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

KAZAKHSTAN REPUBLIC

Country Report on the State of Plant Genetic Resources for Food and Agriculture in the Kazakhstan Republic

Scientific and Production Center of Farming and Plant Growing
Ministry of Agriculture of Kazakhstan Republic

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Note by FAO

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The National Committee prepared the National Report on a State of Plants Genetic Resources for the Food and Agriculture in Kazakhstan under the direction of the Scientific and Production Center of Farming and Plant Growing, Ministry of Agriculture of Kazakhstan Republic.

The National committee included representatives from:

SPCGF – Scientific Production Center of Grain Farming of MOA RK;
SWSPCA – South-Western Scientific and Production Center of Agriculture of MOA RK;
SPCF - Scientific-Production Center of Forestry of MOA RK;
RCLV - Research Center for Livestock and Veterinary
SPCFPP - Scientific and Production Center Food Production and Processing;
RCPV - Research Center of Potato and Vegetable of MOA RK;
IBPH - Institute of Botany and Phytointroduction MES RK;
IPBB - Institute of Plants Biology and Biotechnology, MES RK;
SRIPBS - Scientific Research Institute Problems of Biological Safety, MES RK.

For preparation of the report the published materials, reports of scientific institutes of the Republic, the data of Main Statistical Management, Ministries of Agriculture RK and the National Information Sharing Mechanism have been used.

CONTENTS

LIST OF ACRONYMS

Aktyubinskaya AES	Aktyubinskaya Agricultural Experimental Station
CAC	Central Asia and Caucasus
CAC/ PGR	Central Asia and Caucasus Network on PGR
CBD	Convention on Biology Diversity
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Center of Maize and Wheat Improvement
CWR	Crop Wild Relatives
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Ecological Fund
IBPH	Institute of Botany and Phytointroduction, MES RK
ICARDA	International Center of Agricultural Research in Dry Areas
IPBB	Institute of Plants Biology and Biotechnology, MES RK
IPGRI	International Plant Genetic Resources Institute
Karabalyk AES	Karabalyk Agricultural Experimental Station
KBES	Krasnovodopad Breeding Experimental Station
MEP	Ministry of Environment Protection
MES RK	Ministry of Education and Science of Republic Kazkhstan
MOA RK	Ministry of Agriculture of Republic Kazkhstan
NGO	Non Governmental Organization
NISM	National Information Sharing Mechanism on PGRFA
PGRFA	Plant Genetic Resources for Food and Agriculture
RCLV	Research Center for Livestock and Veterinary
RCPV	Research Center of Potato and Vegetable of MOA RK
SPA	Special Protected Areas
SPCF	Scientific and Production Center of Forestry, MOA RK
SPCFPG	Scientific and Production Center of Farming and Plant Growing, MOA RK
SPCFPP	Scientific and Production Center for Food Production and Processing, MOA RK
SPCGF	Scientific Production Center of Grain Farming, MOA RK
SRIPBS	Scientific Research Institute Problems of Biological Safety, MES RK
SRO	Scientific Research Organization
SWSPCA	South-Western Scientific and Production Center for Agriculture, MOA RK
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
USDA	USA Department of Agriculture
WFP	Wild Plants for Food

RESUME

Plants genetic resources are a major factor for steady agricultural production. The important role of genetic resources in the preservation of ecological equilibrium of an environment and the special importance for ensuring food safety have been noted in the last decade by a number of international documents (CBD, 1992; GPA, 1996; ITPGRFA, 2004). Kazakhstan is a region rich in primary and secondary gene pools of many cultivated and wild plants (Vavilov, 1930). According to Pavlov (1956), the Kazakh flora consists of 5 700 species, according to S.A.Abdullina, (1999) of 6 000 species of vascular plants, of which 210 species are crop wild relatives. In Kazakhstan, there have been radical changes in many ecosystems, deep anthropogenic transformation of steppe and of forest-steppe zone as a result of large-scale scarce of lands during 1954-1960.

According to the "National Report on biodiversity" (1998) during the last few years a number of species can no longer be found in the territory of Kazakhstan. 70 plant species were included in the first edition of the Kazakhstan Red Data Book and are now protected by the Government. New information is being prepared for the second edition of the Red Data Book of Kazakhstan, which will include 404 species of plants in danger. According to «The National program of actions against desertification in Republic Kazakhstan» (Almaty, 1997), half from 19 species of different forage plants are threatened with extinction in the near future. Crop wild relatives and wild plants for food are under direct threat of genetic erosion (Baytenov, 1984, 1988). Landraces and farmers' varieties, unique genetic material, sources of tolerance and resistance to diseases, pests, cold, and drought are at risk of being completely lost (Urazaliev R.A. 1992, 1995).

The Convention of the Biodiversity (CBD) was signed by Kazakhstan together with 152 countries worldwide (1992). With the ratification of the CBD, three national scientific programs have been established for the conservation and sustainable use of PGRFA which have designated 4 basic directions of research: collection; evaluation; documentation and conservation of agriculture plant germplasm identified as sources for economically valuable attributes. First of all, national programs on genetic resources for food and agriculture are directed to identify a particular genetic diversity and the threats to that genetic diversity in *ex situ* collections. Conservation of a biodiversity *in situ*/*ex situ* is a priority for the national program on plants genetic resources. Existing collections are stored with various degrees of risk, due to uncontrollable conditions of temperature and humidity. The difficulty in creating a National genefund has been a priority for Kazakhstan since the decision (1 429 from 29.12.2004), which the Kazakhstan government made decisions regarding construction of National storage.

A brief description of Republic Kazakhstan, its agriculture, and state of a biodiversity, in particular agro-biodiversity, is articulated in the National Report. Questions regarding an effective utilization, conservation, and attraction of new germplasm are connected in the report with *in situ* and *ex situ* resource management and with the decision, in regards to questions about annual inventory and standard certification of new and available germplasm, creation on this basis of base collections. The analysis of national programs, training and the legislation state offer the information about utilization of resources, about both regional and international cooperation and its influence on the admission to genetic resources of plants for food and agriculture, on distribution of benefit from their use and on the contribution of plants genetic resources management in maintenance of food safety and steady development of the country.

INTRODUCTION: CHARACTERISTICS OF KAZAHSTAN REPUBLIC AND ITS AGRICULTURE

Kazakhstan is a land locked country in Central Asia. It is the ninth largest country in the world at 2 717 300 sq km (i.e. 1 049 150 sq miles), exceeding that occupied by twelve countries of the European Union. The population is 15 millions people. Kazakhstan borders upon the following states: China – 1 460 km – long border; Kyrgyzstan - 980 km; Turkmenistan – 380 km; Uzbekistan – 230 km; the Russian Federation – 6 467 km. The northernmost point in Kazakhstan - 55′ 26′ NL –corresponds to the latitude of Moscow Russia. The southernmost point - 40′ 56′ NL – corresponds to the latitude of Madrid, Istanbul, and Salt Lake City, UT, USA. In east–west direction, Kazakhstan extends 3 000 km across an arid/semiarid territory from the Volga River to the Altai Mountains. In the north-south direction, it extends 2 000 km from the lowland plains of western Siberia to the desert of Kyzylkum and the Tien Shan Mountains. The lowest point is Karagie lowland on Mangyshlak peninsula (-132 m below sea level), and the highest point is Khan-Tengri peak in the mountains (about 7 010 m above the sea level). The climate is continental, marked by cold winters and hot summers. The deep continental locating of Kazakhstan appreciably determines its natural settings. More quarters of Kazakhstan territory occupy steppes, half - deserts and semideserts, other quarter - mountains, the seas, lakes and the rivers. In Kazakhstan almost on 22 million hectares have ranged the forests and foresting, there are 11 thousand rivers and the rivulets. The largest rivers of Kazakhstan - Irtysh - (4 248 km), 1 700 km is on territory of republic, Ishim (2 450 and 1 400 km accordingly), Ural (2 428 and 1 082 km), Syr-Darja (2 219 and 1 400 km), Ili (1 001 and 815 km), Chu (1 186 and 800 km), Tobol (1191 and 800 km), Nura (all of 978 km within the limits of Kazakhstan). There are more than 7 thousand lakes and water reservoirs. The largest lakes are Caspian Sea, Aral Sea, Balkhash, Zaisan, Alakol and Tengiz. From the north on the south the territory is divided on following zones: forest-steppe, steppe, semidesert, desert, and then foothill and mountain region. The territory is presented by various soils: the most part of a forest-steppe zone is occupied with chernozem soil, to the south of them are had dark-chestnut, light-chestnut and chestnut soils. Soils of deserts and semideserts are represented by grey soils. In the south and a southeast of Kazakhstan the sands approach to mountains Tjan-shany, this has stretched on 2 400 km. The highest point of Barlykskiy, Jungarskiy, Zailiyskiy, Talasskiy and Ketmenskiy Ala-Tau ridges - the peak of Khan-Tengri (7 010 m above sea level). South Altai adjoins the East of Kazakhstan (figure 1).

FIGURE 1
Physical map of Kazakhstan

Agriculture is one of the leading branches of Kazakhstan's economy. The main objective of the state agriculture programs RK till 2010 is maintenance of the country food security on the basis of competitive production. The tendency of the sown area structure stabilization was outlined in the past years in a plant growing. The predominant role belongs to cereal crops (up to 13.5 mln. ha annually) table 1, 2. Positive dynamics of productivity increasing is noted, table 3. The Export potential of the country estimates within the limits of 5-6 million tons/ year - 6 place in the world grain export (data MOA RK, 2004).

TABLE 1

Structure of areas under crops (%) of Kazakhstan Republic

Groups of crops	Structure of areas under crops (%)
Cereals	80.1
Forage crops	12.0
Oil-producing crops	4.15
Sugar beet	0.1
Potato	0.9
Leguminous	0.2
Technical crops	0.05
Vegetable and melon crops	0.8
Other cultures	0.7
Total	**100**

TABLE 2

Areas under agricultural crops in Kazakhstan, 1990-2005, thousand ha

	1990	1995	2000	2003	2004	2005
All area under crops	35 182.1	28 679.6	16 195.3	17 447.3	17 995.7	18 419.4
Including cereal crops of all	23 355.9	18 877.7	12 438.2	13 862.5	14 260.8	14 802.3
Commercial crops	439.9	702.2	631.1	863.0	919.2	890.5
Potato, vegetable and melon	320.8	310.8	302.3	318.9	324.4	321.9
Fodder crops	11 065.5	8 788.9	2 823.7	2 402.8	2 491.1	2 404.7

TABLE 3

The productivity of agricultural crops in Kazakhstan, c/ha

Cultures	1990	1995	2000	2003	2004	2005
Cereals all	12.2	5.0	9.4	10.8	9.8	11.3
Spring wheat	11.1	5.0	8.8	9.7	8.4	9.8
Winter rye	10.9	4.8	16.1	8.4	7.1	10.0
Maize on corn	34,4	15.8	33.3	43.2	44.6	45.2
Barley	12.8	4.6	10.2	11.4	8.2	10.7
Oat	16.0	5.1	9.6	10.6	7.7	11.0
Millet	12.0	1.6	4.8	8.9	-	-
Buckwheat	8.0	2.0	6.0	7.7	6.1	6.0
Rice	46.5	19.3	29.7	32.7	34.2	32.4
Leguminous	9.7	4.4	12.7	12.2	11.3	10.5
Cotton	27.1	20.3	18.7	20.5	20.5	21.0
Sugar beet	239	91	154	210.4	197.4	241.6
Sunflower	9.2	2.9	4.0	6.8	5.8	7.0
Potato	113	84	106	139.0	140.0	138.0
Vegetables	154	106	153	176.6	186.0	187.5

The assessment of diversity in agricultural systems has shown the major constraints in the country for broadening diversity in crops:

Marketing/commercial obstacles - the level of original and elite seed production does not satisfy the requirement of the markets of such cultures as a brewing barley, corn on grain, rice, leguminous, groat, oil plants, a sugar beet, a cotton plant. The breeding and primary seed-growing of series vegetable, groat, technical and berries crops practically are not led. The areas under cultivation of specified cultures are negligible: 0,07% - a sugar beet, 4,1% - oil plants, 0,8% - vegetables and melon (MOA RK, 2006), table 4. All this affects timeliness and quality of variety changing and variety renovation; it is the main reason for non-distribution diversification in plant growing.

TABLE 4

Structure of areas under agricultural crops, 2006

Culture	The area, thousand ha	%
Wheat, including:	12 398.2	67.8
Winter wheat	668.0	3.6
Spring wheat	11 730.2	64.2
Maize	91.7	0.5
Forage, including:	1 984.4	10.8
Barley	1 776.9	9.7
Rye	44.5	0.2
Oat	163.0	0.9
Groats, including:	255.1	1.4
Millet	75.2	0.4
Buckwheat	91.8	0.5
Rice	88.1	0.5
Leguminous	32.2	0.2
Oil-producing, including:	751.7	4.1
Sunflower	495.8	2.7
Soybean	47.1	0.2
Safflower	80.9	0.5
Mustard	4.0	0.02
Rape	123.9	0.6
Sugar beet	14.6	0.07
Potato	159.3	0.8
Cotton	204.1	1.2
Vegetable and melon	146.9	0.8
Fodder	2 270.8	12.4
Total	**18 276.8**	**100.0**

According to MOA RK (2004), to date the demand for vegetable oil is satisfied mainly due to 2 sources: cottony seeds and seeds of sunflower, the home market of vegetable oil only on 25.8% is provided due to production from domestic raw material of oil plants. 2.6 kg of sugar consumed in the country by one person is produced from domestic raw material, at national unit consumption of 14.7 kg/1 person. Analysis of the market of consumption of fruit-and-vegetable canned food in 2002 has shown that the share of import total amount of consumption compounds about 90 %.

Efforts are necessary for maintenance and sustainable use of profitable crops and species. Augmentation of their market demand connected with crop improvement, seed distribution, improving processing, market development, and public awareness, table 5.

TABLE 5

NISM, priorities and progress achieved for development and sustainable use of profitable crops

The name of culture	Priority for the country	Crop improvement	Post harvest processing	Marketing	Multiplication of seed/ planting material
Oil-producing cultures (rape, safflower, mustard, a soybean)	High	Some on-going activities	Some on-going activities	Some on-going activities	Some on-going activities
Sugar beet	High	Some on-going activities	Activities well advanced	Some on-going activities	Some on-going activities
Cotton	High	Some on-going activities	Some on-going activities	Some on-going activities	Some on-going activities
Legumes (chick pea, peavine, lentil)	Medium-high	Some on-going activities	No activity planned	No activity planned	Some on-going activities
Sorghum (sorghum, Italian millet, sudan-grass)	Medium	Some on-going activities	Activities planned but not initiated	No activity planned	Some on-going activities

The "Concept of agriculture development till 2010" has a section on plant growing diversification, which has directed to increase the areas under profitable crops and reception of high-quality, competitive production (MOA RK, 2004). According "Concept" there is a necessity to increase diversity in agricultural systems by the strengthening of breeding, seed-growing, and increasing of the areas under sowings of following crops:

- Oil-producing plants (a rape winter and summer, a safflower, a soybean);
- Pulse crops (soybean, peas, a chick pea, a peavine, lentil);
- Industrial crops (sugar beet, a cotton plant, tobacco);
- Groat (rice, a buckwheat, panicum);
- Vegetable (tomato, cucumbers, pepper, spicy);
- Horticultural (new berries cultures - a honeysuckle, a sea buckthorn, unarmed a blackberry);
- Arid fodder.

Modernization of agriculture with increasing intensification has been a principal contributing in eroding diversity. Numerous locally adapted traditional varieties of crop plants have been replaced by modern varieties responsive to intensive agriculture. The fewer advanced varieties are dominated on the market. As a result, farmers are losing interest in maintaining genetically diverse traditional varieties and landraces. The percent of areas under modern varieties reaches up to 100%, depending on crops, table 6.

According to MOA RK, to date, varieties and hybrids of local breeding occupy in 2006 more than 6,5 million hectares. In comparison with 2005 the areas under wheat and barley have increased. The areas occupied under rice varieties of local breeding, have increased from 75% in 2002 up to 84% in 2006. The local breeding varieties of a cotton occupied more than 70 000 hectares or 38% of areas, whereas up to 2000 were used only the Uzbek varieties of cotton, fig. 2. Number of local varieties with economic potential for new markets consist 28%, traditional varieties - 2% from 1 233 varieties and hybrids allowed to use in Republic of Kazakhstan, fig 3.

Critical constraints in the increase of local varieties markets and "diversity-rich" products in the country are:

- Emphasis on modern cultivars of staple crops;
- Development/establishment of markets for local varieties is not a national priority;
- Lack of financial support;
- Lack of trained personnel;
- Insufficient seed or planting material;
- Lack of consumer demand.

