, melon is cultivated. Almost all spicy and leavy vegetables-are of local origin.

Armenian Up-Land, being a place of origin for many crops, is famous for fruit specific and variety diversity. Some variety populations of apple (40), pear (15), apricot (15), peach (8) and some varieties of cherry have been preserved in the form of separate plant species, moreover in a few separate farms.

1.5. Factors influencing the State of the Plant Genetic Diversity

Factors influencing the state of the plant genetic resources in the country are directly or indirectly conditioned by the human impact upon agrodiversity:

- natural population of wild crop relatives and plant communities are decreased because of anthropogenic influence, environment deterioration and climatic changes
- genetic erosion, conditioned by the introduction of new varieties resulted from the development of modern breeding; illegal import of plant species and hybrids. It is necessary to note that a great deal of imported varieties being not adaptive to local nature-climatic conditions, become unfit for cultivation and disease spreader
- over use of useful plant populations, pastures and grasslands
- collection of wild edible plants in an unsuitable time period, which brings to significant decrease in nature resources
- worsening of natural pastures and grasslands due to intensive overuse over years

CHAPTER 2.

THE STATE OF *IN SITU* MANAGEMENT

2.1. PGRFA conservation in nature specially protected areas

In-situ conservation of plant genetic resources in Armenia is undertaken in nature specially protected areas (NSPA), which comprise about 60% of flora and fauna species, and outside of protected areas – mostly in state owned land plots.

▪ **History and classification of NSPA**

The formation of the current net of NSPA started in 1958 after creation of the state reserves “Khosrov Forest” (former “Khosrov”), “Dilijan” (changed into a category of national park in 2001) and “Shikahogh”. At the same time Martuni, Gyulakarak, Jermuk and Her-Her *forest farms*, as well as yew, datura, plane, Greece nut, pear, apple, juniper and dogwood wild fruit species growing areals on the territory of Armenia were declared as state protected areas. Other state protected areas (Annex 1) were created later, up to 2007, with different aims of *preservation* of biodiversity.

In Armenia NSPAs are classified:

- by significance as international, republic and local NSPAs
- by their categories – state reserves, national parks, state protected areas and nature monuments.

Currently the net of NSPAs in Armenia is formed of:

- 3 state reserves (“Khosrov Forest”, “Shikahogh” and “Erebouni”) correspond to IUCN “Ia” category. Only scientific research work or special familiarization tourist trips are allowed in the area.
- 2 national parks (“Sevan” and “Dilijan”) correspond to IUCN II category, which are divided into reserve, specially protected area, recreation and economy zones
- nature *monuments* of IUCN III category
- 25 state specially protected areas – reservations correspond to IUCN IV category.

2.1.2. State reserves

“**Khosrov Forest**” was officially declared as a state reserve in 1958; however the fact, that “Khosrov Forest” was created in 330 AD by an Armenian King Khosrov II, was mentioned by a V century Armenian historian Movzez Khorenatzi.

Currently the territory of the reserve occupies 29,196 ha with 16% of forest coverage. Clearings, brush woods, bushes and *forests* occupy about 20% of the territory. Different types of mountain xerophytes plant communities are found on the other 64% of the territory.

The *open* forest of juniper and oak, *pears*, mountain xerophytes, mountain steppe and semi desert formations with prevailing wormwood (*Artemisia fragrans Willd.*) is preserved here—together with some wild crop relatives, fruits such as wild pear, apple, plum, cherry, mountain ash, hawthorn, almond (*Amigdalus fenzlianus*), peanut (*Pistacia mutica*) and cereals – Vavilov rye, etc.

11 endemic plant species grow on the territory of the reserve (*Allium schchianae*, *Centaurea arvensis*, *Campanula bayerniana* ssp. *choziatowskyi*, *Cephalaria armeniaca*, *Astragalus holophyllus*, *Cotoneaster armenus*, *Pyrus elata*, *P.chosrovica*, *P.tamamschianae*, *P.sosnovskyi*, *Rosa zangezura*).

“**Shikahogh**” **state reserve**, created in 1958, is located in the basin of Tzav and Shikahogh rivers and occupies the territory of 12,137 hectares.

The unique naturally well-reserved forest (Mtnadzor gorge) is situated here. The primary targets for conservation here are oak, hornbeam and oak- hornbeam forests, as well as rare plant communities, such as yew grove (*Taxus baccata*) – the only small beech grove found in the south

of Armenia and a walnut grove (*Juglans regia*). *Hipericum Eleonorae* is among growing here endemic plant varieties of Armenia.

“Erebuni” state reserve was created in 1981 with the aim of preservation of wild cereals, including more than 100 varieties of wild wheat and their habitat. The reserve is located in the south-western part of Yerevan at the altitude of 1300-1400 m above sea level on the transition between semi-desert and mountain-steppe zones, covering 89 ha territory.

“Erebuni” state reserve is a “Golden Fund” of wild relatives of largely spread of cultivated varieties. Despite its small territory the flora of the reserve is presented in 292 higher flowering species which belong to 46 families and 196 genera. Among them the number of wild crop relatives is 39. 93, 2% (272 species) of the reserve flora are grasses, 146 species of which (53, 7%) are annuals and biennial plants.

Three out of four species of wild-growing wheat known in the world occur in the reserve: wild one-grain wheat (*Triticum boeoticum* Boiss.), wild Urartu wheat (*T. urartu* Thum. ex Gandil.) and wild two-grain Ararat wheat (*T. araraticum* Jakubz). Among wild cereals seven species of wild barley (*Hordeum spontaneum* C. Koch., *H. bulbosum* L., *H. glaucum* Steud., *H. murinum* L., *H. maritimum* Huds., *H. geniculatum* All., *H. hrasdanicum* Gandil.), two species of wild rye (*Secale vavilovii* Grossh., *S. montanum* Coss.), several species of aegilops (*Aegilops tauschii* Cosson., *A. cylindrica* Host., *A. triuncialis* L., *A. columnaris* Zhuk., *A. trivialis* Zhuk., *A. mutica* Boiss) species are growing and conserved on the reserve territory.

Almond (*Amygdalus fenzliana*) trees, planted here before the territory was declared as a reserve in 1981, are still preserved in the area. As a result of the reserve operation the introduced brushes gradually become extinct and syndinamic succession occurs in the area.

The plant species included in the Red Data Book also grow on the territory of the reserve (*A. crassa*, *S. vavilovii*, *H. spontaneum*, *T. araraticum*, *T. boeoticum*, *T. urartu*, *Gladiolus atroviolaceus*, *Actinolema macrolema*, *Iris elegantissima*, *Merendera trigyna*, etc.).

“Dilijan” National Park was organized in 2002 within the boundaries of “Dilijan” National Reserve and the adjoining territories.

The Park is situated in the northern part of the RA. The occupied territory spreads onto Pambak, Aregun, Miapor, Ijevan and Halab areas of 22765ha The protection zone is 11063ha. Wild fruits such as Caucasian pear (*Pyrus caucasica*), Eastern apple (*Malus orientalis*), plum (*Prunus divaricata*), blackthorn (*P. spinosa*), nut (*Juglans regia*), common hazelnut (*Corylus avellana*), dogwood (*Cornus mas*), different species of hawthorn (*Crataegus*), medlar (*Mespilus germanica*), bird cherry tree (*Padus*), etc. are conserved here. The place abounds in a diversity of berries – currant (*Ribes*), blackberry (*Rubus caesius*), raspberry (*R. idaeus*), gooseberry (*Grossularia*), etc.

The flora of the national park and its protected zone comprises 1200 species of vascular plants, of which 977 species grow in the park zone. 51 of them are trees, 47 – bushes, 696 – perennial grasses, 176 – annual and biennial plants, 7 – parasites. The 5 among the mentioned species (*Bupleurum kozo-poljanskyi*, *Rosa sosnovskyana*, *Linaria zangezura*, *Scrophularia olgae*, *Merendera mirzoevae*) are endemics of Armenia. 54 species of the national park are medicinal and 41 – edible plants.

“Sevan” National Park, created in 1978, is situated in the central part of Armenia. The park occupies a territory of 147 343 ha including the lake surface, and 22 585ha without it. The territory of the protected zone is 342 920ha.

Lake Sevan, the exclusive endemic animal and plant communities of its basin are the main targets of protection. Artanish Peninsula is the largest terrestrial part of “Sevan” National Park with 2500 ha territory. It has rich plant diversity and is covered with artificially planted forests which house pine, poplar, apricot, oleaster, sea-buckthorn as well as other tree and bush communities. 1145 species of vascular plants grow in the park zone, 4 of which are endemic species of Armenia (*Cousinia fedorovii*, *Astragalus coelestis*, *Acantholimon gabrielliana* and *Tragopogon segetus*).

100 species of edible plants are spread in “Sevan” national park and its protected zones (*Chaerophyllum bulbosum*, *Falcaria vulgaris*, *Hippomarathrum microcarpum*, *Asparagus officinalis*, *A. verticillatus*, *Hippophae rhamnoides*, *Thymus kotschyanus*, *Rumex scutatus*, *Rosa sp.* – 10 species, *Sorbus aucuparia*, *Crataegus meyeri*, *C. orientalis*, *C. pseudohetero-phylla*, etc.).

2.1.3. State specially protected areas (Annex 2.) hold the functions of keeping the balance of economic and environmental relations, the improvement and regeneration of animal and plant gene pool, the conservation of natural complexes and their valuable components.

2.1.4. NSPAs and Ecosystem Management

The authority of NSPAs management in the RA according to the RA “Law on Specially Protected Nature Areas” (2006) is imposed upon the Ministry of Nature Protection, yet at present it *operates under different* supervision.

1. Reserves, national parks and 7 of the reservation (Plane Grove, Akhnabat Yew Grove, Gilan, Khor-Virap, Goravan Sands, Sev Lich and Vortan Karmir reservations) are subject to the Ministry of Nature Protection of RA.

The above-mentioned NSPA’s activities, including conservation of wild crop relatives, scientific researches, monitoring and utilization are brought into effect in:

- “Khosrov Forest” reserve, “Khor-Virap” and “Goravan Sands”– by “Khosrov Forest” state reserve NSCO;
 - “Sevan” National Park by “Sevan National Park” NSCO;
 - “Dilijan” National Park and “Akhnabat Yew Grove” reservation by “Dilijan National Park” NSCO;
 - “Erebuni” state reserve, “Sev lich” and “Vortan Karmir” preservations by “Reserve-Park complex” NSCO
2. “Aragatz Alpine” reservation operates under the supervision of the Institute of Physics within the Ministry of Economy.
3. The 3 of the protected areas (Ghihae open forest, Hankavan (hydrological), Jermuk (hydrological) are beyond the administrative authorities of administrative division communities. They are located in state owned territories though within the region boundaries so the question of their subjection still remains open.
4. The other 14 small protected areas operate within structure of “Hayantar” (Armenia Forests) NCSO which is subject to the Ministry of Agriculture. They are included in forestry branches – forest farms as *forest* units.

The Bioresources Management Agency was established within the Ministry of Nature Protection in 2002 (RA Government Decree No. 1236-N, August 8, 2002). “Sevan” and “Dilijan” National Parks, “Khosrov Forest”, “Erebuni”, “Shikahogh” reserves, “Vortan Karmir”, “Sev Lich”, “Akhnabat Yew Grove” and “Pine Grove” reservations have been subject to the Agency since then. The Agency also maintains the activities on the support management of protected areas both in-situ and ex-situ («Jrvej» forest park, “Sochut” in Stepanavan, “Soranner” in Vanadzor and Berd, ljevan dendroparks) with the help of appropriate regulatory divisions of NSPA and dendroparks management.