There is no mechanism for support of building and dilating of producers associations of traditional varieties seeds.

Registration of new varieties is the legal requirement for all cultures. The structure of State Variety Testing Commission includes 12 provincial and 3 regional inspectorates, 4 state stations and 70 variety testing plots, 2 laboratories for assessment of the grain quality. Annually in test for economic utility are about 800-900 varieties and hybrids. The State list of the breeding achievements includes about 1,2 thousand hybrids and varieties of agricultural plants, which allowed using, appendix 1. The registration procedure for new hybrids and varieties is based on an assessment of its value for production and use.

FIGURE 2

The areas under varieties of Kazakhstan and foreign breeding

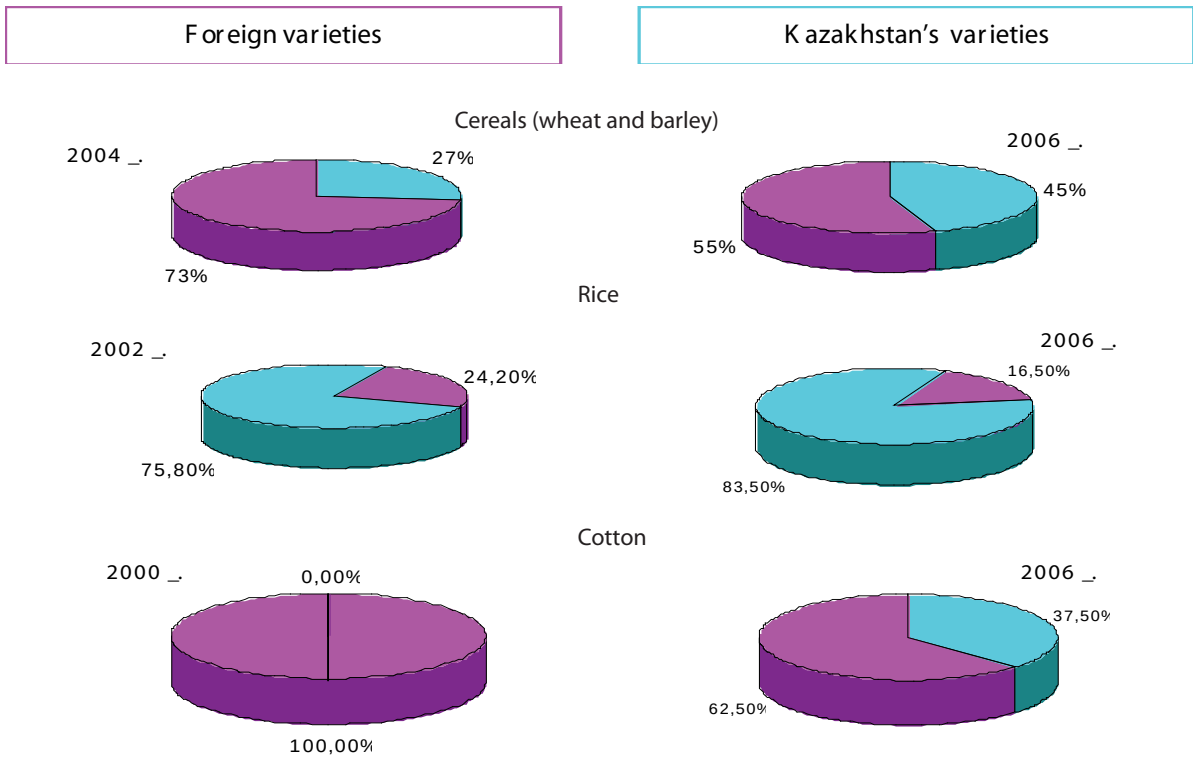


FIGURE 3

Percent of modern and local varieties Kazakhstan's breeding

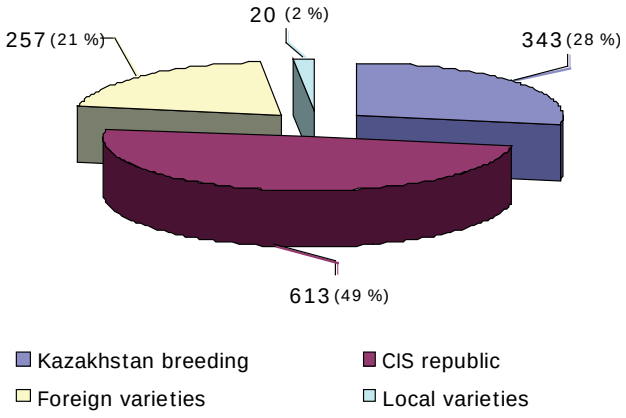


TABLE 6
The areas are under modern varieties, 2004

The name of crops	Settlement percent of an area under modern varieties	Other source
Wheat bread spring	59	Agency of Kazakhstan Republic on statistics "Results of the account of agricultural crops in agricultural productions and large farmer facilities in Republic of Kazakhstan" a Series 3 the Rural, wood and fish facilities, 2004
Wheat bread winter	45	
Wheat durum spring	46	
Wheat durum winter	100	
Maize	63	
Barley winter	64	
Barley spring	25	
Rye	15	
Oat	7	
Rice	4	
Buckwheat	7	
Millet	11	
Triticale	100	
Peas	59	
Chick pea	4	
Mung bean	0	
Soybean	73	
Sunflower	22	
Safflower	82	
Rape	0	
Mustard	0	
Flax olive	67	
Sugar beet	68	
Cotton	6	
Potato	51	
Alfalfa	15	
Sainfoin	5	

18 originators of seeds, 79 elite-seed-growing producers and 165 commodity producers of seeds function in Kazakhstan. Seed quality standards (physical purity, germinability, etc.) are based on nationally defined rules. The law of Republic Kazakhstan «About seed-growing», 2003 defines legal, economic and organizational bases of activity in the seed-growing and is directed on regulation of questions of the organization and functioning of seed-growing system and the state control over production, preparation, processing, storage, transportation, realization, and use of seeds of agricultural plants. According to article # 12 (financing of seed-growing) of the law, support of seed-growing is carried out due to means of the State budget on the basis of conservation and development of agricultural plants seed-growing. The State spends testing of variety and assessment of seeds qualities from the republican budget fund. The state compensates 40% of expenses for production of original seeds (data MOA RK). Within the frame of "State agriculture programs on 2003-2005" the Concept of breeding, a variety testing and seed-growing of crops have been developed, where the basic priorities and problems are certain for the 2005-2010 term.

There are 14 projects (1996-2004) devoted to the activity of seed-growing. The themes captured by projects are - production, storage, processing, check of quality and distribution of seeds. The constraints of maintenance by new varieties seeds are represented in table 7.

TABLE 7

The constraints of maintenance by seeds of new varieties, NISM

Stakeholders	Name of crop/crop group	Constraint	Other constraint
SPCGF, MOA RK	Cereals, grain forage crops, perennial grasses	Poor seed storage facilities; Poor seed germinability; Low seed physical purity; Seed price too high as compared to commodity price	
	Legumes	Varieties poorly adapted to local conditions; Insufficient availability of registered/ certified seed; Insufficient availability of commercial seed	
	Rapeseed	Varieties poorly adapted to local conditions; Insufficient availability of commercial seed; Poor seed storage facilities; Seed price too high as compared to commodity price	
	Cereals/groats	Varieties poorly adapted to local conditions; Insufficient availability of registered/ certified seed; Insufficient availability of commercial seed	
Pomologycal garden, SPCFPP, MOA RK	An apple, a pear, a plum, an apricot, a cherry, a sweet cherry, a currant, a raspberry, wild strawberry	Varieties poorly adapted to local conditions; Insufficient availability of disease-free planting material; Availability and cost of required production inputs	
Krasnovodopad BES, SWSPCA, MOA RK	Cereal crops	Insufficient availability of basic/foundation seed; Availability and cost of required production inputs	
	Fodder crops	Insufficient availability of basic/foundation seed; Availability and cost of required production inputs	
	Oil-producing crops	Insufficient availability of basic/foundation seed; Availability and cost of required production inputs	
Aktyubinskaya AES, MOA RK	Wheat, barley	Insufficient presence of the registered / certificated seeds	
SWSPCA, MOA RK	Fodder arid crops		Demand for seeds is limited. Measures on restoration of seed growing system on forage crops are necessary
RCLV, MOA RK	Fodder plants	Varieties poorly adapted to local conditions; Insufficient availability of basic/foundation seed; Insufficient availability of registered/ certified seed; Insufficient availability of commercial seed; Inadequate seed distribution systems; Distance to seed supplier	
RCPV, SPCFPG, MOA RK	Potato and vegetable crops	Insufficient number of seed-growing facilities and absence of the strain renovation state system.	Varieties poorly adapted to local conditions; Insufficient availability of basic/foundation seed; Insufficient availability of registered/certified seed; Insufficient availability of commercial seed; Inadequate seed production systems
SPCFPG, MOA RK	Perennial cereal grasses	Insufficient availability of basic/foundation seed	
	Medicinal plants	Varieties poorly adapted to local conditions; Insufficient availability of basic/foundation seed; Insufficient availability of registered/ certified seed; Insufficient availability of commercial seed; Insufficient availability of disease-free planting material; Poor seed storage facilities; Poor seed germinability; Low seed physical purity; Availability and cost of required production inputs; Inadequate seed production systems	
	Maize	Insufficient availability of basic/foundation seed	Insufficient material resources for production of base seeds and their reproduction
	Spring barley	Insufficient availability of basic/foundation seed; Insufficient availability of commercial seed; Inadequate seed production systems	
	Oat	Insufficient availability of basic/foundation seed; Insufficient availability of commercial seed; Inadequate seed production systems	

The problems of technical equipment for the processes of breeding, the variety testing, seed-growing, and examination of seeds sowing qualities exist. Poor-quality harvesting and drying, sanitation and storage of seed resources take place. There are system problems in seed-growing separate crops; for example, specialized seed factories are necessary for seeds of a cotton plant and seeds of a sugar beet - (up to 90 percent of sugar beet seeds is bought abroad annually, MOA RK, 2004).

The main constraints in seed-growing:

- Insufficient availability of registered/certified seed;
- Insufficient availability of commercial seed;
- Insufficient availability of disease-free planting material;
- Poor seed storage facilities;
- Poor seed germinability;
- Low seed physical purity;
- Inadequate seed distribution systems;
- Distance to seed supplier;
- Inadequate seed production systems.

For assisting farmers in disaster situations to restore agricultural systems the Law of Republic Kazakhstan «About seed-growing» is accepted (2003). The law includes article 17 point 1 that the State agricultural plants seeds resources, are created and designed for rendering assistance to agricultural commodity producers in events of extreme situations.

The Law of Republic Kazakhstan «About obligatory insurance in a plant growing» has been operating since 2004. The Law regulates the public attitudes arising in the field of obligatory insurance of plant growing and establishes legal, financial and organizational bases for its carrying out at the unfavorable conditions as a result of which there was a destruction or damage of production of a plant growing (a drought, frosts, lack of heat, excessive humidification, hail, downpour, storm, hurricane, inundation, or torrent) when acceptance of any actions on their cultivation or harvesting with the purpose of yield reception is economically inexpedient. The legislation of Republic Kazakhstan, in regards to obligatory insurance in a plant growing, is based on the Constitution of Republic Kazakhstan, on the Law of Republic Kazakhstan «About insurance activity» and other normative legal acts of Republic Kazakhstan. The compensation of fifty percent of insurance payments are carried out from budgetary funds (article 12).

The Law of Republic Kazakhstan «About State regulation of agribusiness development» was accepted in July 2005. The Law is also directed toward maintenance of food safety (article 9).

Priority

For fast, repetitive and effective introduction of a germplasm, adapted for local conditions the international, national and regional agreements are necessary.

CHAPTER 1

THE STATE OF DIVERSITY

Kazakhstan is a region rich in primary and secondary gene pools of many cultivated and wild plants (Vavilov, 1930). According to Pavlov (1956), the Kazakh flora consists of 5 700 species, according to S.A.Abdullina, (1999) of 6 000 species of vascular plants, of which 210 species are crop wild relatives, table 1.

The *Poaceae* Barnhart family is represented in Kazakhstan by 482 species, belonging to 101 genera (Baytenov, 2001). The *Triticeae Dum*. tribe is represented in the country's flora by 6 genera: *Triticum* L. (with 6 species), *Aegilops* L. (with 5 species), *Agropyron* Gaerth. (with 6 species), *Avena* L. (with 5 species), *Elymus* L. (with 25 species), *Hordeum* L. (with 10 species), (S.A.Abdulina, 1999).

Aegilops crassa Boiss., A. *juvenalis* (Thell) Eig, A. *triuncialis* L. are found in Karatau and West Tien - Shan, A. *cylindrica* Host, has a very wide distribution in southern Kazakhstan; A. *tauschii* Coss, is found in Dzungar Ala Tau, Tien - Shan and southern and southeastern Kazakhstan. Various forms of three domesticated *Triticum* species are cultivated in Kazakhstan. These are T. *aestivum* L., T. *turgidum* L., T. *dicoccum* Schrank ex Schulber. Their landraces can be found in localized or widespread distributions across the wheat–growing region of the country. Landraces of T. *turgidum* subsps. *polonicum* (L) Thell are cultivated in the Almaty and Semey regions, landraces of T. *dicoccum* in, western and southern Kazakhstan, and of T. *aestivum* subsps. *compactum* (Host) mac Key in southern Kazakhstan.

As per *Hordeum*, Kazakhstan includes important locations for collecting species of all three barley gene pools. The progenitor of domesticated barley, H. *spontaneum*, can be found in Kazakhstan. The same applies for H. *bulbosum* (secondary gene pool), which crosses easily with domesticated barley and has become an essential breeding tool for production of genetic stocks via the double haploid technique, and for H. *bogdani* and H. *brevisubulatum* (barley's tertiary gene pool), more distantly related species that grow on high saline soils that offer potential for salt - tolerant breeding. H. *brevisubulatum* has played a traditional agricultural role where its pure meadow stands have been harvested as a low – quality hay. With the availability of new biotechnological techniques, hybridizations between barley and its tertiary gene pool species to exploit useful genes are becoming more attainable. Wild *Hordeum* species are found in Tien – Shan and other areas of southeastern Kazakhstan.

Diversity of the wild gene pool of forage crops is particularly rich in Kazakhstan, as a consequence of variety soil-climatic conditions. This gene pool possesses a high degree of tolerance and adaptability to stressful ecological factors, including drought, heat, low temperatures and soil salinity. The wild flora of pastures and forages is represented by 70 species and 29 genera, such as *Trifolium pratense* L, *Onobrychis* Adans, *Melilotus* Adans, *Lotus* L, *Festuca* L, *Dactylis* L, *Bromeae* Dum, *Elytrigia* Dasv, *Elymus* Hochst, *Arrhenatherum* Beauv, (*Lolium* L), and *Poa* L.

55 species of 22 genera of wild-growing fruit species and their wild relatives are found in Kazakhstan. Jungarskiy and Zailiyskiy Ala Tau are the centers of intraspecific diversity and domestication of apple and apricot. Three species of *Malus* have been described in this region: *Malus sieversii*, M. *kirghisorum* and M. *niedzwetzkyana*. According to Ponomorenco (1980, 1992), here are concentrated the world's largest resources of wild-growing apples. The unique agrobiodiversity of a walnut, pistachioes, grapes, plums of South-Kazakhstan (A.D.Dzhangaliev, 1997, 2000, 2004.). Zailiyskiy Ala Tau flora includes 13 species of 9 genera of medicinal plants, 36 species of 18 genera of vegetable crops and 15 species of 8 genera of industrial crops, (table 8).

TABLE 8

Wild relatives of cultivated plants of Kazakhstan's flora

Crops	Number of		The main genera
	Genera	Species	
Cereals	8	15	*Aegilops, Avena, Hordeum, Secale, Fagopyrum, Vicia*
Vegetables	18	36	*Lathyrus Rheum, Lactuca, Daucus, Sinapis, Allium*
Horticultural	22	55	*Ribes,Rubus,Amygdalus,Cerasus, Fragaria, Juglans, Pistacia, Vitis*
Fodder	29	70	*Agropyron, Festuca, Elytrigia, Bromus, Poa, Medicago, Trifolium, Vicia, Melilotus, Kochia*
Technical	8	15	*Cannabis, Allochrusa, Polygonum, Rumex, Linum, Carthamus, Hibiscus, Scorzonera*
Medicinal	9	13	*Rhaponticum, Humulus, Althaea, Salvia, Carum, Saponaria, Matricaria, Erysimum, Viburnum*

Changes in many ecosystems, deep anthropogenic transformation of the steppe and a forest-steppe zone as a result of large-scale scarifying lands during 1954-1960 took place in Kazakhstan. Many of the biological objects are under threat of loss. An exclusive advantage exists due to the mountains (228 species) and the deserts (151 species), containing significant number of species and the ecosystems demanding preservation and the special regime of use (National Strategy and the Plan of Action on Conservation and Sustainable use of a Biological Diversity in Republic Kazakhstan, 1999). According to the National Report about the state of Biodiversity in RK (1998) many species have not been found in the territory of Kazakhstan during last few tens years:

Dryopteris mindshelkensis, Stroganovia robusta, Prangos equisetoides, Dorema karataviense, Acantholimon minshelkense, Mattiastrum karataviense, Eremostachys pectinata, Orobanche karatavica, Centaurea kultiassovii in South Kazakhstan, and

Adisnthum capillus-veneris, Berberis karkaralensis, Betula kyrgyzorum, Anemonoides caerulea, Paris quadrifolia, Alnus glutinosa, Pteridium agnilium, Gymnodenia conopsea, Dacsylorhisa fuchsii, Distamnus angustifolius in the Central Kazakhstan, *Arenaria potaninii* in East Kazakhstan.

Nineteen species are under threat of extinction in the near future: *Stipa anomala, Allium caespitosum, Tulipa regelii, Juno almaatensis, Populus berkakarensis, Atraphaxis teretifolia, Silene betrakdalensis, Cachris herderis, Ikonnikovia kaufmanniana, Niezwedzkia semitschenskia, Rubia cretaceae, Cryptocodon monocephalus, Artemisia cina, Ferula iliensis, F. sugatensis*, etc.

70 species of plants are included in the first edition of the Red Data Book of Kazakhstan and protected by the Government. Material is prepared for the second edition of the Red Data Book of Kazakhstan, which will include 404 species of plants. According to «The National Program of Actions with a Desertification in Republic Kazakhstan» (Almaty, 1997), from 19 species which are threatened with extinction in the near future, half are forage plants. The fruit forests of Kazakhstan in which the gene pool of apple and apricot plants is concentrated, are under threat of extinction, the area of these forests has compounded in 2000 year 7% from those in 1930. The transpollination was the major cause of degradation the fruit forests of Zailiysky and Dzungarian Ala Tau (Djangaliev, 2004).

Wild relatives of wheat, barley, and oats till now are used as pasture cultures, which can lead to their full extinction.

The priority for conservation *in situ* among wild relatives of cereals crops has: *Festuca saurica E. Alexeev, Festuca kurtshumica E. Alexeev, Festuca borissi Reverd, Festuca irtyshensis E. Alexeev; Elymus buchtarmensis Kotuch, E. karakabinica Kotuch, E. marmoreus Kotuch, E. occidental-altai Kotuch, E. tzvelevii Kotuch, E. sauricus Kotuch, E. tarbagataicus Kotuch, E. petraeus (Nevski) Pavl; Leymus alaicus (Korsh) Tzvel,* L. *divaricatus (Drob.) Tzvel; Agropyron tarbagaticum N. Ploth; Hordeum bogdanii Wilensky, H. brevisilatum (Trin) Link; Lolium perenne L; Aegilops cylindrical, A. crassa, A. tauschii*. (Sitpaeva, 2006).

11 species of medicinal plants: *Taraxacum vitalii, Saussurea Mikeshinii, Valeriana chioniphyla, Veronika alatavica, Microgynoecium*, etc. it is necessary to include in the second edition of "Red Data Book" of Kazakhstan. It is connected to the process of unsystematic and illiterate mass preparation of wild-growing medicinal raw material (Muhtubaeva S.K., 2000).

The mechanisms, which are used to monitor genetic erosion in the country:

- Land surveys and inventories;
- Environmental impact assessments;

Two laws: "Environmental impact evaluation" and "Environmental control" are connected to management of the nature and provide safety measures and reductions of impact on environment. The economic activities can be permitted only after environmental impact evaluation, which is spent by special council and the Central State Council according to the law «About environmental impact evaluation» 1997. Environmental impact evaluation includes an assessment of influence on a biodiversity loss with the purpose to provide measures for preservation and rational use of a biodiversity at early stages of economic actions. Negative influence on flora, are restored according to the State Resolution, 2004.

Priority

There is a necessity for any mechanism to assess genetic erosion in both *in situ* and *ex situ* reserves in the country.

The monitoring of genetic erosion in the country is faced with the following constraints:

- Need for genetic erosion assessment is not recognized;
- Lack of skilled personnel;
- Lack of appropriate technology;
- Lack of financial resources.

CHAPTER 2

THE STATE OF *IN SITU* MANAGEMENT

Surveying and inventory are important for monitoring the priority areas of the Global Plan of Action. Surveying and Inventory of PGRFA has been included (1996-2004) in 13 projects from 216 executed. 4 provinces of North-Kazakhstan (Akmolinsk, Karaganda, Kustanay, Pavlodar); 2 provinces of West Kazakhstan (Aktobe, Atyrau); Kizilorda province of South Kazakhstan and 2 provinces of South-East Kazakhstan (Almaty) are surveyed. Surveying methods were geo-botanical and researches of resources. High priorities have been given to all surveying, table 9.

The indigenous knowledge has been used during the survey. The identification of endangered species and assessment of the threat of genetic diversity of PGRFA was made. The following factors are specified as the presumed causes of threat: regular burning of virgin soil field in case of forage crops (SPCGF); unsystematic economic activities of the man, replacement of landraces by modern varieties (SPCFPP); in the case of arid forage crops - unsystematic use of pastures (SWSPCA), an overgrazing of cattle, degradation of pastures, wind and water erosion of soil (SPCLV), uncontrolled intensive using by local population of medicinal raw material (IBF)

There is a number of the constraints for inspection and inventory of PGRFA in the country:

- Unclear regarding what organization is responsible for carrying out of surveys and inventories;
- Insufficient financial support;
- Insufficient number of staff;
- The staff has insufficient skills.

The following geographical areas are identified as priority for surveying and inventory at a national level:

- Western and Northern Tien Shan - grain, leguminous and oil-producing cultures;
- East Tien Shan and Jungarskiy Ala Tau - forage crops;
- Mountain ridges Tarbagatay, Jungarsky, Zailiysky, Kirghizky, Talasky Ala Tau and Karatau - fruit crops;
- Northern Tien Shan and the Kazakhstan Altai - wood and wood forming ;
- Zailiysky Ala Tau - medicinal plants.

The concept of national strategy should be included in the activity - inspection and inventory PGRFA RK during which, not only should cultivated crops and their wild relatives be gathered, but the assessment of diffusions important for a food and agriculture of cultures should be led.

Activity on - farm to management and improvement of plant genetic resources for food and agriculture is not widespread in the country, but has a priority for areas with a high diversity of forage plants and for conservation of fruit wild relatives (an apple, an apricot), wood and wood forming cultures.

5 projects on-farm are devoted to conservation PGRFA, in which about 60 farmers participated. More than 80% which have been involved in two projects - «Conservation *in situ* mountain biodiversity in Kazakhstan» and «Conservation *in situ*/on-farm, landraces and local varieties of an apple and an apricot».

Project GEF/UNDP «Conservation *in situ* mountain biodiversity in Kazakhstan» is included in a number of priorities for National strategy and a plan of action on conservation and sustainable use of a biological diversity. (web-site « the Wood bulletin » <http: // www.forest.ru, 2003).

The sustainable *in situ* conservation of the apple forests and apricot and as a whole, mountain agro-biodiversity of Kazakhstan is the purpose of the project. The project «Conservation *in situ*/on-farm, landraces and local varieties of an apple and an apricot» began in 2002 by SPCFPP. The purpose of the project: - to support the activity of farmers directed on preservation *in situ*/on-farm of landraces and local varieties of an apple and an apricot and their wild relatives; - improvement of national programs of conservation *in situ*/on-farm landraces, local varieties of an apple and an apricot and their wild relatives with participation of farmers and the nongovernmental organizations; expansion of farmers activity to use of genetic resources of landraces, local varieties of an apple and an apricot and their wild relatives in of productivity improvement.

TABLE 9

NISM, projects on survey, inventories and *in situ* conservation

Stakeholder	Name of program/project/ activity	Name of conservation area	Name of taxon
Scientific Production Center of Grain Farming named A.I.Baraev	Formation of new genetic resources of perennial bean grasses and developing of the adapted varieties (alfalfa, sainfoin, sweetclover) for conditions of Kazakhstan	Akmola province	*Onobrychis arenaria; Trifolium pratense; Medicago falcata; Medicago sativa* var. *varia; Melilotus albus; Melilotus wolgicus; Melilotus officinalis*
	Introduction, complex evaluation, formation of genetic resources of perennial forage crops and developing of ecologically plastic varieties of wheat-grass, awnless brome grass of haying and pasturable utilization types for a steppe zone of Kazakhstan		*Elytrigia repens; Bromopsis inermis; Agropyron fragile; Agropyron cristatum; Agropyron desertorum; Psathyrostachys juncea*
	Introduction, complex studying, developing of a gene pool and drawing up of the Northern Kazakhstan herbs catalogue		*Helichrysum arenarium DC.*
Scientific and Production Center of Forestry	Creation of genetic resources banks of wood forming and wood components basic species	Akmola province	*Alnus incana, Populus berkarensis, Betula kirghisorum*
Pomologycal Garden, of SPCFPP	Conservation *in situ*/on-farm local and old races of an apple-tree and an apricot	Almaty province	*Malus Niedzwetzkyana, Malus Sieversii*
	Conservation *in situ* mountain agro-biodiversity in Kazakhstan		*Malus domestica; Malus sieversii*
	Conservation of fruit, berry cultures and grapes germplasm		*Malus domestica; Malus sieversii*
South-Western Scientific and Production Center for Agriculture	To development edaphic and phytocenotic the specialized varietis of arid fodder plants for the south of Kazakhstan: - milk vetch, sagebrush, prostrate summer cypress, winterfat, sainfoin and a saxaul for sandy loam and sandy deserts, Camphorosma and Salsola Richteri Karel for saline deserts	Kizilorda province; South Kazakhstan province; Aktobe province; Atyrau province; West Kazakhstan province	*Calligonum gen.* L., *Eurotia* sp., *Camphorosma, Salsola Richteri Karel, Artemisia* sp.
	Mobilization of desert phyto genetic resources, donors exposure for introduction and selection, conservation of existing collection and information data base bank establishment of arid plants.	Almaty province	
Research Center for Livestock and Veterinary	Creation of fodder plants genefund, a bookmark of samples of seeds on storages, attraction and use a genebank for deducing new high-yielding varieties and hybrids.	Almaty province	*Endemic species of alfalfa, wheat-grass*
	To collect and to study comprehensively species and forms of wild-growing fodder plants with the purpose of introduction in culture and creation of germplasm		*Endemic species of alfalfa, wheat-grass*
Institute of Botany and Phytointroduction	Resource inspection of ridges Western Tarbagatay, Saur, Manrak on revealing stocks of medicinal, aromatic plants	East Kazakhstan area	*Rhaponticum carthamoides u Rhodiola rosea*
	Modern condition of vegetative resources Dzungarian Ala Tau and Alakol hollows, their rational use and protection	Almaty province	*Hippophae rhamnoides* L., *Armenica vulgaris Lam., Berberis heteropoda Schrenk*

Project activities included inventory and monitoring, an assessment of farmer's knowledge and training in modern methods of an apple reproduction and a bookmark of hi-tech gardens, joint breeding of forms and clones, maintenance of farmers by local varieties seedlings. The pilot plots have been selected in areas of a high diversity (SPCFPP, Pomologycal garden). 32 people of local society of farmers have been involved in performance of the project.

The on-farm project activity of the vegetable cultures included the characteristics and an assessment of local varieties of vegetable cultures, reproduction of seeds and allocation of cultivars, a joint use and management of the improved varieties (RCPV).

The on-farm project of SWSPCA «Integration forage production and animal husbandries in steppes of the Central Asia» has been devoted to building of local pastures with use of wild-growing forage crops.

The economic stimulus for farmers, services of production and the diffusions of seeds for increase of management by PGRFA has been used. The on-farm projects have increased public comprehension of value of wild relatives of cultivated plants (CWR) and wild-growing food plants (WFP). Activity was carried out for food safety and plant breeding.

Resource holders, which were involved in conservation on-farm, have lead regional training «Conservation through Sustainable use of Fruit Genetic Resources in Central Asia Research Institute on Plant Industry», (IPGRI, Tashkent, 2003). 2 meetings have been conducted in Kazakhstan. Unfortunately, the priority of on-farm management of PGRFA in national programs is estimated as low. The joint plant breeding with farmers have casual character.

Constraints on-farm management are:

- Insufficient incentive provided to the farmer;
- Inadequate number of the staff, insufficient skills and professional training;
- Insufficient financial support;
- *On - farm* management and improvement of plant genetic resources for food and agriculture are not a national priority.

Priorities

The connection between collections and the users - farmers, breeders, scientists, should be strong for successful performance of National Strategy of plants genetic resources. It is necessary the joint plant breeding with farmers, development of the local varieties market, an exchange of the local varieties seeds. Farmers should be presented a structure of advice or other managing frames of genebank. The conducted measures will promote public comprehension of conservation and improving local PGRFA.

The present state *in situ* conservation of crop wild relatives and wild plants for food is estimated as follows:

- Fruit crops - plans have been developed and significant achievements have been achieved (an apple and an apricot);
- Fodder and vegetable crops - work is in progress without any existing plans;
- Other crops - plans exist, but activities have not begun.

Activity on conservation *in situ* wild-growing relatives has been included in 13 projects which also have been identified as projects on surveying and inventory. As the criteria for identification of CWR/WFP the morphological and biological attributes and properties have been used. The purpose of projects were the maintenance of a high level genetic diversity of crop wild relatives (CWR) and wild food plant (WFP) and acceptances of measures on conservation *ex situ* CWR/WFP being under threat of extinction. The projects increase public comprehension CWR and WFP for food safety and a plant breeding.

The public ecological assessment, which in new market conditions should be an effective mechanism, and be fixed legislatively, allowing the involvement of sociability in the process of regulating and managing the natural resources in Kazakhstan. Traditionally, in Kazakhstan, as well as in other CIS countries, the state environmental impact assessments (EIAs) are spent. EIA is the mechanism of the precautionary ecological control over economic activities. The ecological legislation of Kazakhstan includes about 10 laws and more than 200 normative legal documents. The ecological legislation of Republic Kazakhstan has taken the course on rapprochement with the ecological legislation of the developed countries and introduction of the international standards. Following laws operate - "About environmental control", "About special protected areas", "About ecological assessment», «Wood code», «and Water code», "About land".

In conformity with article 7 the Law of Republic Kazakhstan «About special protected areas» and the "Concept the developments of special protected areas of Kazakhstan Republic till 2030", MOA RK is developed "The program about the system of special protected areas of Republic Kazakhstan on 2007-2009", which was accepted on October, 13th, 2006. The Republican budget and the international grants are sources of the Program financing. Granting the right of land-use on the reserved ground areas and their transfer to compound of lands SPA has effected the Land code (2003) and the Law of Republics Kazakhstan «About special protected areas» (2006). The Governmental order of Republic Kazakhstan «About the statement the Rules of state cadastre in the special protected areas of Republic Kazakhstan» and the Governmental order of Republic Kazakhstan «About the statement of the special Rules about land reservation in protected areas» in 2006 were accepted.

January 1st, 2006 in Kazakhstan 7 botanical gardens (Almaty, Karaganda, Ridder, Zhezkazgan, Aktau, Turkestan, Bakanas), 10 the state reservations, 9 state national natural parks, 2 state wildlife reserves, 55 state protection regimes, 5 state areas of outstanding natural beauty, 26 natural sanctuaries of Republican value are functioning. The total area of SPA -207 755.4 km^2 (1.4 % from all territory of the country, conventional world standards - 10-12 %). 38 thousand hectares of genetic resources of the wood and forming wood is preserved *in situ*, table 10.

According to the Concept of Republic Kazakhstan "About environmental protection on 2004-2015" the area of SPA is stipulated to increase by 2030 up to 17.5 million hectares that will make 6.4% of Republic territory.