Scientific research and monitoring carried out by the staff of divisions of the above-mentioned NCSOs promotes the management of the CWR population.

2.1.5. In Situ Management of PGRFA outside of NSPA

In-situ management of PGRFA outside of NSPA is carried out mainly in forests and natural land types (pastures and grasslands), under the Law of RA and other outcoming regulatory acts.

Apart from the regulations directly related to the preservation of the biodiversity there is a number of other regulations referring to the natural resources. There are provisions targeted on prevention of negative impact of natural resources utilization on biodiversity in general and plant genetic

resources in particular (Land Code of RA /2002/, Entrails Code of RA /2002/ Water Code of RA /2002/) or on compensation of the caused damage (Criminal Code of RA, RA Administrative Violations Code /1985/, “Law on Amendments in the Administrative Violations Code of the Republic of Armenia” (2002), Criminal Code of RA /2003/)

2.2. In-situ related projects (Inventories, Surveys and Research)

2.2.1. Research projects, surveys, management plans

At present activities targeted at the biodiversity conservation and sustainable utilization are fully introduced in a number of strategic documents approved by the Government of the RA.

Biodiversity conservation in NSPAs, including a number of measures on CWR inventory and research is envisaged by NSPAs management plans and/or by mid-term and annual programmes of SNCOs implementing conservation and utilization activities. The complex inventories of PGRFA have failed to be carried out due to the shortage of financial resources, absence of the proper coordination, failure of application of monitoring indicators and proper methodology. That fact has brought about some difficulties in regulation of their conservation and sustainable utilization. Only a few researches and accessories collections have been presented to ensure ex situ management:

- accessories collections organized within frames of appropriate scientific themes, field explorations, including joint collection missions by scientific personnel of the Institute of Botany of NAS, Armenian State Agrarian University and recently involved Scientific Center of Agrobiotechnology
 - a composition of species discovered on the territories of «Sevan», «Dilijan» and «Khosrov Forest» National Parks has been worked out in the framework of the state reserve management plans of the above-mentioned sites.
 - a number of activities targeted on conservation, reproduction, research, monitoring, sustainable use, awareness, establishment of national and international informational system of 99 CWR taxa are envisaged by the workplan of UNEP/GEF “*In situ* conservation of crop wild relatives through enhanced information management and field application” project coordinated by Bioversity International
 - a composition of wild edible and spice vegetable species (240 species) has been published in the framework of «Development of a full project for *in situ* conservation and sustainable use of agrobiodiversity in Armenia» project.

The research priorities of PGRFA are defined based on the objectives of research works carried out by scientific institutions. The conservation priorities are mainly based on the available data on growth areas and the status of a given species confirmed as a result of a research work.

2.2.2. Participatory Management

The project on “Development of Sevan” and “Dilijan” national parks’ participatory management plan” is implemented within the frames of component of “Management of protected areas and biodiversity conservation” It is a part of the “Natural resources management and poverty reduction” project targeted at the poverty reduction through development of mechanisms of sustainable management of natural resources and participatory management plans. “The project on “Development of Sevan” and “Dilijan” national parks’ participatory management plan” views the problem of conservation of plant biodiversity as its primary goal. The communities are directly involved in the activities related to the management plans implementation, taking into consideration their experience, traditions and knowledge.

Within the frames of the component of “Community-based management of watershed basins” project the methods of sustainable management have been carried out in 59 communities of the two marzes of the Republic on 9500ha pastures. The implemented methods are to ensure the conservation of vegetation in high mountain sub alpine and alpine zones.

The representatives of local self governance bodies and communities are permanently involved in the program activities, which, in particular, include the introduction of sustainable agricultural

experience, development of ecotourism, and working out the plans on sustainable utilization of natural resources.

The development of forest management plans within the frames of “State forest management” project (the third component of the “Natural resources management and poverty reduction” project) is a participatory process, which actively involves local communities’ population. Meetings and trainings held there are mainly focused on traditional methods of management of natural resources and analysis and exchange of experience.

2.3. On-farm management

On-farm management related activities are limited because of the lack of awareness of stakeholders concerning on-farm conservation of agrobiodiversity.

The conservation of old traditional varieties of different crops as well as under-utilized and little-spread crops under the conditions of peasant farms is an essential process for the management of diversified agricultural production. The currently implemented «Agrarian technologies assessment» project enhances the solution to these problems. The realization of the program encourages the interlink between science and production, promotes the development of agricultural production, expands the links between collections holders of genetic resources and users, helps the development of national breeding and private seed production farms, ensures logical extension of research programs.

The project is coordinated by the Agriculture Support Republic Center. 806 programs on introduction of agrarian technologies and 59 diverse demonstrated programs were undertaken in the framework of “Agricultural Reforms Support Project” during 2001-2006, and since 2005 within frames of Rural Enterprise and Small-Scale Commercial Agricultural Development Project. The above mentioned programs were implemented in the farms of all marzes of Armenia with their close involvement into the process (*Diagram 4*).

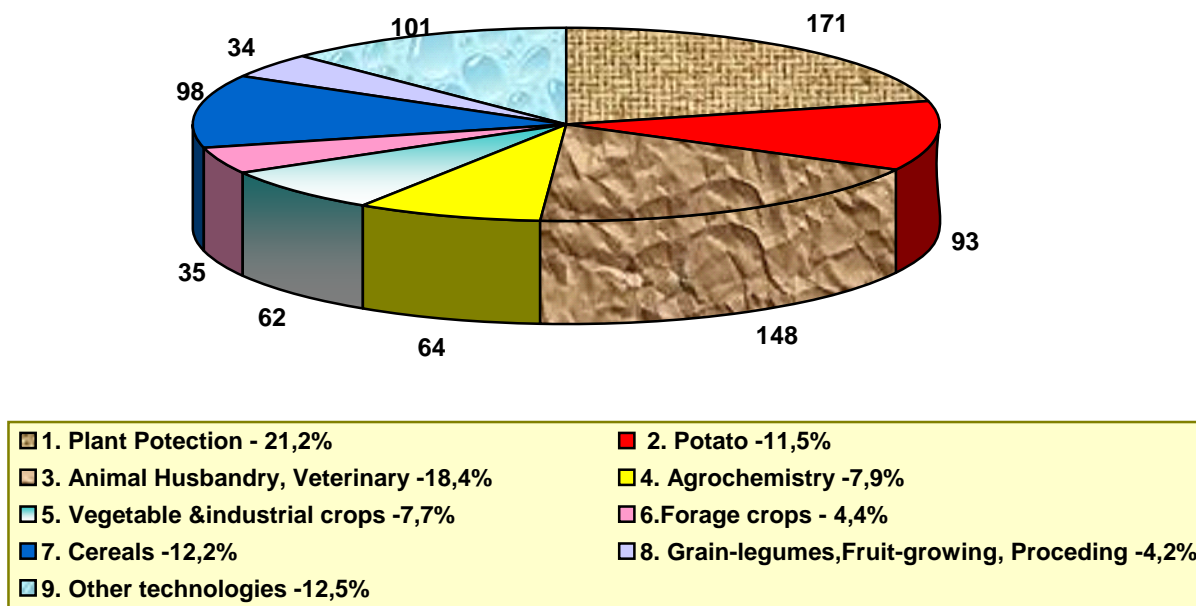


Diagram 4. Agrarian technologies introduced in farms in 2001-2006

Activities targeted at the realization of 41 programs on the assessment of agrarian technologies are in progress now. The introduced technologies are mainly aimed at the prompt solution of urgent problems in agriculture, presented in diagram 1 according to their agricultural orientability.

The conservation of plant genetic resources for food and agriculture is of utter significance for varieties improvement, development of new high productive varieties. Consequently scale of work has been also directed to conservation of traditional varieties and further improvement of genetic resources in the framework of new technologies introduction activities.

40 and more crops have been investigated. New varieties of crops were introduced under different natural climatic conditions and ensured about 15% of growth. The growing of local varieties demonstrated sustainable yield under the impact of severe weather changes and extreme climatic factors. The technologies of high interest are presented in diagram 5 by crop varieties of local and foreign origin.

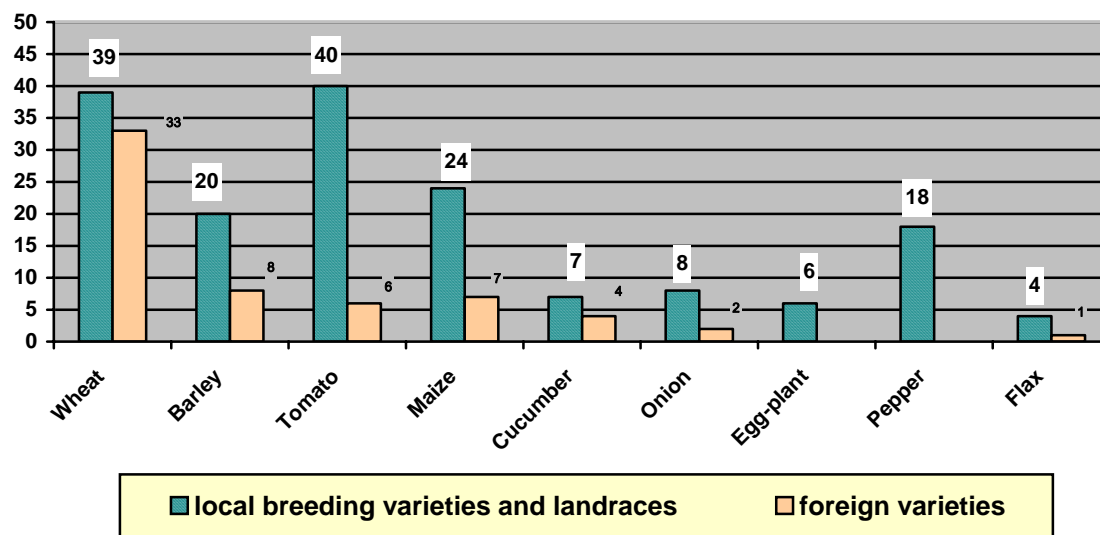


Diagram 5. Agrarian technologies introduced in farms in 2001-2007 by crops varieties of local and foreign origin

Field days, demonstrations, etc. were organized in the framework of the project to ensure the awareness (provision of all necessary information for) of stakeholders, farmers interested in introduced crop varieties and cultivation technologies. The links between farmers and researches in the given field have been established.

The implemented technologies enhanced the conservation and effective use of a number of varieties or variety samples of examined crops (vegetable, industrial, cereals) of local and foreign origin.

2.4. Restoring Agricultural Systems after Disasters

The territory of RA is considered a high risk zone for agricultural production. Agriculture bears drastic losses from droughts, hailing, floods, early spring frosts and other natural disasters. The average caused damage to agriculture is about 15-20 mln \$ USA yearly.

Different zones yearly face natural disasters, which brings about full or partial demolition of 20-25% of yield. The inter-ministerial commission of disaster caused damage and undertaking some support actions.

With the aim to evaluate disaster caused damage and undertake some support actions to farms an Inter-ministerial Commission is formed for providing assistance to farms after natural disasters.

Agriculture insurance system is very significant in the respect of creation of mechanisms of restoring of plant genetic resources, damaged from natural disasters. However it doesn't operate yet, due to high risk. With the aim of restoring agricultural systems the government and donor organizations provide different types of support: provision of seed material or fertilizers, liberation from soil and irrigation taxes, etc.

Not only farms, sown areas but also wild flora, wild edible plants and wild crop relatives suffer from natural disasters. To restore them it is necessary to implement monitoring, to fill collection gaps, to undertake a series of propagation activities.

2.5. *In situ* conservation of Wild Crop Relatives and Wild Plants for Food Production

CWR conservation in NSPA is guaranteed by the legislation of the RA in accordance with the defined conservation procedures. The inventory, registration and studies of wild crop relatives are envisaged by NSPA management plans and/or by state financed mid-term and annual programmes of the SNCOs implementing conservation and utilization activities.

The priorities of CWR and wild food plants conservation are mainly determined by the available data related to plant habitat and to the plant species status based on the research results. A number of provisions of strategies and national programs determine conservation and sustainable utilization of CWR as a component of biodiversity:

- “Food safety policy of the Republic of Armenia” chases an objective to ensure effective management and use of agriculture genetic diversity, especially fodder plants, as well as evaluation, monitoring and rehabilitation

- In terms of improvement of management of plant genetic resources, including CWR, the Agriculture Sustainable Development Strategy (2006) and list of activities for 2006-2015 annexed to it is of ultimate importance. The tasks what the Strategy is targeted on are as follows:

- improvement of land types (pastures) and watering programme implementation. The programme will facilitate the increase of yield capacity of natural pastures and net profit which will benefit poverty reduction

- support to conservation of wild crop relatives which is to be implemented in the following directions:

- establishment of a gene bank of crops and their wild predecessors
- improvement of pastures and grassland, watering of pastures
- establishment of plantations and nurseries for the spices of economic value forest regeneration
- forecast, prevention and development of the complex activities directed to mitigation the negative impact of natural disasters (draught, dry wind, spate, flood, soil salinization, etc.)
- sustainable, well balanced utilization of natural resources.
- conservation of crop wild relatives.

In situ conservation of CWR is mainly carried out in Erebuni state reserve, its management plan development is expected in frames of the UNEP\GEF project on «*In situ* conservation of crop wild relatives through enhanced information management and field application».

2.6. *Improvement of In Situ Management, Priorities and Needs*

2.6.1. *Recent year achievements*

The «National Biodiversity Strategy and Action Plan» (NBSAP) were developed with the GEF support in 1999 where NSPA *in situ* management improvement got a particular attention. NBSAP

strategic activities which were to be carried out in 2000-2004, started to be implemented in 2001, connected with the implementation of GEF/UNDP project on «Assessment of capacity building needs for biodiversity of Armenia and establishment of CHM structure». In the framework of the above-mentioned-project the-country's capacity in the field of conservation of biodiversity including genetic resources and the utilization of nature resources have been assessed.

The “Strategy for access to genetic resources and equitable benefit sharing” as well as the «Strategy on the development of Natural Specially Protected Areas in Armenia» and Action Plan (SNSPAAP) (2003-2010) have been developed. The latter was approved by the Governmental Decree in 2002. The following activities in the field of in situ conservation in are envisaged in the SNSPAAP as priority actions:

- improvement of the system of nature specially protected areas management
- clarification of specially protected areas net
- training of the specially protected areas staff
- direct assistance to nature protecting activities in specially protected areas.
- expansion of the net of specially protected areas
- conservation and rehabilitation and of landscapes and ecosystems
- conservation and restoration of species and plant communities.

Similar activities directed at the improvement of in-situ management are also included in SNSPAAP. At present the programs for the establishment of “Gnishik”, “Jermuk”, “Arevik” and “Arpi Lich” national parks, “Vorotan” and “Kirantz” national parks/reservations as well as “Khor Virap” reservation have been developed by the Ministry of Nature Protection of RA.

Activities on inventory, registration, passportization, creation and confirmation of the list of natural monuments are in phase of consideration by RA government.

The precise definition of the boundaries of “Shikahogh” state reserve and the size of “Plane Grove” state reservation were adopted by the Governmental Decree on RA in 2006. With a contribution of World Bank and Global Environment Facility (GEF), the management plans of “Sevan” and “Dilijan” National Parks were developed under the “Natural Resources Management and Poverty Reduction” project and approved by the Government of RA. Plant and animal studies, technical assistance, awareness raising and other actions have been carried out in “Sevan” and “Dilijan” national parks. The draft management plan-of “Khosrov Forest” state reserve has been developed with the state financial support.

During 2006-2007 actions on clarifying the exact boundaries of the reserve and its mapping were implemented. A management plan was developed. At present the process of adoption of the reserve management plan by the Government of RA is in progress. In the framework of this process the boundaries and the *size* of the occupied territory are to be fixed.

During 2008 natural monuments draft list was submitted for adoption by the government of RA. The list is expected to increase as a result of further new studies.

“Tandzut” national monument, which is a habitat for *Pyrus syriaca*, *P. caucasica*, etc., is presented in the list of natural monuments, expectedly to be introduced to the Government of RA.

2.6.2. Needs and obstacles

Despite the fact that numerous programs concerning in-situ management improvement have been carried out for the last 10 years, there are still difficulties to face:

- very few activities related to public awareness and trainings have been implemented
- no systemized inventory and registration have been carried out during the last decades; though scientific potential is available in the country, the absence of technical and financial capabilities prevents the implementation of the necessary activities

- registration and analysis of the changes in ecosystem, the study of the structural changes in vegetation haven't been thoroughly implemented. Structural changes in flora are particularly significant for the *discovery* of the invasion of alien species
- the legal, administrative and other measures necessary for ensuring of country's biosafety are not legislatively regulated
- the legal field for regulation of use of wild plants is not complete, the procedures of wild plant collection and storage are not in place
- as a result of financial shortage, activities envisaged by management plans fail to be successfully implemented and don't include precise activities aimed at sustainable utilization of CWR
- reservations mainly don't have chapters to determine their preservation procedures. There are no separated organizations to ensure their conservation and utilization functions
- special programs developed for newly-created NSPA can't be implemented because of lack of financial resources.

As it was mentioned the main objective of giving status to reservations to ecosystems is conservation of wild crop relatives' habitats. However, the exact data concerning the boundaries of habitats, components of biodiversity of these territories and composition of CWR species are not available yet. Actions on clarification of the reservation boundaries and its mapping have started since 2006 and are to be completed in 2008. At present the design and sizes only for four reservations – "Plane Grove", "Gilan" (118 ha), "Khor Virap" (53,28 ha) and " Sands of Goravan" (95,99 ha) have been adopted by the Governmental Decrees.

2.6.3. Priorities for future

In case of the above mentioned problems get their solution, the following activities are suggested with the aim of in-situ management improvement;

- CWR study (spreading, inventory of communities and their spices composition, precise definition of habitats and mapping, store registration and evaluation) and monitoring implementation.
- development of evaluation indices of human and natural impact on CWR
- inventory of alien plant species
- introduction of legal and administrative mechanisms for ensuring of biosafety
- technical assistance for on-working *in situ* management bodies; establishment of administrative bodies for reservations management.
- development of charters and management plans for all reservations
- implementation of programmes on new NSPAs establishment
- development of instructions/guidelines for widely used natural resources
- working out of management plant for all forest farms
- development and implementation of awareness and educative programs concerning wild plant resources including woody forest material, and sustainable utilization of pastures and grass lands
- development and implementation of awareness and education programmes on agrobiodiversity on-farm conservation for peasant farms.

CHAPTER 3.

THE STATE OF THE *EX SITU* MANAGEMENT

3.1. Sustaining and Expanding *Ex situ* Collections

3.1.1. Main *ex situ* Collections

Agrobiodiversity *ex-situ* conservation is an important tool for agrobiodiversity conservation. That enables to regenerate PGR for food agriculture, which under the threat of natural disasters or human factor influence and provides constant usage opportunity for plant genetic resources for researchers (with breeding or scientific purposes), farmers and community representatives.

About 11676 accessories of the seed collections are conserved in seven scientific institutions operating within different Ministries of RA (*Table 2.*). All necessary equipment and conditions for long and mid-term conservation of accessories are available only at the Gene Bank of Scientific Center of Agrobiotechnology of the Ministry of Agriculture.

The seed collections of Armenian State Agrarian University, Scientific Centers of the Ministry of Agriculture: SC Agrobiotechnology, SC of Vegetable and Industrial Crops, SC of Viticulture, Fruit-growing and Wine-making, are presented mainly by the accessories of local origin and local breeding varieties. The seed collections of the SC of Agriculture and Plant Protection and Gyumri breeding station of the MoA are presented by breeding lines of ICARDA and CIMMYT nurseries.

Table 2.

Number of accessories of seed collections stored at scientific institutions of Armenia

Organization name	Conserved plants	Maintenance conditions	Accessories number
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Gene Bank of the Scientific Center of Agrobiotechnology of the MoA	the mostly distributed in Armenia crops of high economic value and their crop wild relatives	<ul style="list-style-type: none"> - short-term: +4 0C, seed conservation in foil aluminium packets - in vitro (+4 0C till (-180C) - long-term (-18 0C) – will be soon 	2130
Scientific Center of Agriculture and Plant Protection of the MoA	wheat, barley, chickpea, lentil, soybean, ground-nut	working collection are maintained under the room conditions in paper packets (temperature and humidity are not regulated)	2071
Scientific Center of Vegetable and Industrial Crops of the MoA	vegetable, melon crops and their wild relatives, industrial crops (soybean, flax, tobacco)	working collection are maintained under the room conditions in paper packets and cardboard boxes (temperature and humidity are not regulated)	1491
Laboratory of Plants Gene Pool and Breeding, Armenian State Agrarian University	cereals, vegetable crops, grain-legumes, and their wild relatives, forage	seed collection are maintained under the room conditions in paper packets and cardboard boxes (temperature and humidity are not regulated)	4140
SC of Viticulture, Fruit-growing and Wine-making of the MoA	wild grape, fruits	working collection are maintained under the room conditions in paper packets (temperature and humidity are not regulated)	30

1	2	3	4
Institute of Botany, Botanical Gardens of NAS	cereals, vegetables, grain-legumes, forage grasses	working collection are maintained under the room conditions in paper packets (temperature and humidity are not regulated)	1048
Gyumri Breeding Station of the MoA	wheat, barley, chick- pea	working collection are maintained under the room conditions in paper packets (temperature and humidity are not regulated)	766
TOTAL			11 676

3. 1.2. PGRFA Gene Bank

Paying particular attention to conservation of plant genetic resources for food and agriculture, PGRFA Gene Bank was established in 2006 at the Scientific Center of Agrobiotechnology under the initiative and support of the Ministry of Agriculture. This seed storage is a unique one in Armenia. ICARDA and USDA left considerable material contribution for the Gene Bank establishment.

The Gene Bank maintains agricultural crops of primary importance for RA and their wild relatives, paying particular attention to the crops of Armenian origin (*Diagram 6.*). At present seeds are conserved at +4°C conditions (refrigerator) at the Gene Bank. Soon the seeds will be placed for long-term conservation under deep freezing conditions, which will supposedly conserve them for 50-100 years. The seeds are dried before conservation, reaching humidity of 5-6% and placed into vacuum-closed aluminum foil packets

Active and base collections are available in the Gene Bank. The active collection includes accessories used for breeding and distribution. Placed for long-term conservation accessories of the base collection are not used or distributed.