TABLE 10

The special protected areas of Kazakhstan ("The Program of RK about of SPA system development on 2007 – 2009")

Categories of protected areas	Objects of SPA Reservations	The area (km^2)
Reservations	10	12 035.7
National parks	9 (1)	16 531.3
Protection regimes	55	56 213.1
Natural sanctuaries	26	64.8
Botanical gardens	7	4.2
Areas of outstanding natural beauty	5	113 505.0
Wildlife reserves	2	9 401.3
Total	**107 (6)**	**207 755.4**

Wild relatives, wild plants for food, landraces, farmers' varieties, endemic, the species included in "Red Book" and the species limited area in the territory of Kazakhstan are priorities for conservation *in situ*/on-farm. "The program about the system of special protected areas of Republic Kazakhstan on 2007 - 2009" plans to take under protection the endemic and rare representatives of unique subalpine flora: *Malus sieversii* (Ledeb.) M.*Roem*., *Calophaca*, *Amigdalus ledebouriana* Schlecht., *Rheum altaicum* Losinsk., *Fritillaria pallidiflora* Schrenk, *Oxytropis hystrix* Schrenk, *Daphne altaica* Pall., *Stelleropsis tarbagataica* Pobed., *Mertensia Popovii* N.Rubtz., *Rhodiola rosea* L, *Rhaponticum carthamoides* (Willd.) Iljin.

CHAPTER 3

THE STATE OF *EX SITU* MANAGEMENT

Research organization of MOA and MES RK maintain and store more than 75 thousands accessions of 12 crops groups, table 11, 12, fig. 4, 5. Four research organizations - SPCFPG, SRIA, SWSPCA and SPCGF holders more than 90 % from all'*ex situ* collections of PGRFA in the country.

TABLE 11

NISM, *Ex situ* collections of agricultural plants of RK

№	Group of crops	Number of accessions
1	Cereals	40 161
2	Forages	8 539
3	Leguminous	1 050
4	Fodders	9 386
5	Groats	672
6	Oil-producing	1 327
7	Technical (sugar beet)	354
8	Vegetable and melon	8 532
9	Potato	1 376
10	Horticultural	3 182
11	Wood and wood forming	6 species
12	Medicinal	250 species and forms
	Total	**75 249**

45 projects have been carried out for maintaining existing of *ex situ* collections of agricultural plants; the number of the involved professionals has been as many as 224 people. In five SPC of MOA RK - SPCGF, SPCFPG, SWSPCA, SPCFPP (Pomologycal garden), RCLV have been involved in more than 80% of projects and more than 90% of professionals.

The structure and the status of PGRFA in Kazakhstan

53.4% of the gathered germplasm compound cereal crops; 12.5% - fodder; 11.3 % - forage; 11.3% - vegetable and melon; 4.2% - horticultural crops; 0.5% - technical (a sugar beet); 1.8 % - a potato; oil-producing crops - 1.8%; 1.4% - leguminous; 0.9% - groat. Dominance of the certain crops is noted: more than 80 % of cereal crops collections (barley, corn, rice, oats and triticale) are represented by wheat, the grass and bean crops dominate in collections of forage plants. The germplasm of vegetable and melon crops are presented by 7 302 accessions of 95 crops. 2 crops - a melon (2 246 accessions) and tomato (1 500 accessions) compound 51.3% of collections. The germplasm of horticultural crops is most widely represented by the apple (48.1%), representatives of 8 species are preserved. The germplasm of grapes is preserved in quantity of 364 accessions. *Ex situ* collection of 6 species of wood and bush introducent (including 3 species of the Red Data Book, 12 rare species and 9 species of rare in Kazakhstan but wide spread) occupy the area more than 730 hectares in north region of country. The status advanced/improved cultivar have 67% - of cereal, 46% - of forage, 75% - of leguminous, 57 % - of a potato, 58 % - of horticultural crops. 21% collections of forage, fodder and oil-producing crops contain the breeding material. 30 % collections of fodder, 26% of a potato, 4.2% of horticultural and 89% of medicinal crops are wild-growing species. The collections of vegetable, melon crops and a potato contain a mutant/ genetic stock - 56% and 15% accordingly, Figures 6, 7, 8.

Duplication

11 052 accessions (14.7% from total of stored accessions) have been duplicated in genebank of research organization of RK and abroad. The status of the duplicated accessions is various, table 13.

Storage

More than 70 % of existing collections are stored under short term with a various degree of risk due to uncontrollable conditions of temperature and humidity. Standards of temperature are sustained at storage of two seed collections:

- 18 000 accessions of wheat (SRIA MES RK);
- 2 100 accessions of barley (1 600 - SRIA MES RK and 500 - Krasnovodopad BES).

In vitro is preserved the most valuable collection of fruit crops - 146 accessions a wild apple (Pomologycal garden, SPCFPP).

Medium term storage in household refrigerator is organized by SRIPV for 1 618 accessions of vegetable and medicinal crops.

The viability testing applies to reduce genetic changes or loss of genetic integrity, but the monitoring of viability of *ex situ* collection is performing irregularly, monitoring of genetic integrity is not carried out.

TABLE 12

NISM, *Ex situ* collections of Kazakhstan's PGRFA

Stakeholders	*Ex situ* collections, Group of cultures	Number of cultures	Cultures	Number of accessions
SPCGF	Oil-producing	2	Sunflower and rape	62
	Leguminous	4	Peas, chick-pea, lentil	276
	Cereals	3	Bread and durum wheat, triticale	5 582
	Forage	2	Barley, oat	1 062
	Perennial leguminous grasses	6	Meadow clover, goat's-rue, milk vetch, alfalfa, white sweetclover, yellow sweetclover, volga sweetclover hungarian sainfoin	4 086
	Perennial fodder grasses	6	Wheat-grass, awnless brome grass, upright brome grass, elymus yunceus fish., Quitch-grass, red fescue, meadow fescue	
	Groats	2	Millet, buckwheat	384
	Potato	1	Potato	238
	Medicinal	75		125
Total		**101**		**11 815**
SPCFPP (Pomologycal garden)	Horticultures	10	Apricot, cherry, pear, wild strawberry, raspberry, plum, currant black, a sweet cherry, apple, cherry-plum.	3 182
Total		**10**		**3 182**
RCLV	Cultivar and wild growing fodder - 20 species	15	Milk vetch, woad, peas, sweetclover, cock's-foot, wheat-grass, canary grass, clover, alfalfa, dakota vetch, chick pea, fescue, bentgrass, timothy, sainfoin	842
Total		**15**		**842**
SPCFPG	Cereals	4	Bread wheat, durum wheat, maize, triticale, sorghum	10 923
	Forage	2	Oat, barley	2 041
	Leguminous	4	Soybean, peas, chick pea, lentil	675
	Fodder	6	Cock's-foot, awnless brome grass, alfalfa, meadow fescue, timothy grass, sainfoin	499
	Oil-producing	3	Rape, safflower, sunflower	1 007
	Technical	2	Sugar beet	354
	Medicinal	?		190
SPCFPG (RCPV)	Vegetable and melon cultures	95	The basic cultures - a melon, a water-melon, a tomato, an onions, carrots, a cucumber, pepper, fennel, garlic	7 302
	Potato	1	Potato	1 117
Total		**117**		**24 108**

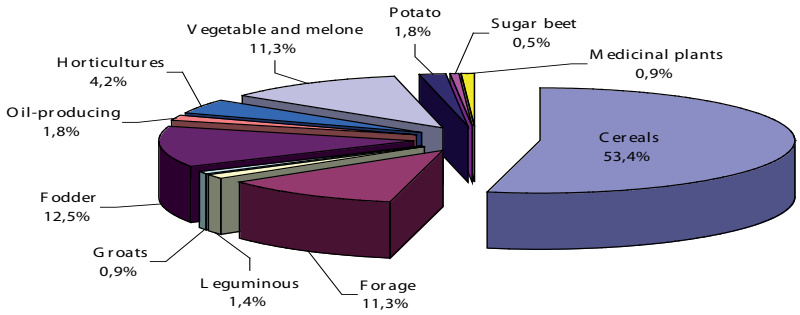
Stakeholders	*Ex situ* collections, Group of cultures	Number of cultures	Cultures	Number of accessions
SWSPCA	Cereals	4	Rice, spring bread wheat, spring durum wheat, spring. Dwarf wheat	3 502
	Sorghum	4	Grain sorghum, sweet sorghum, sudan-grass, broom corn, italian millet, millet	
	Medicinal plants	52		
	Forage	5	Spring barley, fodder winter barley, naked barley, hordeum spontaneum, oat	3 836
	Fodder	32	Saxaul, salsola subaphylla c.A. Mey., Salsola richteri karel., Salsola regida pall., Camphorosma, winterfat, prostrate summer cypress, orache, goosefoot, sagebrush, milk vetch, alfalfa, vetch , chisk pea, sainfoin, giant-fennel, ziziphora, calligonum, wheat-grass, milk vetch, bird's-foot trefoil, sweetclover, peavine, vetch, clover, quitch-grass, elymus yunceus fish., Clinelimus sibiricus nevskii, brome grass, wild rye, fescue, winter rye	3 959
	Vegetable and melon cultures	20	Tomato, ground cherry, an eggplant, carrots, fennel, an onions, garlic winter, pepper sweet and hot, beet, a garden radish, a radish, a string bean, sunflower, cabbage, cucumbers, a melon, a water-melon, vegetable marrows, a bush pumpkin, a pumpkin	1 230
	Potato	1	Potato	21
	Groat			288
	Oil-producing	2	Sunflower, safflower	258
Total		**119**		**13 248**
SPCF	Wood and wood forming	846 species	730 Ha - *ex situ*, collection of wood and bush introducent in northern region	846 species
Total		**846**		**846 species**
SRIPBS MES RK	Cereals	3	Wheat, barley, triticale	20 100
IPBB MES RK	Cereals	2	Wheat, rice	144
	Leguminous			
IBPH MES RK	Medicinal plants	250 species and forms	Medicinal plants of world flora	250

TABLE 13
NISM, duplication of *ex situ* collection

Stakeholder	Name of crop	Status of accessions	Number of accessions safety-duplicated at other genebanks	Genebank holding safety-duplicate
SPCFPP (Pomologycal garden)	Apple	Wild	50	IBPH MES RK
		Traditional cultivar/ Landrace	2	
NWSPCA (Aktubinskaya ES)	Spring wheat (bread, durum), barley	Advanced/Improved cultivar	95	SPCFPG MOA RK
RCLV	Clover	Wild	1	?
SWSPCA (Priaral RIAA)	Rice	Advanced/Improved cultivar	490	SRIPBS MES RK
		Mutant/Genetic stock	146	
		Advanced/Improved cultivar; Mutant/Genetic stock	1 018	IRRI, VIR, VNIIR (Russia)
SWSPCA (Shalkar Experimental Station)	Fodder crops (29 cultures)	Wild	3 866	VNIIR (Russia), RCLV
	Vegetable crops (20 cultures)	Wild; Traditional cultivar/ Landrace; Advanced/ Improved cultivar;	1 076	VNIIR (Russia), RCPV.
	Under-utilized crops	Wild	122	
	Oil-producing	Wild; Traditional cultivar/ Landrace; Advanced/ Improved cultivar; Breeder's line	49	
	Potato		21	
	Wheat		1 896	VNIIR (Russia), SPCFPG, NWSPCA, Aktubinskaya AES)
	Barley		1 356	
	Oat		405	
	Sorghum		170	VNIIR (Russia)
	Italian millet		8	
	Millet		4	
SPCFPG	Cereal crops	Wild	277	IBPH MES RK; USA – NSGC
Total			**11 052**	

FIGURE 4

PGRFA *ex situ* collection of Kazakhstan, 75 249 accessions



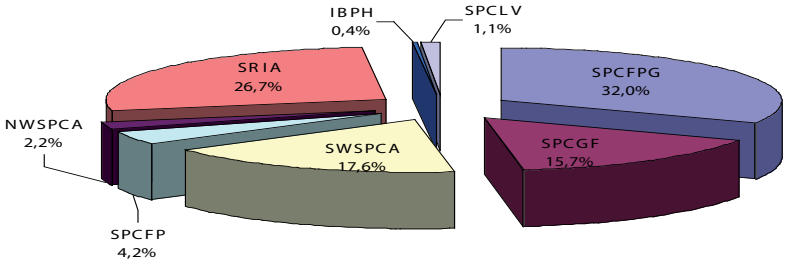
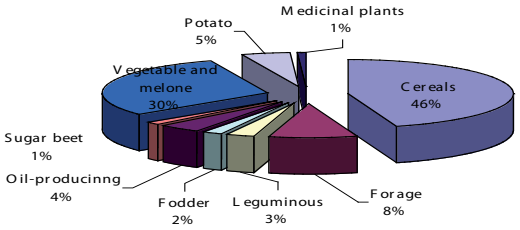
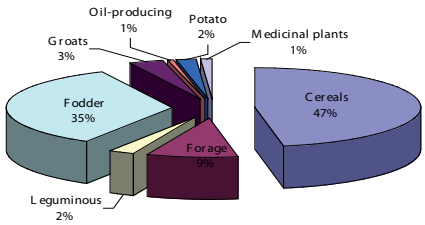


FIGURE 5
PGRFA *ex situ* collection of Kazakhstan

- **SPCFPG, 24 108 accessions**



- **SPCGF, 11 815 accessions**



- **SWSPCA, 13 248 accessions**

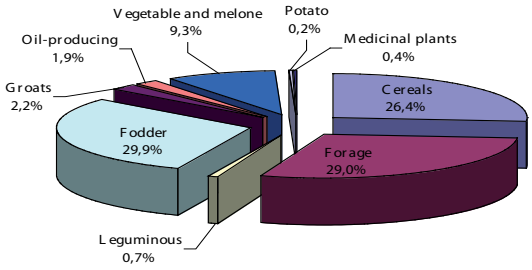
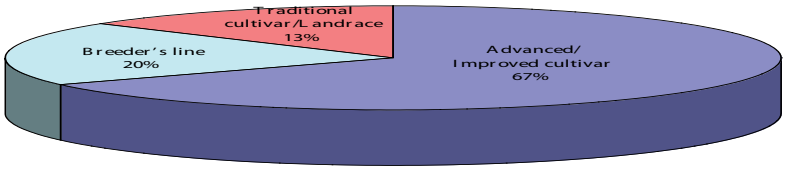
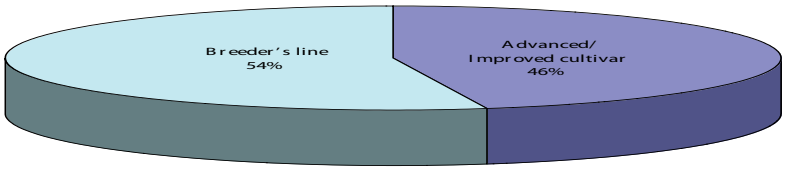


FIGURE 6
Status of Kazakhstan PGRFA *ex situ* collection

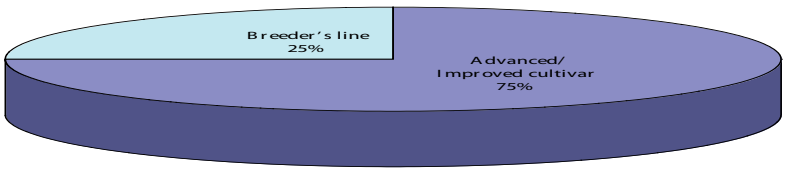
- **Cereals**



- **Forage**



- **Leguminous**



- **Fodder**

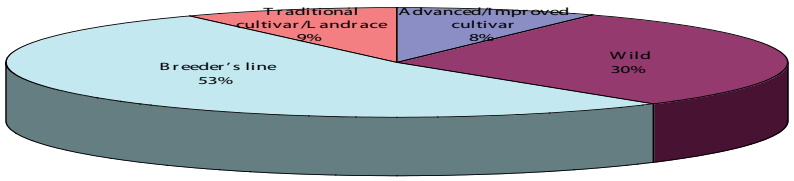
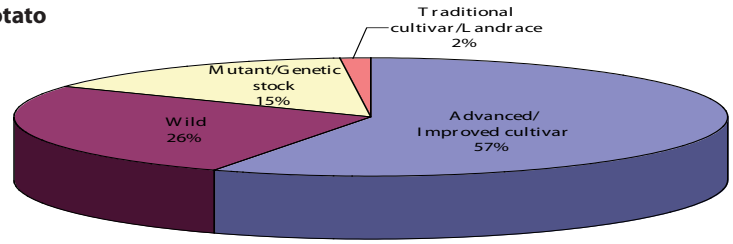
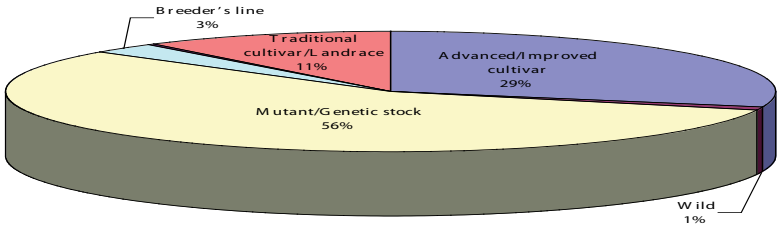