In-vitro culture application is of great importance particularly for reproduction and conservation of threatened, vegetatively propagated and elite genotype species. 100 accessories of six crop species are conserved in the Genebank under *in-vitro* conditions.

Gene Bank activities include acquiring of plant species (working collections of scientific centers, wild nature, farms, markets, seed production farms, international research centers' PGR collections, etc), propagation, regeneration, characterization, evaluation, plant health control, documentation, conservation and distribution.

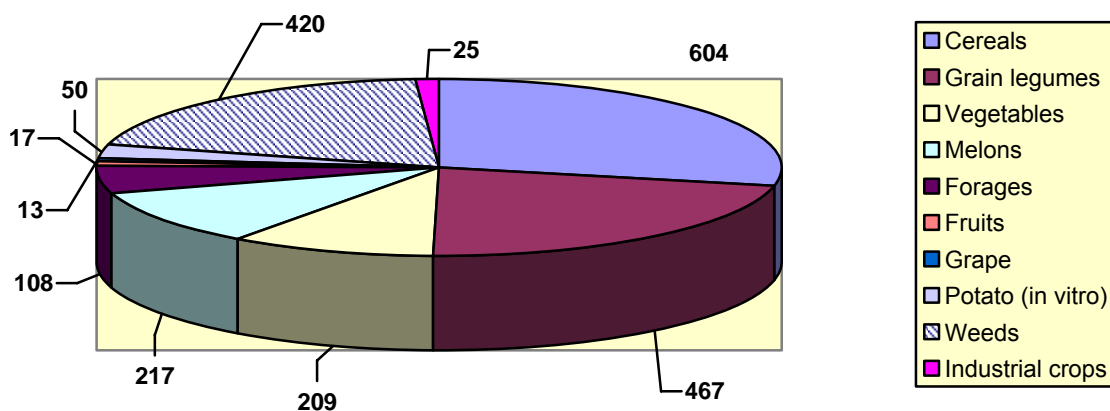


Diagram 6. National Genebank structure

The prevailing bulk of all accessories stored in all scientific institutions is planned to be placed for long-term conservation in the Genebank of the SC of Agrobiotechnology. 1000 species have already been provided to the Genebank from the different working collections. The activities are enhanced both by bilateral agreements and exchange to increase of the Genebank accessories number by plant species of local origin. There is a number of preliminary agreements with N.I.Vavilov Institute of Plant Industry, ICARDA and other organizations.

- **Safety Duplication**

The accessories of plant genetic resources of local origin are, if not fully, but partly conserved in some foreign gene banks (VIR in Russia, Institute of Plant Production in Ukraine, Research Institute of Crop Production in Czech Republic, Kansas State University of USA, etc.). PGRFA accessories, collected during joint collection missions, are conserved also in gene banks of involved researchers' countries.

There is no precise program available on the transfer of *ex situ* collection to other gene banks for safety-duplication. Yet there are some preliminary verbal agreements with some foreign institutions (N.I.Vavilov Institute of Plant Industry, Center for Genetic Resources in Netherlands (CGN)) on safety duplication of Armenian accessories.

- **Wild Crop Relatives Seed Collection**

The very first seed collection of wild crop relatives was established in 1981 by the initiative of prof. P.A.Ghandilyan in the Laboratory of Plant Gene Pool and Breeding of Armenian State Agrarian University (in the past Armenian Agricultural Institute). At present the laboratory maintains (under short-term conservation conditions seeds, spikes, spike lets, herbarium) 4140 accessories of cultivated and wild wheat, barley, rye, aegilops, wild vegetable plants (beet, carrot, onion, etc.), leavy vegetables and grain legumes (vetchling, lentil, vetch, clover, alfalfa, etc.). (*Diagram 7.*)

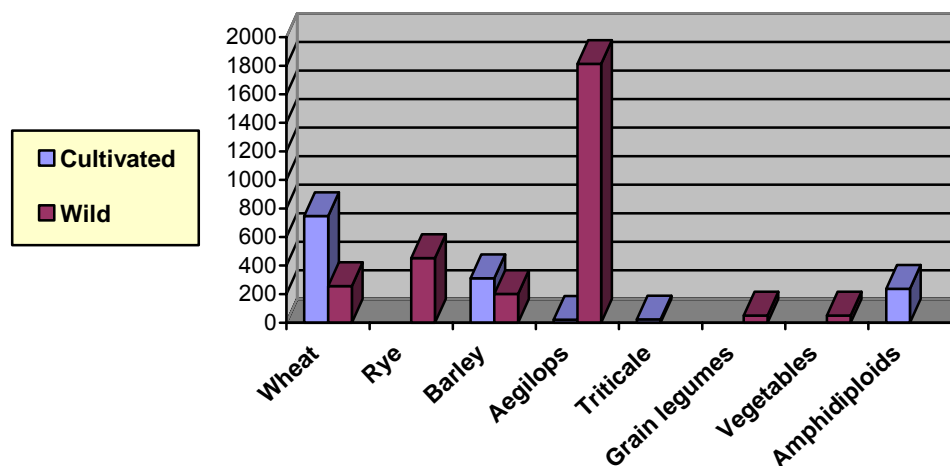


Diagram 7. Seed collection of the Armenian State Agrarian University

3.1.3. Field Collections and Botanical Gardens

- **Field collections**

Field collections of PGRFA are available at the Nalbandyan Experimental Station of the SC of Viticulture, Fruit-growing and Wine-making, at the Eraskhaun Experimental Station of the SC of Soil, Agrochemistry and Melioration, Yerevan Botanical Gardens and private farms. Field collections established in state and private farms comprise 342 accessories, 268 accessories out of them are maintained in research institutions (*Table 3.*)

Table 3.

Number of living collections and occupied territory

Organization name	Crops	Accessories number	Occupied area (ha)
SC of Viticulture, Fruit-growing and Wine-making of the Ministry of Agriculture, Nalbandyan experimental farm	grape	70	15,0
	apricot	25	1,2
	peach	20	1,0
	pomegranate	18	0,5
SC of Soil, Melioration and Agrochemistry of the Ministry of Agriculture	grape	67	13,0
	fruits	25	5,6
Botanical Gardens of NAS	grape	18	1,5
	fruits	25	3,0
Total		268	40.8
Demonstration and collection orchards established in private farms by the support of the state and donor organizations			
Tavush Marz, Bagratashen Avan	peach	15	2,0
	apricot		0,5
Tavush Marz, Aygehovit community	fruits	40	1,5
Aragatsoth Marz, Oshakan community	peach	12	1,2
	apricot	7	0,5
Total		74	5.7

The grape collection of the SC of Viticulture, Fruit-growing and Wine-making embraces local breeding varieties, as for fruits (apricot, peach, pomegranate) the field collections include both local and foreign breeding varieties and clones. Grape varieties and clones of local origin prevail in the grape collection of the SC of Soil, Agrochemistry and Melioration.

- **Botanical Gardens**

The following establishments play a great role in plant genetic resource conservation and spreading:

- Yerevan Botanical Garden of NAS, contains living collection of aboriginal flora with 850 species including about 131 tree and bush species,
- Sevan Botanical Garden, the branch of Yerevan Botanical Garden, contains about 440 species with 17% share of local tree species,
- Vanadzor Botanical Garden, the branch of Yerevan Botanical Garden, contains about 600 plant species with more than 60 species of aboriginal trees.
- dendroparks, which are distributed within different administrative and floristic regions of RA.

Living plant collections build up botanical gardens and dendroparks. They are grown in open space and greenhouses and used for demonstration and research purposes. The open soil collections of trees, bushes and woody lianas and flowering plants were created taking into consideration taxonomic, geographical, ecological, decorative, etc. principles.

Yerevan Botanical Garden dendrarium was established with an ecology-geographical purpose basis, demonstrating dendroflora collections of Caucasus, The Crimea, Euro Siberia, Eastern Asia, the Far East and North America.

At present about 6000 plant species are grown and conserved under ex-situ conditions in Botanical Gardens and dendroparks. 5000 of them are to be found in Yerevan Botanical Garden where, besides 1200 tree-bush and 2000 flower species growing in the open soil, about 1000 species of tropical and subtropical plants are conserved in greenhouses.

Exceptional importance is also given to site of aboriginal flora in living conditions, which is introduced by 500 species. The site of aboriginal flora in Armenia, introduced by approximately 500 species, is considered exceptionally important.

3.1.4. Documentation System of the Ex situ Collections

Since the time of creation of the ex-situ collections and over, documentation has always been applied in scientific centers. The information on maintained accessories is reflected mainly in registration books. The centralized Database of plant genetic resources of Armenia was created with ICARDA support in 2001.

Since 2006 the central Database of plant genetic resources, as a national catalogue, has been updated in PGRFA gene bank established within the Scientific Center of Agrobiotechnology of the Ministry of Agriculture. The software developed and provided by ICARDA is used for data enter into a computer. The Database is expected to be available for all stakeholders.

The central Database of plant genetic resources includes passport (accession number, taxon, common name, collection number, geographical coordinates, country of origin, breeder's name, parental forms, etc.) and partly characterization and evaluation data of a great deal of plant accessories of the *ex situ* collections of RA. Passport information of accessions have been collected based on plant descriptors developed jointly by FAO and Bioversity International for separate plant groups. At the moment the national catalogue comprises 4976 accessories passport data.

The database of the Laboratory of plant gene pool and breeding of the Armenian State Agrarian University is operated through ACCESS program. Passport data of wheat accessories have been correlated according EWDB format. The database of the Scientific Center of Vegetable and Industrial crops is operated through Excel program. Other scientific centers reflect all information concerning accessories data in registration books. All *ex situ* collections data are periodically loaded to EURISCO internet search catalogue.

3.1.5. Improvement and expansion of the ex situ conservation: needs and priorities

Some anthropogenic factors, environment worsening and climatic changes bring about reduction in population number, narrowing of distributional range of numerous plants, including crop wild relatives.

Along with the process of agriculture and breeding development, some local variety-populations of crops, with a lower yield index in their relation to modern breeding varieties, gradually remain beyond cultivation. Yet, they are considered valuable breeding material due to their adaptability to local conditions, resistance and other biological and economic features. In this case the necessity of plant genetic diversity conservation is increasing, becoming one of the important components of the country's policy.

To expand the activities in the field of PGRFA ex-situ conservation scientific research studies have been implemented for years. It's an ongoing process carried out in relevant scientific institutions (SC of Agriculture and Plant Protection, SC of Vegetable and Industrial Crops, SC of Agrobiotechnology, SC of Viticulture, Fruit Growing and Wine-Making, SC of Soil Science , Agrochemistry and Melioration, Institute of Botany of NAS, Armenian State Agrarian University, Yerevan State University) related to the management objectives of plant genetic resources such as plant natural population studies, accessories collections, identification, characterization, evaluation, use in breeding and conservation. The research activities and their results are reflected in various scientific and popular-scientific publications, theses and proceedings of scientific conferences and meetings.

The financing of research themes is carried out in accordance with priorities defined by agricultural sustainable strategy, focused on plant gene pool conservation, and expansion of genebank of cultivated plants and their wild relatives, the creation of economically valuable species plantations and nurseries and the sustainable usage of natural resources. Primary objectives include

regeneration of fruit crops, local traditional and breeding varieties of grape, and the restoration of the collection of grape landraces. Mother orchards and *nurseries* were established in 2000-2004 in state experimental and private farms with the aim of creation and expansion of fruit crops living collections (*Nalbandyan experimental farm of the SC of Viticulture, Fruit-growing and Wine-making – 1.5 ha with 10 varieties of peach and 0.3 ha with 5 apricot varieties, 0.8 ha grape living collection in private farm in Aygehovit community of Tavush Marz with 6*).

At present the activities on evaluation of abiotic factors resistance of wild wheat and vegetable plant collections accessories are carried out.

Three year project on “Elaboration and introduction of the technologies of conservation, evaluation, characterization and documentation of autochthonic (local origin) plant genetic resources for food and agriculture in Armenia” state financed program was approved by the Government in 2008. It is targeted at expanding available seed collections, enhancing opportunities for reliable conservation, providing relevant technical means to carry out research and study expeditions, exchange and conservation of genetic material.

- **Need and Priorities**

Following measures and activities are essential to ensure PGRFA reliable conservation and the expansion of *ex situ* collections

- to equip the *ex situ* collections holder institutions with laboratory equipment and technical facilities including computers
- to train the *ex situ* conservation and data base involved staff
- to provide the institutions with sustainable internet connection to facilitate communication and accessories related data exchange
- to create enabling environment for accessories identification through application of modern methodologies and tools
- to enhance facilities for *in vitro* regeneration and maintenance of recalcitrant seeds
- to increase public awareness concerning PGRFA conservation and effective use; to get all interested farmers involved into accessories regeneration, characterization and evaluation activities
- to restore a collection of traditional varieties of cultivated plants through carrying out of restoration activities, repatriation of accessories of Armenian origin from gene banks of other countries, study and sampling of landraces still cultivated in separate farms
- to restore living collections of old traditional and breeding varieties of grape and fruits through rehabilitation of old collections, establishment of new ones by the technical support provided from donor and international organizations
- To expand the scale of accessories characterization and evaluation activities; to ensure wide PGRFA usage for breeding and variety improvement.

3. 1.6. Genetic erosion of ex-situ collections

The threat of erosion for *ex situ* collections increases as result of low seed germination, small number of seeds in accessories, limitations occurred during regeneration (different agro-ecological conditions, fair isolation of cross-pollinated plants).

At present the accessories of *ex situ* collections of the scientific institutions of Armenia prevail in having low germination or are absolutely void of it. With the absence of a gene bank they were maintained in not proper short term conservation conditions: not optimal room temperature. Due to limited financial and technical means they have been not propagated and regenerated on time.

The decrease in the quantity of PGR accessories is also observed in collection orchards of scientific centers of MoA. That's a result of insufficient cultivation, negative impact of biotic and abiotic factors, land privatization, etc.

A number of projects addressed regeneration needs of endangered accessories of *ex situ* collections are regularly implemented. The activities, carried out in the framework of implemented

projects, mostly cover vegetable crops and vegetatively propagated plants. Some activities have been carried out on wheat accessions regeneration. The implementation of the project on “Conservation and utilization in breeding of wild relatives of cereals in Armenia (2004-2006)” enhanced reproduction of 164 accessions of cereals. Reproduction of 1080 valuable samples of wheat, *Aegilops* and barley is anticipated to be done with the support of Crop Diversity Trust within the submitted project proposal.

Work scale ensuring regeneration and genetic diversity is necessary to extend in order to mitigate genetic erosion danger of *ex situ* collections. It is necessary to extend work scale addressed on regeneration and genetic diversity in order to mitigate genetic erosion danger of *ex-situ* collections. In this respect there is a demand for organization of training courses, either on regional or international level, supported by proper methodology or guidelines.

3.2. Planned & Targeted Collecting

3.2.1. Collecting Activities over the Past 10 Years

The increasing anthropogenic impact on the nature and global changes of ecological situation of biosphere threaten some plant species and bring about disappearing of some populations. Large scale utilization of biodiversity occurred without taking into account natural reproduction capacities and necessary preconditions for conservation. This kind of utilization gradually caused degradation and biodiversity overall impoverishment. After land privatization crop biodiversity drastically decreased; this is a consequence of a number of factors, including introduced plant species, soil, water and environment pollution, global climate changes, intensive agriculture, non-application of rotation in agricultural system, etc. In this conditions targeted and justified collections of plant samples (proper period of time, according to defined procedures and methodologies) will enhance *ex-situ* reliable conservation.

Samples selection which are subject to collection is stipulated with the objectives of research programs or study expeditions, as a rule, taking into account sample availability in *ex-situ* collections, species status (rare, endangered, etc), significance for food production and agriculture (old varieties, wild crop relatives), exchange opportunities.

PGRFA samples collection is periodically carried out by a scientific staff of the Institute of Botany of NAS, Armenian State Agrarian University and, in recent years, SC of Agrotechnology of MoA within the framework of relevant scientific themes, international and regional programs and field explorations, including joint international collection missions. The inventory of the flora of Armenia (species composition, distribution in the republic) is in the range of basic objective of the Institute of Botany. With the above mentioned objective herbarium and seeds for anatomic, caryological research and conservation purposes is collected as a result of periodically organized field explorations.

In 1998-2008 a large number of valuable accessions of cultivated and wild plants (cereals, grain legumes, forage grasses, fruit, fruit-berries, grapes, industrial, forest, ornamental) was collected as a result of all arranged local and international collection missions.

Traditional varieties and wild crop relatives make out the greater part of the collected material.

Some collection missions were carried out by the support of international organizations and with direct participation of researchers from Russia, Australia, Great Britain, USA, Syria, Slovenia, Japan, etc.

3.2.2. Research needs and priorities for planned and targeted collections

Scientific institutions while arranging expeditions usually face some constraints to their work: insufficient financing, the lack of trained staff, appropriate means of transportation, equipment and technical tools. The extension of planned and targeted collections of genetic resources focuses on the field collections and joint collection missions within the framework of regional and international

projects. That enables not only to make precise identification, but also to implement evaluation activities with joint efforts to ensure the usage of the accessories.

The planning of collecting activities on the basis of national catalogue data will contribute to effective use of technical and financial means. It will be possible after the data related to *ex situ* collections accessories have been loaded into the national catalogue.

3.2.3. Basic shortenings of collections of plant genetic resources (gaps, ways for their revelation and elimination)

At present the majority of *ex situ* collections accessories in scientific centers is in need of regeneration, even under the most optimal conservation conditions the vitality of samples is expected to fall in the course of time. In case of unique single samples similar losses can be irreplaceable. Consequently, monitoring of accessories vitality and periodical regeneration must remain a primary objective for *ex situ* conservation activities.

It is necessary also to improve the level of documentation in collections holder institutions, through use of computer programs, preferably of general format.

Running of national catalogue and coordination of *ex situ* collections by a national gene bank will enable precise identification of accessories subject to regeneration and implement correlated regeneration activities. To eliminate basic shortcomings in PGRFA collections there is a need for technical, methodological and training support from international organizations.

CHAPTER 4

THE STATE OF PGRFA USE

4.1. Utilization and enhancing of use of plant genetic resources

4.1.1. *Sharing of Plant Genetic Resources*

All existing *ex situ* collections in the republic since the very day their establishment have served as an object for investigation and initial breeding material. It has always been provided to scientific and educational institutions (scientific staff, students, post-graduate students) upon request. Yet even now there is no adopted mechanism on plant genetic resources distribution or any legislative base. At present the need for creation of the mechanism is being negotiated in terms of fulfillments of International Treaty on PGRFA obligations related to access to genetic resources and benefit sharing.

4.1.2. *Characterization and evaluation*

To encourage national capacity it is demanded to develop national information system, which will contain characterization and evaluation data of stored accessions PGRFA. *Ex situ* collections accessions have not been fully characterized at present, which is conditioned by the absence of modern methodological, technical facilities and proper staff. Evaluation data mainly contain agronomic features; characterization data – morphological or, in some cases, cytological.

Activities on plant genetic resources evaluation and characterization are implemented in eight scientific and educational institutions of the Ministry of Agriculture, Ministry of Education and Science and National Academy of Sciences.

The research results are published in national and international journals, proceedings of scientific conferences. The majority of available information is not digitized which hampers the exchange of information among different scientific institutions and *ex situ* collections holders.

To ensure effective and sustainable use of PGRFA in the republic it is necessary

- to enter evaluation and characterization data of all *ex situ* collections accessions into the national catalogue and update it periodically
- to ensure the access of evaluation and characterization data through establishment of an appropriate mechanisms for that
- to expand the range of implemented scientific themes directed at accessions evaluation
- to involve farmers and non-governmental organizations into genetic resources evaluation activities

4.1.3. *Base collections*

Ex situ base collections are available at the gene bank of the SC of Agrobiotechnology. The rest of them are short-term conservation collections, constantly used for breeding and comprehensive study purposes. The problem of creation of their base collections can be gradually solved in case long-term conservation conditions are available.

4.2. Improvement of use of plant genetic resources

4.2.1. *Actions taken to improve the use of plant genetic resources*

Relevant studies and applied projects targeted at the use of plant genetic resources, varieties improvement and creation of new varieties are carried out in the Republic:

- 159 new varieties of 15 crops have been developed and registered by the “Seed Agency” due to the use of introduced genetic resources in breeding and varieties improvement activities in last ten years
- “Armsim” variety of soft wheat was released in 2006 as a result of the study and selection of ICARDA and CIMMYT breeding nursery lines

- 4 variety samples of durum wheat and 2 perspective varieties of barley have been selected as a result of long testing of the wheat and barley breeding lines from ICARDA and CIMMYT breeding nurseries carried out in different natural climatic conditions
- 4 varieties of chick pea “Hatzavan”, “Sisian”, “Lilit” and “Alina” have passed a state variety testing and are ready to be released in 2008.
- 3 varieties of winter wheat (“Armik”, “Van”, “Aray”), 2 varieties of winter barley (“Utik”, “Sevan”), winter varieties of barley (“Alashkert”, “Vektva”), 2 varieties of soybean (“Milena”, “Menua”) are to be submitted for variety testing in 2008
- in 2005-2008 176 breeding lines of vegetable crops received from the World Vegetable Center have been evaluated in terms of adaptability to local conditions
- Breeding activities based on utilization of local breeding and imported varieties of grapes and fruit crops have been implemented. About 40 elite forms which are at the stage of investigation have been created.

The experience on the use of wild crop relatives in breeding is also available:

- Soft wheat variety “Voskehask” (*Aegilops tauschii* x Bezostaya 1) has passed variety testing and been released. It is cultivated now in the pre-mountain zone (Kotayk Marz) in a number of farms
- “Syunik 1” new variety of rye has been created through individual selection from rye field-weed variety. It has also passed state variety test
- “Zvartnots” emmer wheat variety has been created through crossing between durum wheat and two-grain wild wheat. It is at the stage of propagation, to be submitted for state variety test
- “Marina” new variety sample of barley has been created through crossing between wild barley (*H. bulbosum*) and multi-row barley (*H. vulgare*). It is at the stage of propagation, to be submitted for state variety test.

4.2.2. Constraints of the use of plant genetic resources

A number of factors hamper full and more effective use of plant genetic resources:

- the lack of stored accessories characterization and evaluation data based on application of modern assessment methodology
- the low level of access to accessories characterization and passport data due to the absence of designed web sites and internet connection
- the lack of appropriate staff (young specialists, breeders), technical means facilities and training for full scale breeding implementation
- the lack of strong collaboration links between collection holders of genetic resources and users, as well as farmers
- limited number of accessories is available in the gene bank and other collections

In recent years, with the purpose of mitigation of the above mentioned constraints, some actions, aimed at the extension of the use of plant genetic resources, have been taken.