FIGURE 7
Status of Kazakhstan PGRFA *ex situ* collection

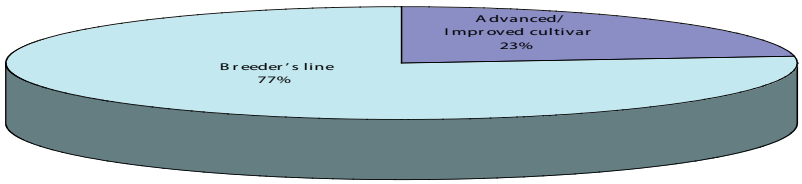
- **Potato**



- **Vegetable and melon**



- **Oil-producing**



- **Sugar beet**

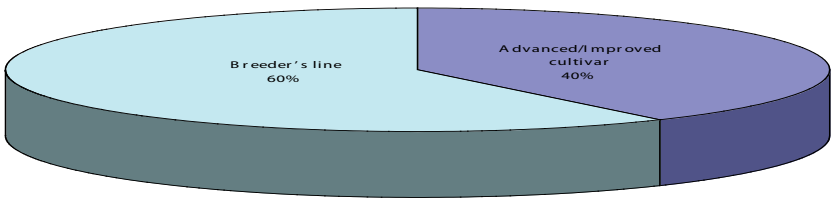
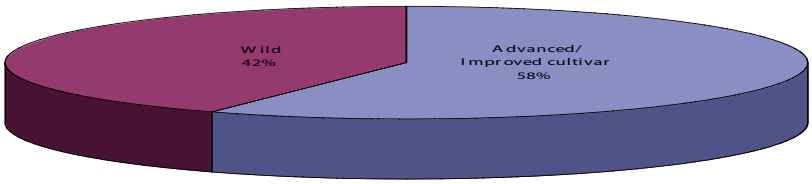
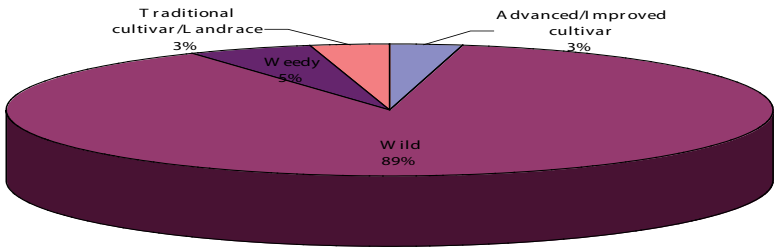


FIGURE 8
Status of Kazakhstan PGRFA *ex situ* collection

- **Horticultures**



- **Medicinal plants**



Creating the necessary conditions for long-term and medium term storage of *ex situ* collections, inventory of collections *ex situ*, regular performance of monitoring of viability and genetic integrity are the priorities of the management of *ex situ* collection in the country.

Constraints: the insufficient financing, the inappropriate and lack of equipment, lack of the purposeful approach and insufficiently trained personnel.

The storage of collections *ex situ*, especially in conditions of short-term storage (the basic form of storage at present) makes process of regeneration by one of priority of the National program on plants genetic resources. Necessity of regeneration is established for all crops. 3 - 5 years (depending on culture) requires for completing the regeneration.

Priorities

For each collection *ex situ* it is necessary to develop a plan for regeneration: to identify number of taxon and number of accessions of everyone taxon, which requires regeneration.

Constraints

The infrastructure of regeneration activity is not adjusted; in case of of cross-pollinated crop cannot be provided sufficient isolation. The ability for regeneration of accessions from other organizations as a whole is absent.

The international collecting missions for collecting wild relatives of cultivated plants are lead from the beginning of 90-th years. In 1990, it was organized by the collecting mission of the USSR, Czechoslovakia and Poland for the collecting of cultivated and wild forage crops in the territory of Kazakhstan and Uzbekistan.

Three collecting missions (2000, 2003 and 2004) were carried out by support and with participation: USAID ICARDA, CIMMIT, VIR. The collecting missions have been conducted in regions, which were known for diversity. Basically, cereal, fodder crops and medicinal plants were collected. According to «Conventions on a biological diversification» the collecting material was divided between participants and carefully documented. Herbarium were taken for an accessions, which could not be identified in a field or carried uncharacteristic morphological characters, basically, it concerned collections of wild relatives. Since 2000, within the national programs, target expeditions for the collecting of wild-growing relatives are annually organized, table 14.

Incomplete coverage of targeted *taxa*, incomplete geographical coverage, missing of known local, landraces, historical varieties - the gaps which have been identified in existing collections. The methods which were used to identify gaps-compared stored material against historical and geographical references. There are not publications in the field of methods of definition of the gaps in existing collections.

The development of a national information system is needed for identifying the gaps in existing collections and giving a priority to the planned and targeted collecting missions of PGRFA. Special attention should be given to further action at a national or sub-regional level. The actions or support from regional and/or international organizations are needed. Information systems of the regional and international organizations can assist to identify the gaps by way of comparison of a stored collection with historical and geographical references.

TABLE 14

NISM, Collecting mission of wild relatives

Year	Region	Participants	Material	Number
1990	Kazakhstan, Uzbekistan	Czechoslovakia, Poland, Bulgaria, USSR	Advanced and wild forage crops	185 accessions of seed and 300 herbarium accessions
2000	Kazakhstan, Kyrgizya, Uzbekistan	Kazakhstan, Kyrgizya, Russia, USA, ICARDA	Cereals, fodder legumes crops and their wild relatives	339 accessions 22 genera
2003	Kazakhstan – South-East and East area	SPCFPG MOA RK, IBPH MES RK	Wild relatives of cereal crops	144 accessions 49 populations, 28 species, 14 genera
2004	Kazakhstan – Central and East area	SPCFPG MOA RK,, IBPH MES RK, Washington University, USA	Wild relatives of cereal crops	133 accessions 45 population, 37 species, 17 genera
2003-2004	Kazakhstan –Northern area	SPCGF	Wild relatives of fodder crops and medicinal plants	342 accessions
2002-2005	Kazakhstan, Kyrgizstan, Uzbekistan, Central Kazakhstan	SWSPCA, ICARDA, VIR	Wild relatives of cereal, fodder and vegetable crops	1 446 accessions
2006	Kazakhstan – West area	SPCFPG MOA RK	Wild relatives of cereal, fodder leguminous crops and medicinal plants	241 accessions

There are insufficient financial supports for realization of the planned and targeted collecting mission of PGRFA in the country.

The high priority has the development of alternative management for *ex situ* conservation of vegetative propagated and recalcitrant seeded plants, as well as for species neglected in current conservation activities. It is especially important for fruits (an apple, an apricot), berries (wild strawberry, a blackberry, a raspberry, a currant) and for the vegetable crops (garlic, onions, mint, a series spicy species). At present, conservation *in vitro* are being conducted for two crops - a wild apple and an apricot (Kovalchuk I *et al.*, 2001- 2006). The need for research of *ex situ* conservation of vegetative propagated and recalcitrant seeded plants, as well as for species neglected in current conservation activities are high; however capabilities are low or medium. The actions or support from regional and international organizations are needed to expand the activities of *ex situ* conservation.

CHAPTER 4

THE STATE OF USE

A major factor limiting the increased use of *ex situ* collections of PGRFA is inadequate characterization and evaluation of accessions. Research has shown that the use of *ex situ* collection often is inadequate and genetic diversity is underused.

The use of germplasm is limited by the insufficient depth of a study, a various degree the improvement of breeding and loss of the adapted genotypes owing to an introgression. The capacity to carry out germplasm characterization or evaluation for each collection, taxon or crop/crop group by the different types of descriptors is various, table 15.

TABLE 15

Organization's capacity the characterization/evaluation of germplasm

Group of crops	Percent of accessions			Evaluated for	
	Characterized for traits	Based on molecular markers	Biochemical	Abiotic stresses	Biotic stresses
Cereals	100	2.0	10-70	50-100	10-100
Leguminous	80 -100		100	50-100	10-100
Fodder and oil-producing	40-60		10-100 (oil-producing); 5- 90 (fodder)	50-100	10-100
Horticultural	95-98			50-100	10-100
Vegetables and potato	27-69			50-100	10-100
Medicinal	10-15 -100		15.0	25	10-100

There is not a standardized information system for analysis of data, which were received under the characteristics and of germplasm assessment. Information system and core collections only are forming. Basically, the publications have covered the passport and evaluation/characterization data of *ex situ* collections. The greatest number of publications cover two cereal crops - wheat and barley, table 16.

TABLE 16

NISM, publications

Stakeholders	Name of *ex situ* collection	Publication coverage, data type-analyzed	Number of publication
SPCGF MOA RK	Wheat and barley collection	Passport data, Evaluation/ characterization data	13
	Collection of perennial fodder grasses		5
	Collection of perennial leguminous grasses		3
	Collection of Northern Kazakhstan medicinal plants		6
	Collection of groat crops		2
	Collection of forage crops		4
	Collection of oil-producing crops		3
Total on SPCGF			**36**
SPCF, MOA RK	Collection of wood and wood forming	Evaluation/characterization data	1
Pomologycal garden, SPCFPP, MOA RK	Collection of horticultures of Pomologycal garden SPCFPP	Passport data, Evaluation/ characterization data	2
Aktubinskaya AES, NWSPCA, MOA RK	Collection of forage crops	Evaluation/characterization data	2

Stakeholders	Name of *ex situ* collection	Publication coverage, data type-analyzed	Number of publication
SWSPCA, MOA RK	Collection of arid fodder crops of SWSPCA	Passport data, Evaluation/ characterization data	2
	Collection of medicinal plants of SWSPCA		1
	Collection of cereal crops of Krasnovodopad BES		3
Total on SWSPCA			**6**
RCLV, MOA RK	Collection of fodder plants of SPCLV	Passport data, Evaluation/ characterization data	7
IBPH, MES RK	Collection of world flora medicinal plants	Evaluation/characterization data	1
IPPGB, MES RK	Collection of wheat lines and forms	Evaluation/characterization data	8
RCPV, SPCFPG, MOA RK	Collection of vegetable and melone crops	Evaluation/characterization data	1
SPCFPG, MOA RK	Wheat collection	Passport data, Evaluation/ characterization data	61
	Collection of triticale		5
	Collection of maize		3
	Collection of barley		23
	Collection of sugar beet		1
	Collection of oil-producing crops		1
	Collection of medicinal plants		1
	Collection of leguminous crops		1
	Collection of fodder grasses and leguminous fodder grasses		1
Total on SPCFPG			**97**
Total			**161**

The capability to perform breeding for different crop groups is estimated as stable. The local genebank, regional/ international network and CGIAR genebank were used as sources of germplasm. Joint breeding involves farmers in setting the priorities of breeding.

The improvement of specific traits and population through incorporation or base broadening are the basic types of activities in the genetic enhancement. The rationale for activity: gain in breeding programs, specific trait not available in current breeding materials.

The assessment of genetic diversity through molecular markers and studying of pedigree for 2 crops - wheat, barley was made. With the purpose of the improvement in the cultivated wild species not earlier involved: *Aegilops, Secale* L., *Agropyron* L. have been investigated. Wild species - *T. timopheevi, T. militinae, T. Kihara, T, macha, T. dicoccum, T. turgidum, T. polonicum, T. spelta, T. sferococcum, T. compactum* as sources of resistance to diseases, of grain high quality, winter and drought hardiness have been used. The valuable initial stock combining productivity with resistance of the wild form is created. The lack of genetic diversity in the series of economic valuable traits and properties of plants is noted.

The traits or characteristics intended for improvement:

- **Cereals**

Productivity, grain quality, early maturity, resistance: during drought, lodging, diseases (yellow, brown, stem rusts, septoria) and to pests; salt-endurance, cold and winter hardiness.

- **Forages**

Productivity of grain and green matter, the low content of protein, resistance to a loose smut and a crown rust (oats); productivity and the low content of protein (<12 %), resistance to a common bunt and to a loose smut, a stem rust, a helminthosporiosis, and to pests (barley).

- **Grain legumes**

Productivity, resistance to: cold, drought, capacity for industrial technology in the cultivation, the high quality of grain (Soya been, chick pea, peas).

- **Fodder**

Productivity, a resistance to: diseases and pests, cold and drought hardiness, fixing of nitrogen (alfalfa); winter hardiness (sainfoin); resistance to a shattering of seeds, the low contents of a coumarin (a sweetclover yellow, white - *Melilotus officinalis* Pall); winter hardiness, a salt-endurance (wheat-grass); quality, resistance to: a shattering, a drought, longevity, grazing and a salt-endurance, (*Elymus yunceus* Fish.); resistance to abiotic stress (heat and drought) and productivity (arid fodder); productivity of a green and dry matter, seeds, multi hay cutting, resistance to diseases and trampling (perennial grasses).

- **Oil plants**

Increase of an oil percentage and resistance to pests (safflower).

- **Groat**

Productivity, early maturity, quality, resistance to the diseases, to the lowered temperatures (*panicum*); productivity, stability, quality, drought-resistance, resistance to shattering and lowered temperatures (buckwheat); productivity, the content of sugar (sorghum).

- **Fruits and berries**

Winter hardiness, high productivity, quality of fruits (apple). Late blooming, resistance to moneliose, compactness of tree crown, quality of fruits (apricot); resistance to diseases, winter hardiness, high quality of fruits, keeping quality (pear); winter hardiness, resistance to diseases, productivity, various times of ripening, quality of fruits (plum); winter hardiness, productivity, quality of fruits (cherry); resistance to conditions of growth, resistance to diseases and pests, productivity (wild strawberry)

- **Medicinal**

Productivity, the contents of biologically active substances.

Priority

The building of a standardized information system with the core collections consisting of samples, which reflect diversity as much as possible. Augmentation of accessions characterized by molecular markers and biochemical traits.

Constraints

Constraints to establish core collections in the country are:

- Lack of trained personnel;
- Need for core collection is not recognized;
- Limited number of accessions available;
- Lack of access to germplasm as needed to establish core collections;
- Inadequate available information on accessions;
- Methodology too complex.
- The absence of the modern equipment and long time for performance program.

The utilization for species of Kazakhstan flora is extremely various. According to Karmysheva, etc. (1979), useful qualities possess more than 1 500 species. Over 500 species concerns to medicinal plants (Vintergoller, 1979); 350 species - to technical plants (Pavlov, 1947). More than 500 species of Republic are fodder, nearby 300 - technical, more than 250 - medicinal, 150 species - food and volatile oil plants (Baytulin, 1986, etc. al). According to Grudzinskaya (2006), the most numerous of medicinal (1 300 species), fodder (1 028), decorative (649), technical (534), honey (532), and volatile oil (500) plants. It is necessary to consider, that the majority of species simultaneously are poisonous and medicinal, or food, honey plants, technical, etc., therefore the number of species in the resulted groups of useful plants does not reflect total of species of Kazakhstan flora, table 17.

Most of all medicinal species belongs to families: *Asteraceae Dumort*. (136), *Lamiaceae* Lindl. (83), *Ranunculaceae* Juss. (80), *Fabaceae* Lindl. (79), *Rosaceae* Juss. (76), *Apiaceae* J.Agardh (58), *Brassicaceae* Burnett (57), *Scrophulariaceae* Juss. (47), *Polygonaceae* Juss. (43), *Chenopodiaceae* Vent. (40).

Decorative species to families: *Asteraceae* (61), *Fabaceae* (51), *Rosaceae* (43), *Ranunculaceae* (38), *Salicaceae* Virb. (37), *Poaceae Barnhart* (24), *Scrophulariaceae* (17), *Lamiaceae* (16).

Fodder plants most of all meets as representatives of families: *Fabaceae* (189), *Poaceae* (154). *Asteraceae* (111), *Chenopodiaceae* (72), (42), *Brassicaceae* (38), *Polygonaceae* (38), *Ranunculaceae* (34), *Cyperaceae* Juss. (33), *Lamiaceae* (29), *Caryophyllaceae* Juss. (20).

Food plants - in families: *Rosaceae* (53), *Asteraceae* (34), *Fabaceae* (33), *Polygonaceae* (33), *Apiaceae* (30), *Brassicaceae* (28), *Chenopodiaceae* (27).

Not less than of 500 species of volatile oil plants are represented in flora of Kazakhstan that makes 8,3%. The richest families of a volatile oil plants: *Apiaceae* (79), *Lamiaceae* (59), *Asteraceae* (71), *Rosaceae* (21), *Ranunculaceae* (7), *Brassicaceae* (5), *Cupressaceae* Rich.ex Bartl. (4).

The high content of essential oils is revealed at 45 species: *Juniperus semiglobosa* Regel, J.*serawschanica* Kom., J.t*urkestanica* Kom., J.*sabin*a L. (*Cupressaceae*), *Abies sibirica* Ledeb., *Picea schrenkiana* Fisch. (*Pinaceae Horan*), *Mentha longifolia* (L.) *Huds*., *Dracoc*e*phalum nodulosum* Rupr., *Ziziphora clinopodiois* Lam., Z.*bungeana* Juz., *Thymus marschallianus* Willd. (*Lamiaceae*), including the species of families: *Apiaceae*, *Asteraceae* (*Egeubaeva*, 2002).