- Within the framework of the EC/FAO project on “Designing an Integrated Strategy to for Improved Utilisation of Plant Genetic Resources for Food Security in Armenia” a joint study has been conducted by FAO, ICARDA and the Ministry of Agriculture of RA, titled “Elements of a National Strategy for Management and Use of Plant Genetic Resources in Armenia”. Some crucial recommendations on PGR conservation and use for the development of national policy have been introduced in the Study Report.

- A number of projects (e.g. participatory studies within the UNDP/GEF project on “in-situ conservation of crop wild relatives through enhanced information management and field application) which contributed to strengthening of collaboration links due to the all stakeholders involvement (collection holders, users, taxonomists) have been implemented.

- A realization of scientific theme on accessories evaluation of abiotic and biotic stress related resistance have been undertaken

- Within the framework of Agrarian technology assessment program (Rural Enterprise and Small-Scale Commercial Agriculture Development Project) underutilized crop varieties have been tested in farms (black wheat, patison, physalis) with the purpose of demonstration and introduction of new cultivation technologies.

4.2.3. Recommendations

Following actions are necessary to be undertaken to ensure effective and wider use of PGRFA:

- to extend activities on characterization and evaluation of geneplasma, taking as a ground the priorities, pointed out in the « Agriculture sustainable development strategy»
- to organize training courses at regional or international level on evaluation of plant genetic resources, use of molecular and biotechnological methods in breeding
- to strengthen institutional capacities, improve technical facilities
- to extend a range of pre-breeding activities
- to strengthen the links between breeders and seed producers, to encourage farmers' and seed producers' interest to modern varieties and technologies
- to improve means of communication and information exchange
- to improve of plant varieties protection system; to create privileged and favorable conditions for breeders by developing relevant legal environment.
- to organize field days with the purpose of demonstration of advantages of modern breeding varieties and marketing features of traditional ones
- to raise the level of public awareness, to incorporate PGRFA related issues into education and public awareness programmes.

4.2.4. Reducing genetic weakness in Agriculture System

As a result of privatization of land resources of agricultural significance the size of a farm plot in average is now about 1,4 ha. That hampers profitable application of intensive technologies (crop rotation, work mechanization, etc.). Cultivated land was fragmented into more than 1, 2 mln land plots. New technologies, the latest scientific achievements are not applied in farms. The major part of entities doesn't have relevant education and work experience. That impedes farming systems, agro-technical rules application, which, in its turn, brings to vulnerability of agrarian systems.

The solution to the problem includes land consolidation, diversification of agricultural production, farm cooperatives, creation of voluntary units (associations, communities, units) and introduction of new technologies.

4.2.5. Promoting desertification of crop production systems, Development and Commercialization of Under-Utilized Crops and Species

Vertical zoning of the territory of the republic and diversity of soil-climatic conditions are favorable for cultivation of multi-type crops, particularly fruit and vegetable plant species. At present with the purpose of extension of cultivated plants assortment the scientific institutions of MoA of RA study and develop cultivation technologies for new crops, which are demonstrated and tested on the farms within the framework of Agrarian technologies assessment project.

In scientific theme titled «Non traditional crops» was approved for the SC of vegetable and industrial crops.

4.3. Seed production system and sale markets

The establishment of profitable seed production system is of strategic significance for the country's food security.

A strong system of agricultural crops seed production existed in the republic before 1990's. Scientific research institutes were involved in primary seed-breeding and more than 120 seed-production state farms operating in the field of agriculture dealt with seed production. These farms were liquidated after privatization and, in fact, both primary seed-breeding (super elite, elite

production) and its reproduction in seed-breeding farms stopped operating in the republic. As a result the volume of production of high productive seeds drastically went down; the succession of seed propagation and reproduction technologies was broken, which sharply cut down technological progress in the branch.

The Gyumri Breeding Station, Echmiadzin experimental farm of the SC of Agriculture and Plant Protection and CS of Vegetable and Industrial crops have taken up primary seed-breeding since 1994, producing a limited quantity of winter wheat and vegetable crops seed material. The opportunity for partly satisfaction of land users' demand in seeds has been created due to the seeds/planting material export. However the reserve and insurance foundations failed to be established; no capital investments were made.

At present the low level of meeting a demand on quality seed material (15-20% at its best) brings to low yield of cereal crops. The lack of seed fields is a major constraint for the introduction of seed-production system; great deals of seed fields are in unsatisfactory phytosanitary state. Non-application of crop-rotation, the lack of appropriate technical base also proves to be unfavorable.

The «Concept of seed-breeding development in the Republic of Armenia in 2003-2010» has been elaborated by the Ministry of Agriculture to regulate the relations between state and private seed production sectors as well as for specification. The priority is given to development of private seed-breeding farms.

By the support of the Government of Armenia the new programme on production of high reproduction seeds of cereals has been started. The programme is implemented on the basis of Gyumri Breeding Station, SC of Agriculture and Plant Production, «Seed Producers Association of Syunik», «Seed Producers Support Association». The subsidy provided by the state will be serve as an incentive for production of high reproduction seeds, since now this business is not profitable. In nearest future it is expected to continue this seed production subsidy programme for other crops types.

To increase of a range of cereals production and level of self-sufficiency the state programme on «Development of seed-breeding of wheat and barley in the Republic of Armenia in 2007-2011» was developed. The ensuring of productions of high quality seeds of the best released varieties of local breeding and hybrids of vegetables crops which are of great demand, is also envisaged by this state programme.

4.4. Cultivation and Distribution of Local Varieties

Modern intensive crop varieties, especially of wheat, barley, potato, vegetable melon crops, due to their high productivity and resistance to pests and diseases, gradually displaced local varieties from the market. Local traditional varieties, which are quite adapted to local conditions and possess the best taste qualities, are still cultivated by some entities for their own needs in limited quantities. The list of old local varieties includes for example, Karmir Akfahat (Ferrugineum), Alti-Aghanj (Ferrugineum), Spitakahat (Grecum), Zarda (Hamadanicum), Galgalos (Delfi). They are less productive but more resistant to climatic changes in compliance with the imported varieties.

The grain legumes, despite their food and forage significance, occupy a limited area. In local markets they are mainly presented by highly demanded local varieties. Emmer wheat also belongs to the number of crops of this type and there is also high demand for emmer wheat landraces, which belongs to the number of likely crops, due to its taste qualities.

A great deal of imported vegetable crop varieties and hybrids has lower quality and taste features than the local ones. That aroused a great demand for local varieties of tomato and other vegetables in a market. Local varieties exceed the imported ones by their quality features; they are also accessible to farms and other rural entities for low prices for seed material.

CHAPTER 5

THE STATE OF THE NATIONAL PROGRAMMES, TRAINING AND LEGISLATION

5.1. Education and Training

The challenges of improvement of the level of ecological education are highlighted as priorities and envisaged in the «National Biodiversity Strategy and Action Plan». That particularly related to training of teachers, lecturers and the improvement of educational system aimed at biodiversity conservation at the level of schools and higher educational institutions.

The training of the appropriate staff through organization and conducting of seminars, workshops and experience exchange is underlined as a strategic direction in the «Strategy on the development of Natural Specially Protected Areas in Armenia» and Action Plan».

In 2001 the Law of RA “On population ecological education and upbringing” was adopted. According to this law the ecological education is implemented at pre-school, secondary, secondary-vocational, high, post-graduate levels, also involving wide levels of society.

PGRF related education is carried out mainly by specialized chairs of Armenian State Agrarian University and Yerevan State University.

Some short-term training courses organized by international organizations (Bioversity International, ICARDA, SIMMYT, AWWC, CIP NUFFIC, etc.) play an essential role in training specialists on PGRFA conservation methodology, accessories documentation, data base operation, running a gene bank, in-vitro conservation of plant material.

In the Republic there is a necessity in organization of trainings at local, regional and international levels. That refers to application of modern molecular and biotechnological methods for evaluation of genetic material, cryo-conservation, use of geographical information, application of new methods and modern approaches applied in adaptive breeding, accessories phytosanitary control.

5.2. Legislation

According to Article 10 of the Constitution of the Republic of Armenia the environmental control, its rehabilitation and effective use of natural resources are guaranteed by the state.

The country’s legislation which more or less relates to the issues of effective management of PGRFA has significantly been improved during the last 10 years (*Annex 3*).

- new regulations to eliminate gaps in legislation regulating the use of plant genetic resources has been elaborated – the Law of RA “On environmental control” (2005), “On seeds” (2005)
- to develop market economy, to sign new international agreements, to harmonize the national legislation with EU legislation the following regulations have been elaborated: the Law of RA “On nature specially protected areas” (2006), Forest Code (2005), the Law of RA “On plant quarantine and plant protection” (2006)
- the Law on “On new plant varieties” is at the stage of development.

A number of secondary legislation act and decrees related to PGRFA conservation and sustainable usage have been developed and adopted by the Government to ensure laws compliance.

Though PGRFA conservation and use related legislation has been significantly improved, yet there are challenges which can not be regulated by present legislation:

- development of encouragement mechanisms for the author of a breeding variety
- farmers’ rights precise determination
- development of criteria of PGR monitoring in special protected areas and cadastre running mechanisms
- establishment of control on penetrating of invasive species, which are potentially dangerous for PGR

- regulation of access to plant genetic resources and sharing of benefit resulted from their use.

5.3. Information Systems

It is difficult to ensure the effective use and conservation of plant genetic resources without centralized informational system. That enables farmers to get proper information on varieties and more effective use. Regularly updated database helps to find out accessories of prior importance in terms of PGRFA conservation, to organize collection missions and for users, to acquire accessories with required features.

In this respect some actions are taken in the Republic to register ex-situ collections accessories, to load information into computer database, to ensure their data availability in international catalogues. Yet, there are some issues to be solved:

- Up-to-date databases linked with a national inventory are not in place, which makes the access to seed collections difficult for breeders and farmers.
- No intranet structure to accommodate such linkages is available.
- In spite of availability of qualified and dedicated staff, additional staff is needed to carry out various tasks: develop and maintain information systems, perform regeneration activities, evaluations and monitoring of the population status in protected areas.

5.4. Public Awareness

Armenia has a signatory of Aarhus Convention since 2001. By assistance of OSCE four Public Environmental Information Centers have been established in 4 marzes to meet the obligations of the Convention. Centers are furnished with appropriate equipment, computers, and library and actively involve representatives of local communities into decision-making in the field of biodiversity conservation and sustainable use as well as planning and implementation of relevant activities.

The issues concerning public involvement in decision making in the field of bioresources protection and management plans development process are defined in a separate Chapter (Chapter VII) of the Law of RA “On nature specially protected areas”, where public rights to be informed on NSPAs related activities are highlighted.

The national reports on biodiversity prepared by RA Ministry of Nature Protection and information on plant resource collections, import and export permissions can be found on www.mnp.am Internet website, which is available for all layers of population.

In the framework of “Assessment of Priority Capacity Needs for Biodiversity Conservation and Establishment of CHM Structures” project, “Armenian biodiversity” website was designed and launched in 2002 (www.biodiv.am).

In the framework of “UNEP/GEF *In situ* conservation of crop wild relatives through enhanced information management and field application” project a national site (www.cwr.am) has been created to ensure CWR related information exchange and access.

As an output of the “Ecological information, education and public awareness raising” project funded by TACIS, the draft “Regulations on ecological information collection and dissemination” was developed.

Activities on public awareness raising and information dissemination are actively implemented at local level in forms of organization of public hearings, round tables, establishment of regional environmental information centers, dissemination of booklets/brochures on relevant themes, conduction of lectures, etc. Many regional and international projects related to PGR conservation and use include the public awareness component, within frames of which booklets, video films, meetings with local communities and farmers, field days are organized. A great number of projects related to biodiversity conservation and public awareness are implemented by more than 10 NGOs.

CHAPTER 6.

THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

6.1. General Situation on International Collaboration

During the last years the collaboration of the republic with regional and international organizations related to PGRFA conservation and usage (FAO, Biodiversity International, ICARDA, CIMMYT, CIP, ACIAR, Asian Center on Vegetable breeding development and research, World Vegetable Center, etc.) as well as other countries' gene banks, research institutions (Russia, Slovakia, Japan, USA, etc.) has significantly expanded.

The Ministry of Agriculture has signed collaboration agreement with ICARDA covering germplasm exchange, information and related methodology sharing, visits of scientists. Within the frames of this agreement some Armenian specialists have been trained by ICARDA on documentation and databases.

The SC of agriculture and Plant Protection of MoA have a joint programme of activities targeted on potato virus free mini-tubs production.

The cooperation agreement between USDA/MAP and Armenia covered germplasm exchange, training on GRIN system, collections missions on the territory of the republic.

The organization of collection missions, through collaboration agreements, English language and data base operating trainings, specialized courses has significantly benefited (contributed) to the improvement of qualification of the involved staff and public awareness. Along with that seed collections has been enriched and national gene bank has been established.

In 2004 together with other Caucasus republics Armenia has been included into EU "European Neighborhood Policy" (ENP). Taking into consideration the country's priority issues related to environment protection and biodiversity Armenia has submitted its recommendations to be included into Armenia-EU Action Plan, where Armenian environmental cooperation with European countries in this given sphere has to be reinforced.

6.2. International Networks

Being a member of ECPGR since 2002 Armenia is represented in working groups of its coordination network.

Republic of Armenia is full member of the Regional Network – Central Asia and Trans-Caucasus Network and took part in many projects implemented in the framework of this network.

Armenia is a part of WIEWS (Global Network of the World Information and Early Warning System on PGR), 18 institutions have been registered in the system, including state, private organizations and NGOs.

6.3. International Programs and Agreements

At present the Republic of Armenia is a party to 15 environmental conventions and 3 protocols, including:

- ♦ Convention on Biodiversity (1993)
 - Cartagena Protocol on Biosafety (2004)
- ♦ UN Framework Convention on Climate Change (1993)
 - Kyoto protocol (2002)
- ♦ The Ramsar Convention on Wetlands (1993)
- ♦ Convention to Combat Desertification (1997)
- ♦ The European Landscape Convention (2004)
- ♦ International Convention on Plant Protection (2006)

- ♦ International Treaty on PGRFA (2007)
- ♦ The Convention on the Conservation of European Wildlife and Natural Habitats (2008)

The Global Plan of Actions for conservation of plant genetic resources for food and agriculture on PGRFA were adopted by Armenia in 1996.

Armenia has also been a member of European Cooperative Program on PGR since 2000.

Armenia is a party of Pan-European Strategy on Biological and Landscape Diversity and participants to the processes held within that strategy.

Armenia is included into UNDP, UNEP and OSCE “Environment and Security” regional initiative’s “Risk transformation cooperation” project implementation. The development of a legal document (“Caucasus Convention”) addressed needs in conservation of Caucasus mountainous ecosystems is envisaged.

It is essential to note that international price growth of food products is a serious challenge, which is possible to overcome only with joints efforts of international societies and states, particularly focusing on the expansion of regional collaboration in this field and implementation of joint projects.

CHAPTER 7.

ACCESS TO PGRFA AND BENEFIT SHARING RESULTING FROM THEIR USE, AND FARMERS' RIGHTS

7.1. Access to Plant Genetic Resources

Through ratification of the Convention on Biological Diversity in 1993 the Republic of Armenia committed to the fulfillment of obligations on PGR conservation and sustainable use along with responsibilities on access to genetic resources and equitable sharing of benefit arising out of their use.

On March 20, 2007 the country joined the International Treaty for Plant Genetic Resources for Food and Agriculture. Being a member of this international treaty, Armenia, like other member countries of the Treaty, has to meet commitments to enhance the access to plant genetic resources covered by Annex 1 of the Treaty (*Annex 4.*) and equitable sharing of benefits resulting from their use.

At present Armenia has not developed any special legislation regulating access to genetic resources. Available *ex situ* collections accessories in Armenia, acquiring the appropriate certificate from of the Plant Quarantine State Inspectorate of the ministry of Agriculture of RA are provided to other countries' gene banks, scientific institutions for their research work, accessories exchange upon request.

7.2. Fair and Equitable Sharing of the Benefits of the Use of PGR

The provisions on equitable sharing of benefits of the use of PGR, which are defined by the Convention on Biological Diversity, are in an urgent need of improvement of regulations in Armenia. The first step in this area were undertaken in 2002, when within the framework of UNDP/GEF "Self-assessment of the national capacities for the global environmental management" project the draft national strategy on access to genetic resources and was developed. It was based on the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization. The activities directed at the revision of the national strategy along with development of conception and law on access and benefit-sharing are implemented in the framework of the project "In-situ conservation of crop wild relatives through enhanced information management and field application".

7.3. Implementation of Farmers' Rights

The rights of peasant farms are regulated in Armenia by Civil Code (2001). The Government of RA also regulates economic activities of farms, individual farmers through tax policy, Water and Land Codes, Law «On breeding achievements protection», Law «On water users and associations of water users», and secondary legislation. With the purpose of protection of farmers concern and increase effectiveness of agricultural systems Government of RA has a successive approach in the implementation of the state programmes addressed to the development of irrigation system, land improvement, pastures watering, agricultural crops pest control.

"The Strategy of sustainable development of agriculture" project envisages improving tax and crediting system in agriculture through development and introduction of subsidizing mechanisms.

CHAPTER 8.

CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

The challenge of raising the level of food security is one of priorities of the country's economy. At present this challenge is considered in the terms of international price growth for food products, taking into account the republic's dependence on import of a number of food products of vital importance.

The rise of the level of physical and economic availability of food products is implemented in compliance with the requirements of the RA Law of the Republic of Armenia on "Food Security" (2002) within the framework of Food Security policy of RA and Poverty Reduction Strategy Paper.

Activities targeted at the rise of the level of physical and economic availability of food products contribute to the increase of the level of self-sufficiency for main food products.

In 2005-2007 the average data for the level of self-sufficiency for wheat was 37,3%, grain legumes crops - 53,2%, vegetable oil - 5,6%. In this respect the replacement of import food products by locally produced food products is getting very important, which, in its place, is conditioned by profitable management of plant genetic resources used for food production and agriculture.

A series of measures are undertaken to raise the level of availability of food products. The implementation of these measures will enhance the increase of production of agricultural products and foster the rise of the level of main food products self-sufficiency. Activities envisaged by strategic documents include objectives related to the PGRFA profitable management:

- stimulation of the local production of food products of vital importance, especially bread, vegetable oil, sugar
- introduction of new technologies for cultivation of more profitable forage crops (maize, fodder beet, Jerusalem artichoke, non-traditional crops, etc.)
- introduction of new technologies for cultivation of new crop varieties
- introduction of crops ensuring high value added value and satisfying market requirements.

The National Programme on «Agriculture development and increase of the level of self-sufficiency for main food products for 2008-2010» is in the stage of development at the moment. It is in the range of activities targeted at the raise the level of self-sufficiency of agricultural food products of vital importance, to create favorable conditions for agricultural entities, to enhance sub-sectors of relative advantages and by proper using agricultural resource potential.

List of principal crop wild relatives of Armenia

Crop name	Species name	Crop name	Species name
CEREALS		LEGUMES	
Wheat	<i>Triticum araraticum</i> Jakubz.	Lentil	<i>Lens orientalis</i> (Boiss.) Schmalh.
	<i>T. boeoticum</i> Boiss.		<i>L. ervoides</i> (Brign.) Grande
	<i>T. urartu</i> Thum.ex Gandil.	Liquorice	<i>Glycyrrhiza glabra</i> L.
Aegilops	<i>Aegilops crassa</i> Boiss.		<i>G. echinata</i> L.
	<i>A. tauschii</i> Cosson	Pea	<i>P. sativum</i> L. subsp. <i>humile</i> (Holmb.) Greut., Matthäs & Risse
	<i>A. umbellulata</i> Zhuk.		<i>P. elatius</i> M. Bieb.
	<i>A. cylindrica</i> Host		<i>Vavilovia formosa</i> (Steven) Fed.
	<i>A. triuncialis</i> L.	Grass pea	<i>Latirus cicera</i> L.
	<i>A. biuncialis</i> Vis.	Bitter vetch	<i>Vicia ervilia</i> (L.) Willd.
	<i>A. triaristata</i> Willd.	OIL and/or FIBER CROPS	
	<i>A. columnaris</i> Zhuk.	Safflower	<i>Carthamus oxyacanthus</i> M. Bieb.
<i>A. mutica</i> (Boiss.) Eig.		<i>C. gypsicola</i> Iljin	
Rye	<i>Secale vavilovii</i> Grossh.	Turnip	<i>Brassica rapa</i> L.
	<i>S. montanum</i> Guss.	Rape	<i>Brassica napus</i> L.
Barley	<i>Hordeum spontaneum</i> C.Koch	Flax	<i>Linum bienne</i> Mill.
	<i>H. glaucum</i> Steud.	Gold of pleasure	<i>Camelina sativa</i> L.
	<i>H. murinum</i> L.	Hemp	<i>Cannafis sativa</i> L.
	<i>H. geniculatum</i> All.	CONDIMENTS	
	<i>H. marinum</i> Huds.	Thyme	<i>Thymus kotschyanus</i> Boiss. & Hohen
	<i>H. violaceum</i> Boiss. et Huet	Summer savory	<i>Satureja hortensis</i> L.
	<i>H. bulbosum</i> L.	Tarragon	<i>Artemisia dracunculus</i> L.
	<i>H. hrasdanicum</i> Gandil.	Sumac	<i>Rhus coriandra</i> L.
FRUITS CROPS		Wormwood	<i>Artemisia absinthium</i> L.
Mountain ash	<i>Sorbus aucuparia</i> L.	Lemon balm	<i>Melissa officinalis</i> L.
	<i>S. haiastana</i> Gabr.	Caraway	<i>Carum carvi</i> L.
	<i>S. takhtadjanii</i> Gabr.	Oregano	<i>Origanum vulgare</i> L.
	<i>S. subfusca</i> (Ledeb) Boiss.	Brown mustard	<i>Brassica juncea</i> (L.) Czern.
Crataegus	<i>Crataegus orientalis</i> Pallas ex M.Bieb.	Hop	<i>Humulus lupulus</i> L.
	<i>C. pontica</i> C.Koch	Coriander	<i>Coriandrum sativum</i> L.
Apple	<i>Malus orientalis</i> Uglitzk.	Mints	<i>Mentha longifolia</i> (L.) L.
Grape vine	<i>Vitis sylvestris</i> C.C.Gmelin		<i>M. pulegium</i> L.
Currants	<i>Ribes biebersteinii</i> Berland. ex DC.		<i>M. arvensis</i> L.
	<i>R. armenum</i> Pojark.	VEGETABLES	
Diospyros	<i>Diospyros lotus</i> L.	Spinach	<i>Spinacia tetrandra</i> Steven ex M. Bieb.
Plum	<i>Prunus domestica</i> L.	Beet	<i>Beta vulgaris</i> subsp. <i>maritima</i> (L.) Arcang
	<i>P. cerasifera</i> Ehrh.		<i>B. lomatogona</i> Fisch. et C.A.Mey
	<i>P. spinosa</i> L.		<i>B. macrorrhiza</i> Steven
Pear	<i>Pyrus caucasica</i> Fed.		<i>B. corolliflora</i> Zoss. ex Battler
	<i>P. syriaca</i> Boiss.	Carrot	<i>Daucus carota</i> L.
	<i>P. takhtadzhianii</i> Fed.	Asparagus	<i>Asparagus officinalis</i> L.
	<i>P. medvedevii</i> Rubtzov		<i>A. verticillatus</i> L.
Medlar	<i>Mespilus germanica</i> L.		<i>A. persicus</i> Baker
Cornelian cherry	<i>Cornus mas</i> L.	Garden cress	<i>Lepidium sativum</i> L.
Pomegranate	<i>Punica granatum</i> L.	Chicory	<i>Cichorium intybus</i> L.
Silver berries	<i>Elaeagnus angustifolia</i> L.	Leek	<i>Allium ampeloprasum</i> L.
	<i>E. orientalis</i> L.	Purslane	<i>Portulaca oleracea</i> L.
Fig	<i>Ficus carica</i> L.	Sorrel	<i>Rumex acetosa</i> L.
Wood strawberry	<i>Fragaria vesca</i> L.		<i>R. crispus</i> L.
Raspberry	<i>Rubus idaeus</i> L.	Watermelon	<i>Citrullus colocynthis</i> (L.) Schrad.
Quince	<i>Cydonia oblonga</i> Mill.	Melon	<i>Cucumis melo</i> L. subsp. <i>agrestis</i> (Naud.) Pangalo
Apricot	<i>Armeniaca vulgaris</i> Lam.		Radish
Sea buckthorn	<i>Hippophaë rhamnoides</i> L.	NUT CROPS	
Jujube	<i>Ziziphus jujuba</i> Mill.	Almond	<i>Amygdalus nairica</i> Fed.&Takht.
Rosa	<i>Rosa hemispherica</i> J. Herm.		<i>A. fenzliana</i> (Fritsch) Lipsky.
Sweet cherry	<i>Cerasus avium</i> (L.) Moench	Hazel	<i>Corylus avellana</i> L.
Sour cherry	<i>Cerasus vulgaris</i> Mill.	Walnut	<i>Juglans regia</i> L.
Bird cherry	<i>Padus racemosa</i> (Lam.) Gilib.		
Gooseberry	<i>Grossularia reclinata</i> (L.) Mill.		