The species of plants with insecticidal activity is more often in families: *Asteraceae, Scrophulariaceae, Chenopodiaceae, Fabaceae, Ranunculaceae, Apiaceae, Lamiaceae, Rosaceae, Solanaceae* Juss., etc. The genera richest by such species: *Achillea* L., *Artemisia* L., *Pyrethrum* Linn., *Tanacetum* L., *Delphinium* L., *Glycyrrhiza* L., *Dodartia* L., *Linaria* Hill., *Lepidium* L., *Verbascum* L., *Vexibia* Rafin.и etc. (Gemedjieva, Sitpaeva, Vasilyev, 2002).

The assessment of Kazakhstan genetic resources has allowed revealing the level of study of useful plants. First of all, the food, medicinal and decorative species are estimated and studied. 66% of species (3 797 species from the general number, Gemedjeva, 2004) are characterized. The chemical compound is investigated for 1 753 species (31%) and useful properties for 1 495 species (26%) from 5 728 species («The Illustrated determinant of Kazakhstan plants», 1969, 1972; «The Red Book Kazakh SSR», 1981; the 9-languid edition «Vegetative resources … », 1984-1996; «Wild-growing useful plants of Russia», 2002). It has created the bank of experimental data on research of a chemical compound for more than 300 species of plants, the most common recommendation has been for an introduction to the state pharmacopoeia of Kazakhstan and in applied medicine (Musychkina, 2004).

Over 300 wild-growing species of higher plants from 64 families were objects of resource researches. The tannic, technical, medicinal, foods, volatile oil-producing plants were studied. For 57 species of medicinal plants (*Artemisia* L., *Aconitum* L., *Delphinium* L., *Glycyrrhiza* L., *Lagochilus* Bunge, *Polygonum* L., *Rosa* L., *Ephedra* L., *Rumex* L., etc.) the resource characteristics is given (Gemedjeva, 2000). The species of family *Alliaceae* are perspective for all-round studying - genera *Allium* L. (124 species) in which is characterized no more than 21% of species, also species of family *Apiaceae* (p. *Ferula* L., *Seseli* L., *Schrenkia* Fisch. *et* C.A.Mey., etc.), and family *Asteraceae* (*p. Alfredia* Cass., *Aster* L., *Centaurea* L., *Chondrilla* L., *Cirsium* Hill, *Cousinia Cass*., Crepis L., etc.) which require the further studying. The interest for study of a chemical compound and useful properties is represented the species from the families earlier not studied or having only short data (not less than 15): *Ceratophyllacea*e S.F.Gray, *Elatinaceae* Dumort., *Globulariaceae* DC., *Plumbaginaceae* Juss., etc., and also the species of families: *Boraginaceae, Brassicaceae, Caryophyllaceae* Juss., *Chenopodiaceae, Cyperaceae, Fabaceae, Lamiaceae, Poaceae, Polygonaceae, Ranunculaceae, Rosaceae, Rubiaceae* Juss. *Scrophulariaceae, Zygophyllaceae* R.Br.

TABLE 17

The basic groups of useful plants (quantity of species)

The basic groups of useful plants	Quantity of species	Are brought in «the Red book Kazakh SSR»
Medicinal	1 300	24
Fodder	1 028	7
Decorative	649	87
Technical	534	10
Honey plants	532	-
Weedy	501	-
Volatile oil plants	500	-
Food	443	17
Poisonous	307	2
Ecologically significant	172	1
Wild relatives	275	-
Insecticidal	119	-

Quantity of the projects promoting development and commercialization of under utilized crops and species are limited, but the interest of producers in alternative cultures high, table 18. Efforts are necessary for maintenance and sustainable use of under utilized crops and species. 67 species of edible plants of Kazakhstan belong to poorly used cultures demanding wide study, breeding, and well-adjusted marketing (appendix 2).

Priority

The potential of many cultures remain non-realized, there are cultures poorly or absolutely not investigated, their introduction on the basis of wide study and use of a gene pool with the subsequent breeding is a new approach in the decision of a problem diversification production.

TABLE 18

NISM, the projects target under-utilized crops or species

Stakeholder	Name of program/ project/activity	Target	Name of taxon	Name of crop	Areas of interest	Topics covered
Pomologycal garden	Conservation *in situ*/on-farm local and old races of an apple-tree and an apricot	Local varieties	*Armeniaca vulgaris*	Apricot	Almaty province	Research; Improvement of culture; Distribution of seeds; Public understanding
		Local varieties	*Malus domestica*	Apple		Research; Improvement of culture; Public understanding
RCLV	Development of silage making method from green weight of no conventional forage crops and an estimation of forages quality on eatability and nutritional value	Under-ultilized crops or species	*Rumex* L.	Dock	Almaty province	Research; Improvement of processing; Development of the market; Public understanding
		Under-ultilized crops or species	*Silphium perfoliatum*	Cup plant		Research; Improvement of processing; Development of the market
		Under-ultilized crops or species	*Heracleum sosnowskyi*	Cowparsnip		Research; Improvement of processing; Development of the market; Public understanding
		Under-ultilized crops or species	*Galega orientalis*	Bead moulde		Research; Improvement of processing; Development of the market; Public understanding
		Under-ultilized crops or species	*Helianthus tuberosus*	Jerusalem artichoke	Almaty province	Research; Improvement of processing; Development of the market; Public understanding

CHAPTER 5

THE STATE OF NATIONAL PROGRAMS, TRAINING AND LEGISLATION

National Academic Center of Agriculture Research (NACAR) of the Ministries of Education and Sciences of Republic Kazakhstan (1996 - 2001), the Ministry of Agriculture of Republic Kazakhstan (MOA RK- department of a science) since 2002 on present time are functioning as a governance structures responsible for coordinating and facilitating of PGRFA activities in the country.

Three national programs for the conservation and sustainable use of PGRFA:

- «The Collecting, studying, conservation and use of germplasm intensifying ecological breeding», 1996-2001, NACAR;
- «The creation, development and use the germplasm of agricultural plants, animals and microorganisms» 2001r, NACAR; 2002 - 2005, MOA RK;
- «The conservation, studying, the organization of storage and building the base of the information data the genepool of agricultural cultures » 2006-2008rr, MOA RK have determined the 4 basic directions of researches: collection; evolution; documentation and storage the germplasm of agriculture plants.

Participating partners:

- Plant breeders;
- Farmers;
- Universities;
- National genebanks;
- Ministry of Agriculture;
- Ministry of Education and Science.

National programs cover the activity areas of the Global Plan of Action:

- Area 1 - Surveying and Inventorying Plant Genetic Resources for Food and Agriculture;
- Area 2 - Supporting On-Farm Management and Improvement of Plant Genetic Resources for Food and Agriculture;
- Area 4 - Promoting *In Situ* Conservation of Crop Wild Relatives and Wild Plants for Food Production;
- Area 5 - Sustaining Existing *Ex Situ* Collections;
- Area 6 - Regenerating Threatened *Ex Situ* Accessions;
- Area 7 - Supporting Planned and Targeted Collecting of Plant Genetic Resources for Food and Agriculture;
- Area 8 - Expanding *Ex Situ* Conservation Activities;
- Area 9 - Expanding the Characterization, Evaluation and Number of Core Collections to Facilitate Use;
- Area 10 - Increasing Genetic Enhancement and Base-Broadening Efforts;
- Area 11 - Promoting Sustainable Agriculture through Diversification of Crop Production and Broader Diversity in Crops;
- Area 13 - Supporting Seed Production and Distribution.

The priority areas of GPA in which the country benefit most of all:

- 9 - Expanding the characterization, evaluation;
- 11 - Promoting sustainable agriculture;
- 13 - Supporting seed production and distribution.

The creation of agency or the committee responsible for PGRFA activity coordination, which would include representatives of the governmental, private, public and nongovernmental organizations, are the priority of national programs of PGRFA.

Constraints - the number of technical and managerial/policy experts working in the National programs are decreasing.

The 3 workshops and meetings of concerned persons and organizations were held to review national activities on conservation and use of PGRFA:

- Republican Conference «Genbank of plants and its use in breeding», Almaty, 1995;
- The International Conference «Problems of an effective utilization the germplasm of plants, animals and microorganisms», Astana 2000;
- The International Conference «Development of key directions of agricultural sciences in Kazakhstan: breeding, biotechnology, genetic resources », Astana, 2004.

The laws are regulating the conservation and sustainable use of PGRFA:

- The wood code, 1993;
- The environment protection law, 1997;
- The law on ecological assessment, 1997;
- The law on special protected areas, 1997;
- The contract about cooperation in the field of conservation and use of genetic resources of cultivated plants of the CIS states, 1999;
- The law on protection the achievements of breeding, 1999;
- The law on plant quarantine, 1999;
- The law of plants protection, 2002;
- The law on seed-growing, 2003;
- The land code, 2003;
- The decision about special protected areas, 2006.

No short course training opportunities exist in the region, but national programs staff have participated in short courses outside the region. The international organizations (IPGRI, CIMMIT, ICARDA) since 1997 have lead the international and regional trainings and courses in various activity areas of GPA, table 19.

TABLE 19

NISM, the training courses on PGRFA

Name of training course	Year	Number of participating staff	Coordinating organization
Conservation and Use of Plant Genetic Resources for Central Asian Countries	1997	2	IPGRI/ICARDA
Conservation and Utilization of Plant Genetic Resources in Agriculture and Forestry	2001	2	DSE/ZEL, Germany
Advanced Wheat Improvement	2000	1	CIMMYT, Mexico
Wheat Improvement	1997-2002	10	CIMMYT, Turkey, Mexico
The organization and realization of industrial tests in demonstration crops	2000	5	CIMMYT, Almaty
Agricultural science and production: integration in world system through knowledge of the international experience and modern lines of development	2000	5	CIMMYT, Almaty
Cereal Diseases and Insect Pests Management	2004	7	ICARDA, Uzbekistan
Development and approbation the techniques of surveying and perfection of breeding criteria of local both landrace varieties of apple and apricots	2003	2	IPGRI
Conservation and use of genetic resources in rural and wood farms	2001	2	IPGRI / ICARDA
Barley germplasm improvement	2003	3	ICARDA
Expert system in agriculture	2004	1	ICARDA
Bed planting and zero till planting for irrigated and rainfed wheat and maize production systems	2004	2	CIMMYT
DNA molecular marker techniques for crop improvement	1998 - 1999	2	ICARDA
Documenting of plants genetic resources	2002 - 2005	2	ICARDA
Darvin - IPGRI courses on plant genetic resources conservation	1997	1	IPGRI, Hungary
Total		**47**	

The GPA activity areas addressed:

- 1. Surveying and Inventorying PGRFA;
- 1.1 Taxonomy;
- 2. Supporting On-farm Management and Improvement of PGRFA;
- 4. Promoting *In Situ* Conservation of Crop Wild Relatives and Wild Plants for Food Production;
- 5. Sustaining Existing *Ex Situ* Collections;
- 7. Supporting Planned and Targeted Collecting of PGRFA;
- 8. Expanding *Ex Situ* Conservation Activities;
- 8.1. *Ex situ* Conservation of Vegetative Propagated and Recalcitrant Seeded Plants;
- 9. Expanding the Characterization, Evaluation and Number of Core Collections to Facilitate Use;
- 9.1. Germplasm Characterization and/or Evaluation;
- 9.2. On-farm Evaluation;
- 10.1. Plant Breeding;
- 11. Promoting Sustainable Agriculture through Diversification of Crop Production and Broader Diversity in Crops;
- 13. Supporting Seed Production and Distribution.

The following statements describe the state of education and training of PGRFA in the country:

- A strategy exists, but is not being adequately implemented;
- Some training and education opportunities exist in the country.

The greatest obstacles to training in PGRFA in the country:

- Lack of awareness of the training needs within the country;
- Lack of trained personnel in the country to provide training;
- Lack of financial resources;
- Paucity of resource materials to improve existing training programs;
- Paucity of human resources to provide quality training.

The awareness of Kazakhstan public of PGRFA of the value of plant genetic resources for food and agriculture conservation and use are limited, the public awareness activities are not coordinated. The awareness of the PGRFA value integrated into pre-secondary and secondary educational curricula do not reflect specificity the problems of PGRFA. There is no uniform program of ecological education (The National Plan of Action on environmental control for sustainable development RK, 1999).

The tendencies to strengthen ecological education exist in Universities. 15 Universities have the faculties bound to ecological disciplines. The disciplines «Ecology and monitoring of the industry», «Geography and ecology», «Chemistry and ecology», «Biology and ecology» are led, but the training opportunities of universities in the region of topics related to PGRFA conservation and use are not sufficient to meet needs.

The long-term strategy of Kazakhstan development up to 2030 contains the section "Ecology and natural resources - 2030" where ecological education is included as one of priorities. "National strategy and the Plan of Conservation and Sustainable Use of Biodiversity RK" (1999) is planning the activity on strengthening ecological education and trainings.

With this purpose:

- The following magazines and newspapers on a regular basis are issued: The Ecological courier, The Ecological bulletin, The Ecology and Sustainable development, The Ecological Bulletin;
- The program about a biological diversity of Republic Kazakhstan, the project of the nongovernmental organization «The Altay fund» is issued by TV;
- The net on diffusion of the environmental information ("Ecology through mass media ") is organized by Ministry of Environment Protection;
- The web-site which covers the broad audience of ecology questions is developed.

The targeted audiences:

- Scientists
- Farmers
- School children
- General public

Topics covered:

- National policy
- Environmental education

All projects of the non governmental organizations provided the education of local population in the field of preservation the biodiversity. The project «Strengthening public participation in addressing global environmental problems» is implemented in Republic at financial support UNDP/GEF/SGP. The purpose of the project: the development of opportunities for the non-governmental organizations in the field of information support for local populations in the remote areas of Kazakhstan.

Priority

It is necessary to expand and improve education and training in the country. Specialized training is needed to upgrade and enhance the education of personnel involved in conservation and use of PGRFA. This capacity-building activity may be organized nationally, regionally or internationally. In the country, there exists the necessity to promote public awareness of the value of PGRFA conservation and use and to increase the public awareness activities through well-coordinated National PGRFA Programs.

The greatest constraints to developing and using public awareness materials:

- National priorities have not been established;
- Staff has insufficient skills and knowledge;
- It is not clear which organization is responsible for this activity;
- Insufficient financial support.

CHAPTER 6

THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

The Kazakhstan Republic signed in 1992 and ratified in 1994 the UN Convention on Biological Diversity. The National Strategy and Action Plan on conservation and sustainable use of biological diversity of the country was developed in 1998 with the financial support of the GEF and UNDP and with the participation of domestic scientists and consultants. The National Strategy and Action Plan on conservation and sustainable use of biological diversity was developed in line with the requirements of the Convention regulations, the national specifics and the social-economic situation of the Republic. The first part of this work was completed in the summer of 1998 by publication the National Report "Conservation and Sustainable Use of Biological Diversity in Kazakhstan Republic".

The Government of Kazakhstan signed agreements concerning environment protection with the Governments: USA, 1995; Israel, 1995; Turkey, 1997; Georgia, 1996 and with the various international, nongovernmental and commercial organizations: публикацией

- World Bank and its regional office in Kazakhstan
- Global Environmental Facility
- UNDP
- The Asian Bank of Development
- The UN Environment Program and its European and Asian offices
- The European Bank of Reconstruction and Development
- TACIS
- UNO UNESCO Commission on Sustainable Development
- NABU
- Flora and Fauna International
- FAO
- WWF
- ICARDA
- European Agency on Environment
- IUCN - The World Conservation Union
- WCMC
- The European Center of Nature Protection
- CIDA

The International Agreements and Memorandums in the field of agriculture development, agricultural science, conservation and use of plants genetic resources are signed, table 20.