STATE RESERVATIONS OF ARMENIA

N	Name	Year of establishment	Territory (ha)	Location	Protected objects
1	2	3	4	5	6
1	“Arjatkhlēni” Hazelnut	1958	40	Northern slopes of Ijevan Mountainous Range, Khaghaghaghbyur River Basin, 1500-1800m above sea level	Relict groves of yew and hazel-nut
2	Ijevan	1971	7800	Slopes of Ijevan Mountainous Ranges, River Aghstev Basin, 900-2100m above sea level	Rare and valuable animal species (brown bear, roe-deer, black grouse)
3	Gandzakar (Upper Aghdan)	1971	6800	Ijevan Mountainous Ranges, River Paytajur Basin, right tributary of River Aghstev	Mountainous forests, rare and valuable animal species (brown bear, roe-deer, black grouse)
4	Akhnabat Yew Grove	1958	25	Polaz River Basin, south-eastern slopes of Miapor Mountainous Range, near the village Akhnavank, 1400-1700m above sea level	Unique relict yew grove with 300-400 year old trees
5	Her-Her Open Woodland	1958	6139	Right tributary of River Arpa, Her-Her River Basin, 1400-2000m above sea level	Relict yew open woodland and remnant orchards of pear, tragacanth milk vetch
6	Jermuk	1958	3865	Arpa River Basin, 1100-2800 m above sea level	Rare animals, Armenian mouflon, Bezoar goat, brown bear, Caucasian leopard, mountainous forests
7	Yeghegis	1971	4200	Right tributary of River Arpa, River Yeghegis Basin, 1200-2800m above sea level	Rare and valuable animal species – bezoar goat, Armenian mouflon, Caucasian leopard, rich diversity of wild wheat
8	Jermuk hydrological	1981	18000	Upper course of River Arpa	Mineral water Jermuk
9	Caucasian Rosebay	1959	1000	Northern slopes of Pambak and Tsakhkunyats Mountainous Ranges, 1900-2200m above sea level	Caucasian rose-bay
10	Margahovit State reservation	1959	5000	Northern Slopes of Pambak Mountainous Range, 1900-2200m above sea level	Forest animals – roe-deer, brown bear, red deer, Caucasian black grouse
11	Goris	1971	1900	Basins of River Vorotan and its tributary Vararakn, 1400-2800m above sea level	Forest ecosystems typical for the region, threatened species of flora and fauna
12	Boghakar n	1989	2728	Slopes of Southern Zangezur Mountainous Range, 1400-2100m above sea level	Typical species of Armenian flora and fauna
13	Sev Lich	2001	240	Near the crater of the Mount Mets Ishkhanasar (Syunik volcanic plateau), 2658m above sea level	High mountainous volcanic reservoir and adjacent areas with plant and animal associations, 102 species of vascular plants, alpine meadows

1	2	3	4	5	6
14	Juniper Open Woodlands of Sevan (Gyuney)	1958	3312	Slopes of Areguney and Sevan Mountainous Ranges surrounding Lake Sevan	Unique relict juniper and oak open woodlands with typical fauna and flora
15	Getik	1971	6000	River Getik Basin, right tributary of River Aghstev, 1500-2700m above sea level	Rare and valuable animal species – roe-deer, brown bear, wild boar, black grouse
16	Pine of Banx	1958	4	Marmarik River Basin, northern slopes of Tsakhkunyats Mountainous Range, 1800-2000m above sea level	Unique planted stands of pine of Banx
17	Plane Grove	1958	64,2	Southern Armenia, Tsav and Shikahogh River Banks, 700-800m above sea level	The only natural plane grove in the Caucasus
18	Arzakan and Megradzor	1971	14500	Marmarik and Dalarik River basins, 1600-2100m above sea level	Rare and valuable animal species – roe-deer, brown bear and other forest species
19	Hankavan hydrological	1981	9350	Upper course of River Marmarik	Mineral water Hankavan
20	Gyulagarak Pine	1958	2576	Northern slopes of Bazum Mountainous Range surrounding Lori depression, 1400-1900m above sea level	Relict pine forests
21	Ararat Vordan Karmir	1987	204	Semi-desert areas of Ararat Valley, 850-1000m above sea level	Ararat cochineal and typical semi-desert vegetation, unique plant association
22	Goravan Sands	1958	95,99	Inclined flat areas of Ararat valley, on the southern outskirts of the town Vedi, nearby the village Pokr Vedi, near village Goravan, 1100-1200m above sea level	Remnant sands with unique species of plants and animals
23	Aragats Alpine	1959	300	“Kare” Lake with adjacent alpine meadows, 3200-3350m above sea level	“Kare” (Stone) Lake and surrounding alpine flora
24	Khor Virap	2007	50,28	Central Armenia, Ararat Marz, in the administrative boundaries of Pokr Vedi village community, left side bank of Araks River, nearby the monastery complex Khor Virap, adjacent to Artashat ancient capital, 820m above sea level	Wetland ecosystems of international significance: flora and fauna, especially swimming birds, rare species of flora and its habitat
25	Gilan	2007	118	Pre-mountain zone of South-western part of Geghama Mountainous Range, 1330-1400m above sea level – “Khosrov Forest” State Reserve on the base of “Bayburd” site	Semi-forest and pre-mountain ecosystems, flora and fauna and historical-cultural values

List of laws related to PGR conservation and use

<i>Law of the Republic of Armenia</i>	<i>Year</i>
Law on Expertise to Assess the Impact on Environment	1995
Law of the Republic of Armenia on Environmental Impact Examination	1995
Law on Environment Protection Taxes and Natural Resources Consumption Taxes	1998
Law on Flora	1999
Law on Breeding Achievements Protection	1999
Law on Lake Sevan	2001
Law on Environmental Control"	2005
Law on Tariffs for Compensation of Harm Causes to Flora and Fauna due to Environmental Legislation Violations	2005
Law on Payments for Bioresources Use and Environment Protection	2005
Forest code"	2005
Law on seeds	2005
Law on Plant Quarantine and Plant Protection	2006
Law on Nature Especial Protected Areas	2006

List of plant species covered by Annex 1 of the Treaty available in the flora of Armenia

Major food Plants	Number of species available in Armenian flora	Leguminous forage plants	Number of species available in Armenian flora	Grass forage plants	Number of species available in Armenian flora
Asparagus	3	Astragalus	128	Andropogon	1
Avena	3	A.cicer	yes	Agropyron	7
Beta	4	Hedysarum	8	A.cristatum	yes
Brassica	4	Lathyrus	24	Agrostis	11
Brassica napus	yes	L.cicera	yes	A.stolonifera	yes
Brassica repa	yes	L.hirsutus	yes	Alopecurus	8
Armoracia	1	L.odoratus	yes	Arrenatherum	2
Barbarea	1	L.sativus	yes	A.elatius	yes
Cameliana	1	Coronila varia	yes	Dacthylis	1
Crambe	4	Lotus	4	D.glomerata	yes
Diploaxis	2	L.corniculatus	yes	Festuca	15
Eruca	1	Lupinus	2	F.arundinacea	yes
Isatis	4	L.albus	yes	F.pratensis	yes
Lepidium,etc	13	L.andustifolius	yes	F.rubra	yes
Raphanus	1	Medicago	12	F.ovina	yes
Rorippa	2	M.falcata	yes	F.gigantea	yes
Sinapis	1	M.sativa	yes	Lolium	3
Cicer	2	M.rigidula	yes	L.perenne	yes
Daucus	1	Melilotus	5	L.rigidum	yes
Fragaria	3	M.albus	yes	L.hybridum	yes
Helianthus	1	M.officinalis	yes	Phalaris	2
Hordeum	11	Onobrychis	21	Ph.arundinacea	yes
Ipomoea	1	O.vicifolia	yes	Phleum	12
Lens	2	Ornithopus	1	Ph.pratense	yes
Malus	2	Trifolium	29	Poa	16
Pennisetum	1	T.alpestre	yes	P.alpina	yes
Phaseolus	5	T.ambigum	yes	P.annua	yes
Pisum	3	T.angustifolium	yes	P.pratensis	yes
Secale	3	T.arvense	yes		
Solanum	4	T.hybridum	yes		
S.melongena	yes	T.pratense	yes		
S.tuberosum	yes	T.repens	yes		
Sorghum	2				
Triticosecale	1				
Triticum	13				
Vicia	30				
Vigna	1				
Zea	1				

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