TABLE 20
Regional and International Collaboration

The Agreement about Multilateral Interstate Specialization of Production and Deliveries the Seeds of Agricultural Crops Varieties and Hybrids, October, 9th, 1992	The Azerbaijan Republic (since August, 16, 1995), Republic Armenia, Byelorussia, Republic Kazakhstan, the Kirghiz Republic, Republic Moldova, the Russian Federation, Republic Tajikistan, Turkmenistan, Republic Uzbekistan, Ukraine, the Hungarian Republic (since July, 25, 1996), the Czech Republic (since January, 13, 1998), Republic Croatia (since July, 1, 1999)
The Agreement on Interstate Mutual Relations on Questions of Agriculture, April, 28, 1993.	The Azerbaijan Republic, Republic Armenia, Byelorussia, Georgia, Republic Kazakhstan, the Kirghiz Republic, Republic Moldova, the Russian Federation, Republic Tajikistan, Republic Uzbekistan, Ukraine
The Cooperation Agreement in Sphere of an Agricultural Science, 08.09. 1999.	The government of Republic Kazakhstan and the International Center of Maize and Wheat Improvement – CIMMYT
The Memorandum concerning Scientific and Technical Cooperation, 06.06. 2001.	The National Academic Center of Agrarian Researches (NACAR) in Kazakhstan and the International Center of Agricultural Researches in Dry Areas (ICARDA)
The Agreement between New Independent Republics of Central Asia and ICARDA, 1995.	Republic Kazakhstan, the Kirghiz Republic, Republic Tajikistan, Republic Uzbekistan,
The Agreement on the Common Agrarian Market of CIS States, March, 06, 1998.	Republic Armenia, Byelorussia, Georgia, Republic Kazakhstan, the Kirghiz Republic, Republic Moldova, the Russian Federation, Republic Tajikistan, Republic Uzbekistan, Ukraine
The Cooperation Agreement in the field of Conservation and Uses of Cultural Plants Genetic Resources of CIS States, June, 04, 1999. Minsk	The Azerbaijan Republic, Republic
The Concept of the Coordinated Agrarian Policy of the CIS States, May, 30, 2002.	Armenia, Byelorussia, Georgia,

The basic purpose of the Minsk agreement (1999) in the field of conservation and use of genetic resources of cultivated plants are:

- Maintenance of mutually advantageous access to accessions, gathered in genbanks of former republics USSR;
- Rapprochements the legislation of the States with a view of exchange by plants genetic resources between the States;
- Assistance of free and duty-free movement of samples through borders in view of requirements of the phytosanitary control;
- The Sides assist in use of varieties and hybrids created in their territories.

The agreements with the International Center of Maize and Wheat Improvement - CIMMYT (08.09. 1999r) and the International Center of agricultural Researches in Arid regions - ICARDA (06.06.2001) have been signed with the purpose to increase of agricultural production, conservation of plants genetic resources, the savings of an environment in Republic Kazakhstan by means of attraction of foreign investments into an agricultural science, uses of the international centers experience of science, deliveries of modern devices and the equipment and of training of the scientific staff. Within the limits of the concluded Agreements are organized:

- An exchange of scientists, experts and high technologies;
- An exchange of germplasm and breeding material according to the current legislation of Republic Kazakhstan and the International Convention on a biological diversity;
- An exchange of the scientific information and methodology;

By the international centers were organized:

- Consultations the staffs of the international research organizations to increase the level of national scientific researches of Republic Kazakhstan;
- Services of foreign scientists for realization of research programs;
- Grants for training the Kazakhstan scientists and experts;
- Financial supports for the participation of the Kazakhstan scientists and experts in symposiums, seminars and the conferences concerning themes, representing of mutual interest;
- Maintenance with a seed material in the quantities necessary for experiences and demonstrations;
- Maintenance with the equipment.

The interactions between the international and national programs in the field of plant breeding have breadth and a uniform route. The international varieties testing are organized so that directly to provide with beneficial genetic diversity

the farmer and the breeder (genetic sources and donors for national programs). The international nurseries influence a compound of varieties globally and in the subsequent provide economic success of farmers through identification widely adapted germplasm, possessing high degree of hereditary stability in numerous conditions. During the past 10 years, breeders in Kazakhstan have tested the order of 12 000 accessions of cereals, forage, leguminous cultures of the international nurseries of CIMMYT and ICARDA. From International to State Varieties Testing Commission of RK have transferred highly productive, resistant against diseases 3 varieties of wheat, 1 variety of chick pea, 2 variety of nut, 1 variety of winter barley; 3 variety of spring barley.

The «Regional strategy of conservation and use of genetic resources of plants for agriculture and the food in the Central Asia and Caucasus» has been accepted in March 2007 (CGIAR Programs Facilitation Unit, Tashkent, IPGRI / ICARDA, 2007).

Regional Strategy, the document regarding long-term planning, determines principles, priorities and the basic directions of activity in conservation and use of genetic resources of plants in the Central Asia and Caucasus. Regional Strategy determines the direction of effective conservation and use, legal, scientific, financial and personnel maintenance, management and coordination, the international cooperation in the field of genetic resources of plants for food and agriculture. The basic objects of Regional strategy are the major regional collections of PGRFA. Through this collection effective conservation, use and exchange of PGR in region of CAC will be carried out.

CHAPTER 7

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

Kazakhstan is a participant of the Plants Genetic Resources Network organized in 1999 in Central Asia and Caucasus. The joint research program on steady development of the agriculture, which was developed with nine centers of CGIAR and by National systems of agricultural researches for the CAC countries, has been in operation since 1999. The working groups are organized by region, and Kazakhstan is responsible for work with cereal crops.

The projects « *In situ*/on-farm conservation of agro - biodiversity in the Central Asia », « Creation of a computer database of wood genetic resources in the Central Asia », « Creation of a computer database on fruit genetic resources of the Central Asia » is carried out in common.

Several networks have been established in the country for the wide use of crop germplasm for mutual benefits, such as setting regional and global priorities in germplasm conservation, genetic enhancement and enrichment, table 21.

TABLE 21

NISM, networks on PGRFA

Network on plants genetic resources	Coordinating organization	GPA activity areas
Kazakhstan - Siberian network on improvement of a spring wheat	CIMMYT	Increasing genetic enhancement and base-broadening efforts; Promoting sustainable agriculture
Regional nursery on the improvement winter and facultative wheat in region of the Central Asia and Caucasus	CIMMYT	Increasing genetic enhancement and base-broadening efforts; Promoting sustainable agriculture
The regional project «Plant genetic resource conservation, documentation and utilization in Central Asia and the Caucasus »	ICARDA	Expansion of activity on *ex situ* conservation, Constructing comprehensive information systems for PGRFA
The regional project «Increase of the stability of a winter wheat to a yellow rust with use traditional and molecular-genetic approaches»	CIMMYT	Increasing genetic enhancement and base-broadening efforts; Promoting sustainable agriculture
The regional project «Conservation through sustainable use of fruit genetic resources in Central Asia»	IPGRI	Surveying and inventorying, assistance to *in situ*/on-farm conservation

The support that Government has provided the activity of network:

- Technical expertise in joint activities;
- Organization and hosting of network meetings;
- Institutional infrastructure to participate in joint activities;
- Information management support;

The major benefits gained by the country through PGRFA networks:

- Transfer of technology;
- Exchange of germplasm;
- Increased stakeholder participation;
- Increased research facilities;
- Sharing of responsibilities for network activities;
- Exchange of technical expertise;
- Training for national programs scientists;
- Exchange of information;
- Access to advanced research results;
- Joint characterization and evaluation of germplasm;
- Increased awareness of PGRFA.

No constraints exist to the effective participation of a country in regional and/or international PGRFA networks.

The information management plays a pivotal role in PGRFA conservation and utilization by its involvement in the collection, documentation, summarization and dissemination of information in a user-friendly manner (GPA, FAO, 1996).

There is not a standardized information system in the country between organizations participating in the activities of the National Programs. Since 2004 the country has participated in the project of ACIAR (Australian Center for International Agricultural Research) - «Plant genetic conservation, documentation and utilization in Central Asia and the Caucasus». In 2006 the project began «The building of national information system on genetic resources of plants of Kazakhstan according to the international descriptors», financed by MOA RK.

Priority

To build a comprehensive information system to develop the best approach to conservation and use both *ex situ* and *in situ* diversity of PGRFA. Augmentation the number of PGRFA networks for support the safe duplication of germplasm and exchange by germplasm and information.

Constraints

Some 1-33% of GPA stakeholders in the country equipped with computers and have connection with the Internet (dialing).

CHAPTER 8

THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

The genetic resource of agricultural plants provides a biological base of national safety and stability. Decisions regarding foodstuffs, present and future, is a strategic valuable capital in any country. These resources correctly used will never be exhausted by virtue of internal compatibility inherent in them between preservation and utilization (Global Plant of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, FAO, 1996).

Kazakhstan owns the important genetic resources for a feed and agriculture, including endemic, wild relatives of cultural plants and the wild plants used in food.

Kazakhstan is a region rich in the primary and secondary gene pools of many cultivated and wild plants (Vavilov, 1930). According to Pavlov (1956), the Kazakh flora consists of 5 700 species, according to S.A. Abdullina, (1999) of 6 000 species of vascular plants, of which 210 species are crop wild relatives. The specified species enter in primary, secondary and tertiary genepools of cultural plants being that, valuable genetic material representing exclusive interest as genetic sources of many economic-useful attributes. This genetic diversity and at the moment generates a new biodiversity which is potentially and economically important component of natural ecosystems as a result of interaction. From local PGRFA the country receives as direct benefit - direct use as products of plant growing, and indirect in reception of the breeding-improved forms. One of major factors of increase of economic efficiency and stability of agricultural production RK are new varieties and hybrids. Genetic resources determine the success of breeding work and prospect of its development. The volume of seed collections of the basic agricultural crops in Kazakhstan is made more than 70 thousands samples. The unique material of local breeding - sources and donors of adaptability, stability to different stresses, efficiency is collected. On the basis of an available germplasm it is created and realized in the country more than 700 grades and hybrids. The characteristic and constant estimation economic - valuable attributes are the precondition the use of the collected germplasm. The interactions between the international and national programs in the field of plant breeding have breadth and a uniform route. The international varieties testing are organized so that directly to provide with beneficial genetic diversity the farmer and the breeder (genetic sources and donors for national programs). The international nurseries influence a compound of varieties globally and in the subsequent provide economic success of farmers through identification widely adapted germplasm, possessing high degree of hereditary stability in numerous conditions. During 10 years by breeders of Kazakhstan is tested the order of 12 000 accessions of cereals, forage, leguminous cultures of the international nurseries of CIMMYT and ICARDA. From International to State Varieties Testing Commission of RK are transferred highly productive, resistant against diseases 3 varieties of wheat, 1 variety of chick pea, 2 variety of nut, 1 variety of winter barley; 3 variety of spring barley. The perspective breeding material of international nurseries (CIMMYT) participated in the organization of demonstration experiences for farmers (1999-2004).

In the Republic, despite successes in breeding of the agricultural crops, unstable production demands creation of varieties, which on a more essential level attributes of adaptability and stability would be lifted: winter hardiness, drought resistance, stability to wreckers and illnesses. The presence of improved germplasm - effective and strong with genetic stability to insects, illnesses, stresses of an environment help to achievement of specified goals.

However, in past years connection with deterioration of the ecological situation, many wild species and wild-growing relatives which represent exclusively big interest as genetic sources of many economic useful attributes, including high stability to illnesses, wreckers, a cold, a drought, are under direct threat of genetic erosion. By inclusion in the breeding process they are potentially capable to solve a much wider *spectrum* of problems than that which they solve now. Wild forms, local varieties, especially the materials adapted for a microclimate, quickly disappear as a result of replacement by the modern varieties. Almost are completely lost landraces, farmers' varieties of national breeding. The modern varieties, which have gone through modernization of agriculture, highly adapted, carefully selected, have an inevitably limited genetic base.

The necessity for genetic diversity, as much as possible, adapted to concrete ecological resources has increased. Value PGRFA for the country in the future will increase, that will demand preservation of the unique genetic diversity of plants. It is necessary to create a system, which would allow keeping existing and additional created stocks of germplasm. Creation and preservation of genetic resources of grain crops *ex situ* are factors for increase in economic efficiency and stability of an agricultural production of Republic Kazakhstan.

Monitoring the performance of the Global Plan of action is important for defining priorities and development of future plans for effective utilization of genetic resources at both national and international levels. The effective mechanism for the information interchange, received as a result of research, is a National Information Sharing Mechanism, which represents the computerized system for gathering and information interchange at national and international level.

The establishment of the National Information Sharing Mechanism for performance of the Global Plan of action was a very important project, especially for Kazakhstan, which just began to create, develop and introduce information structures on PGRFA for effective management of food security and sustainable development. Involvement of active, reliable and responsible stakeholders is essential as well as existing networks.

NISM strengthens National Programs of the country on PGRFA by:

- Assistance in understanding the status and dynamics of genetic resources of plants for the food and agriculture;
- Involving national partners in creation of the National Information System, allowing to lead the all-round analysis of cumulative data in time. The target information provides basis for identification of blanks and priorities in performance GPA, and thus, creates a basis for planning available resources;
- Increase of an opportunity of the country in management of genetic resources of plants for the food and agriculture; providing the use of the joint data among users.

NISM provides a basis for performance of the Global Plan of Action.

Strategy of Kazakhstan PGRFA development

The establishment of the Information Sharing Mechanism has rendered the essential help in preparation of the National Report and identification of the priorities and constraints of future activities in the field of GPA implementation in RK.

In situ management

Priorities

- The national strategy should include a survey and inventory of plant genetic resources for food and agriculture RK an activity which should not be limited to cultivated crops and their wild relatives, but the assessment of diffusions important for food and agriculture cultures should be lead.
- The connection between collections and the users - farmers, breeders, scientists, should be strong for successful performance of PGRFA National Strategy. It is necessary for there to be a joint plant breeding with farmers, development of the local varieties market, and an exchange by the local varieties seeds. Farmers should be presented with a structure, advice or other managing frames of genebanks. The conducted measures will promote public comprehension of conservation and improving local PGRFA.
- International, national, and regional agreements are necessary for fast and effective germplasm introduction, adapted for local conditions.
- Wild relatives, wild plants for food, landrace, endemic, the species included in "Red Book" and the species which have limited territory in Kazakhstan are priority for conservation *in situ*.

Ex situ management

Priorities

- Creation of appropriate conditions for long term and medium term storage, regular performance monitoring of viability and genetic integrity of collections *ex situ*.
- For each collection *ex situ* it is necessary to develop a plan for regeneration: to identify the number of accessions of everyone taxon, which requires regeneration.
- Development of a national information system for identifying the gaps in existing collections and give priority to the planned and targeted collecting of PGRFA. Special attention should be given for the opportunity of further

action at a national or sub-regional level. The actions or support from regional and/or international organizations are needed. Information systems of the regional and international organizations can assist to identify the gaps by way of comparison of a stored collection with historical and geographical references.

Management of the use

Priorities

- Creation of a standardized information system and core collections consisting of samples, which reflect the diversity. Augmentation of percent of accessions characterized by molecular markers and biochemical traits.
- The traits or characteristics of agriculture crops needed for improvement:

Cereals

Productivity, grain quality, early maturity, resistance: to drought, lodging, diseases (yellow, brown, stem rusts and a septoria) and to pests; salt-endurance, cold and winter hardiness.

Forages

Productivity of grain and a green matter, the low content of protein, resistance to a loose smut and a crown rust (oats); productivity and the low content of protein (<12 %), resistance to a common bunt and to a loose smut, a stem rust, a helminthosporiosis, and to pests (barley).

Grain legumes

Productivity, resistance to: cold, drought, capacity for industrial technology of cultivation, the high quality of grain (soybean, chick pea, peas).

Fodder

Productivity, a resistance to: diseases and pests, cold and drought hardiness, fixing of nitrogen (alfalfa); winter hardiness (sainfoin); resistance to a shattering of seeds, the low contents of a coumarin (a sweetclover yellow, white - *Melilotus officinalis* Pall); winter hardiness, a salt-endurance (wheat-grass); quality, resistance to: a shattering, a drought, longevity, grazing and a salt-endurance, (*Elymus yunceus* Fish.); resistance to abiotic stress (heat and drought) and productivity (arid fodder); productivity of a green and dry matter, seeds, multi hay cutting, resistance to diseases and trampling (perennial grasses).

Oil plants

Increase of an oil percentage and resistance to pests (safflower).

Groat

Productivity, early maturity, quality, resistance to the diseases, to the lowered temperatures (*panicum*); productivity, stability, quality, a drought-resistance, resistance to a shattering and the lowered temperatures (buckwheat); productivity, the content of sugar (sorghum).

Fruits and berries

Winter hardiness, high productivity, quality of fruits (apple). Late blooming, resistance to moneliose, compactness of tree crown, quality of fruits (apricot); resistance to diseases, winter hardiness, high quality of fruits, keeping quality (pear); winter hardiness, resistance to diseases, productivity, various times of ripening, quality of fruits (plum); winter hardiness, productivity, quality of fruits (cherry); resistance to conditions of growth, resistance to diseases and pests, productivity (wild strawberry).

Medicinal

- Productivity, the contents of biologically active substances.
- Wider use of molecular markers for an assessment of *ex situ* collections genetic diversity.
- There is a necessity to increase diversity in agricultural systems by the strengthening of breeding, seed-growing and increasing the areas under sowings of following crops: oil plants - rape winter and summer, safflower, soybean, mustard, flax olive, peanut, castor-oil plant, poppy; pulse crops - soybean, peas, a chick pea, a peavine, lentil; industrial crops - a sugar beet, a cotton plant, tobacco; groat - rice, a buckwheat, *panicum*; vegetable - tomato,

cucumbers, pepper, spicy; horticultural - new berries cultures - a honeysuckle, a sea buckthorn, unarmed a blackberry; arid fodder.

- The potential of many cultures remain non-realized, there are crops poorly or absolutely not investigated, their introduction on the basis of wide study and use of a gene pool with the subsequent breeding is a new approach in the decision of a diversification production problem.
- Increasing the production level of original and elite seeds of following crops: brewing barley, corn on grain, rice (grain), a soybean, peas, a chick pea, a peavine, lentil (leguminous crops), a buckwheat, *panicum* (groat), a rape, a safflower (oil-bearing plants), a sugar beet, a cotton plant (technical), perennial cereal grasses, arid (fodder), vegetable and a potato, berries, grapes.
- Modernization of agriculture with increasing intensification has been a principal contributing in eroding diversity. Numerous locally adapted traditional varieties of crop plants have been replaced by modern varieties responsive to intensive agriculture. This trend needs to be reversed by increasing demand for genetically diverse traditional varieties and diversity-rich materials in the market place. This will encourage farmers to maintain locally adapted diversity on-farm as "living collections" of PGRFA.

The national programs and training

Priorities

- Creation of an agency or committee responsible for the coordination of activity on PGRFA, which would include representatives of the governmental, private, public and nongovernmental organizations;
- Augmentation of PGRFA networks number for support of germplasm safe duplication, and exchange of germplasm and information.
- Building a comprehensive information system to develop the best approach to conservation and use both *ex situ* and *in situ* preserved diversity of PGRFA.
- It is a necessity of any mechanism to assess genetic erosion in both *in situ* and *ex situ* reserves in the country.
- There are necessities in expanding and improving education and training in the country. Specialized training is needed to upgrade and enhance the capacity of personnel involved in conservation and use of PGRFA. This capacity-building activity may be organized nationally, regionally or internationally.
- It is necessary to promote public awareness in regards to the value of PGRFA conservation and its use.
- These problems, designated above, demand legislative answers to some questions relating to the coordination and financing of PGRFA research.

APPENDIX 1

THE AREAS OCCUPIED WITH VARIETIES OF THE KAZAKHSTAN BREEDING, ALLOWED TO USE, 2006

Culture, variety	The area, thousand ha	Year of division into districts	Оригинатор	Area of cultivation
Spring wheat:				Akmola
Akmola 2	1 109.8	1998	SPCGF	
Karabalykskaya 90	710.54	1995	NWSPCA	Pavlodar, Karagandy, Kostanay, Akmola, North Kazakhstan
Kazahstanskaya rannespelaya	538.83	1991	SPCFPG, Karabalykckaya AES	Kostanay, Akmola
Lyubava	449.8	2003	TOO «Phyton», Kostanay area.	Kostanay, North Kazakhstan
Tselinnaya 3S	347.12	1996	SPCGF	Kostanay, Akmola, North Kazakhstan
Lyutescens 32	220.9	1996	SPCFPG	Kostanay
Astana	210.4	2004	SPCGF	Akmola, North Kazakhstan
Tselinnaya yubileinaya	153.96	1988	SPCGF	Kostanay, Akmola
Ertis 97	92.0	2003	PSRIA	Pavlodar
Eritrospermum 35	91.3	1991	NWSPCA, SPCGF	Akmola, North Kazakhstan
SID88	58.1	1993	NWSPCA, SPCGF	Kostanay, Akmola, North Kazakhstan
Kazahstanskaya 25	55.4	1997	SPCFPG	Kostanay
Kazahstanskaya 15	55.3	1993	SPCFPG, PSRIA	Pavlodar, North Kazakhstan
Kazahstanskaya 19	41.9	1994	SPCFPG	Kostanay
Ulbinka 25	41.6	1989	EKSRIA	East Kazakhstan
Damsinskaya 90	31.08	1995	SPCGF	Akmola, North Kazakhstan
Karagandy 22	31.3	2004	KarSRIPGB	Pavlodar, Karagandy
Pamyat 47	30.0	1995	Krasnovodopad BES	South Kazakhstan
Kazahstanskaya 4	27.6	1980	SPCFPG	Almatinskaya
Volgouralskaya	18.8	2003	Uralskaya AES, Samara SRIA	West Kazakhstan
Shortandinskaya 95 uluchshennaya	15.02	2006	SPCGF	Akmola
Lyutescens 90	9.55	1996	SPCFPG, Zhezkazgan ES	Akmola, North Kazakhstan
Karagandy 70	6.8	1992	KarSRIPGB	Pavlodar, Karagandy
Arai	4.9	1999	SPCFPG	Almatinskaya
Celinnaya 26	4.6	1986	SPCGF	East Kazakhstan
Altai	2.7	2006	EKSRIA	East Kazakhstan
Kostanay 52	1.9	2000	Karabalykckaya AES	Kostanay
Kazahstanskaya 17	1.25	1994	SPCFPG	East Kazakhstan
Fiton	0.8	-	-	
Kargala 9	0.4	2005	Aktubinskaya AES, SPCFPG	Aktobe
Sseke	0.09	-	PSRIA	Pavlodar
Total spring wheat	**4 272.440**			
Winter wheat:				Zhambyl, South Kazakhstan, Kizilorda
Steklovidnaya 24	177.2	1995	SPCFPG	
Krasnovodopadskaya 210	94.0	1976	Krasnovodopad BES	South Kazakhstan
Bogarnaya 56	62.8	1981	SPCFPG	Almaty, Zhambyl

Culture, variety	The area, thousand ha	Year of division into districts	Оригинатор	Area of cultivation
Kazahstanskaya 10	52.8	1992	SPCFPG, Semipalatinsk branch of EKSRIA	Almaty, Kizilorda
Naz	37.5	2001	SPCFPG	Zhambyl, East Kazakhstan
Zhetysu	35.73	1993	SPCFPG	Almaty, South Kazakhstan, Zhambyl, Kizilorda
Almaly	24.03	2003	SPCFPG	Almaty, Zhambyl, Kizilorda
Yuzhnaya-12	15.0	1992	Krasnovodopad BES	South Kazakhstan
Sapaly	1.3	2001	SPCFPG	Almaty
Eritrospermum 350	0.6	1998	SPCFPG, IBPH	
Akterek	0.035	2002	SPCFPG, Tatarstan	Kizilorda
Karlygash	0.025	1986	SPCFPG	
Yubileinaya	0.016	2001	SPCFPG	
Total winter wheat	**501.036**			
Total wheat	**4 773.476**			
Barley:				Almaty, Zhambyl, Kostanay, Akmola, North Kazakhstan, East Kazakhstan
Arna	216.32	1997	SPCFPG	
Baisheshek	155.9	1985	Krasnovodopad BES	Almaty, Zhambyl, South Kazakhstan
Celinnaya 91	72.95	1996	SPCGF	Pavlodarskaya, Akmola
Medikum 85	46.45	1989	NWSPCA, VNIIR Russia	Kostanay, Akmola, North Kazakhstan
Ubagan	28.7	2003	Karabalykckaya AES	Kostanay, Akmola
Zhuldyz	24.2	1993	SPCFPG	Almaty
Granal	19.11	1991	NWSPCA	Kostanay, Akmola
Bereke	7.0	1994	Krasnovodopad BES	South Kazakhstan
Celinnaya 30	2.98	1991	SPCGF	Akmola
Karagandy 5	2.7	2000	KarSRIPGB	Karagandy
Astana 2000	0.75	2005	SPCGF	Akmola, North Kazakhstan
Karabalykskaya 150	0.56	1996	Karabalykckaya AES	Karagandy, Aktobe
Ilek 9	0.02	2007	SPCFPG, Aktubinskaya AES	Aktobe
Total barley	**577 640.0**			
Winter rye:				East Kazakhstan
Zashita	4.93	1991	EKSRIA, Institute of Cytology ans Genetic SB RAS	
Triticale				
Taza	0.12	2002	SPCFPG	
Oat:				Akmola
Bitik	1.22	1996	SPCGF	
Buckwheat:				Pavlodarskaya
Shortandinskaya 2	4.0	2004	SPCGF	
Shortandinskaya krupnozernaya	0.75	1994	SPCGF, Tatarskyi SRIA	Akmola, North Kazakhstan
Shortandinskaya 2	0.01	2004	SPCGF	Akmola
Total buckwheat	**4 760.0**			
Sunflower:				Almaty
Kazahstanskii 3124	39.2	2001	EF oil-producing cultures	
Sunkar	23.1	2005	EF oil-producing cultures	Pavlodar, East Kazakhstan
Kazahstanskii 341	16.65	1998	EF oil-producing cultures	Akmola, North Kazakhstan
Zhaina	7.5	2004	EF oil-producing cultures	West Kazakhstan, Aktobe
Kazahstanskii 465	6.9	2005	EF oil-producing cultures	East Kazakhstan
Vostochnyi	5.66	2004	EF oil-producing cultures	
Solnechnyi 20	1.5	1998	EF oil-producing cultures	East Kazakhstan, North Kazakhstan,
Kazahstanskii 1	0.77	1993	EF oil-producing cultures	East Kazakhstan

Culture, variety	The area, thousand ha	Year of division into districts	Оригинатор	Area of cultivation
Gulbagys	0.1	2007	EKSRIA	Pavlodar, East Kazakhstan
Total sunflower	**101 380.0**			
Flax:				Akmola
Kostanaiskii yantarnyi	1.2	1994	NWSPCA	
Maize:				Almaty
Kazahstanskaya 587	7.0	1989	SPCFPG, PSRIAEA, Krasnodar SRIA	
Sairam	6.0	2002	PK «Yassavy»	South Kazakhstan
KazZP678	4.2	1996	SPCFPG, Institute of Maize	Almaty
Kaz-43TV	2.3	1974	SPCFPG, SWSPCA	
Kazahstanskaya 700SV	2.3	1993	SPCFPG, ТФ	Zhambyl
Alatau 107 TV	0.01	1992	SPCFPG, ВНИИ кукурузы	Almaty, West Kazakhstan
Total maize	**2 181.0**			
Sugar beet:				Almaty
KazSIBMS 14	466.0	2001	SPCFPG, Institute of Cytology and Genetic	
Rice:				South Kazakhstan, Kizilorda
Marzhan	61.6	1987	PSRIAEA	
Ushtobe	2.6	1963	Karatal experimental field of KazSRIF	Almaty
Pak li	1.3	2004	SPCFPG, PK «Opytnoe»	
Madina	0.248	2007	IPPGB	Kizilorda
Total rice	**65 748**			
Safflower:				Zhambyl, West Kazakhstan, South Kazakhstan
Nurlan	44.5	1996	Krasnovodopad BES	
Akmai	31.8	2002	Krasnovodopad BES	Almaty, South Kazakhstan, Zhambyl
Total safflower	**76 300.0**			
Soybean:				Almaty
Kazahstanskaya 2309	14.9	1992	SPCFPG	
Zhalpaksai	5.0	2003	SPCFPG, Ukrainian SRI of irrigated agriculture	Almaty, East Kazakhstan
Total soybean	**19 900.0**			
Potato:				Almaty, Karagandy
Tamasha	29.6	1996	KarSRIPGB, SRIPV	
Tohtar	5.5	2003	SRIPV, IMBB	Almaty
Aksor	1.25	1998	SRIPV	Zhambyl, West Kazakhstan, Aktobe
Tamyr	0.3	2000	SRIPV	Zhambyl
Zhanaisan	0.2	2003	SRIPV	Zhambyl
Kokchetavskii rannii	0.15	1993	Kokshetau branch SPCGF, SRIPV	Akmola
Kazahstanskii	0.005	2007	SPK «Cemenovodcheckoye»	South Kazakhstan
Total potato	**37 005**			
Cotton:				South Kazakhstan
PA-3044	71.4	1999	SRIC	
Egemen-10	5.7	2006	EF «Kelesskyi »	
Ak Bayauyt	3.5	-	-	
Zhuldyz	2.5	-	-	
Total cotton	**83 100.0**			
Millet:				West Kazakhstan obl.
Uralskoe 109	8.0	1981	Uralskaya AES	
Shortandinskaya 7	0.3	1994	SPCGF	Akmola
Aruzhan	0.015	2007	EKSRIA	East Kazakhstan
Total millet	**8 315.0**			

Culture, variety	The area, thousand ha	Year of division into districts	Оригинатор	Area of cultivation
Alfalfa:				South Kazakhstan
Krasnovodopadskaya 8	30.0	1962	Krasnovodopad BES	
Semirechenskaya mestnaya	16.5	1934	-	Kizilorda
Krasnovodopadskaya Skorospelka	3.1	1992	Krasnovodopad BES	South Kazakhstan
Uralskaya sinyaya	0.8	1950	Uralskaya AES	West Kazakhstan
Kokshe	0.03	1968	Kokshetau branch SPCGF	East Kazakhstan
Wheat-grass:				West Kazakhstan
Uralskii uzkokolosnyi	60.0	1994	Uralskaya AES	
Taipakskii	1.7	2006	Uralskaya AES	
Elymus yunceus Fisch.:				West Kazakhstan
Bozoiskii	3.6	1975	SPCLV	
Sweetclover:				Kizilorda
Akbas mestnyi	100.0	1990	SPCGF	
Italian millet:				Akmola
Krupnosemyannyi 1	0.9	1972	Северо-Казахстанская СХОС	
Awnless brome grass:				East Kazakhstan, North Kazakhstan
Vostochno-Kazahstanskii	0.48	1972	EKSRIA	
Total	**217 110.0**			
Onions:				West Kazakhstan
Karatalskii	0.3	1959	Karatal EF of KazSRIF	
Mestnyi	0.4	1943	-	
Total onions	**0.7**			
Melon:				West Kazakhstan
Iliiskaya	0.4	1979	SRIPV	
Total	**6 552.414**			

APPENDIX 2

EDIBLE UNDER-UTILIZED PLANTS OF KAZAKHSTAN

	Species	Genera
1.	*Allium altaicum* Pall. - *an onions*	*Alliaceae*
2.	- *microdictyon* Prokh.	"
3.	- *nutans* L.	"
4.	- *schoenoprasum* L.	"
5.	*Armeniaca vulgaris* Lam. - *an apricot*	*Rosaceae*
6.	*Cerasus erythrocarpa* Nevski - *a cherry*	"
7.	- *fruticosa* (Pall.) G. Woron.	"
8.	- *mahaleb* (L). Mill.	"
9.	- *tianschanica* Pojark.	"
10.	- *vulgaris* Mill.	"
11.	*Corylus avelana* L. – a filbert	*Corylaceae*
12.	*Crataegus almaatensis* Pojark. - *a hawthorn*	*Rosaceae*
13.	- *altaica* Ledeb. ex Loud.	"
14.	- *korolkowii* L. Henry	"
15.	- *pontica C.* Koch	"
16.	- *sanguinea* Pall.	"
17.	- *songorica C.* Koch	"
18.	- *turkestanica* Pojark.	"
19.	*Fragaria vesca* L. - wild strawberry	*Rosaceae*
20.	- *viridis* Duch.	"
21.	*Elaeagnus angustifolia* L. - oleaster	*Elaeagnaceae*
22.	- *orientalis* " L.	"
23.	- *oxycarpa* Schlecht.	"
24.	*Glycine max.* (L). Merr. - a soybean	*Fabaceae*
25.	*Grossularia acicularis* (Smith) Spach - a gooseberry	*Grossulariaceae*
26.	*Hippophae rhamnoides* L. - sea-buckthorn berries	*Elaeagnaceae*
27.	*Malus niedzwetzkyana* Dieck. – an apple	*Rosaceae*
28.	- *sieversii* (Ledeb.) M. Roem.	"
29.	*Padus avium* Mill. - a bird cherry	*Rosaceae*
30.	*Phaseolus acutifolius* - a string bean	*Fabaceae*
31.	- *vulgaris* * L.	"
32.	*Pisum sativum* * L. - peas	"
33.	*Physalis alkekengi* * L – a ground cherry	*Solanaceae*
34.	*Pinus sibirica* Du Tour - a cedar	*Pinaceae*
35.	*Pistacia vera* L. - a pistachio	*Anacardiaceae*
36.	*Prunus spinosa* L. - a plum (sloe)	*Rosaceae*
37.	*Pyrus regelii Rehder - a pear*	"
38.	- *turcomanica* * Maleev	"
39.	*Rheum altaicum* Losinsk. - a rhubard	*Polygonaceae*
40.	- *maximowiczii* Losinsk.	"
41.	- *tataricum* L. Fil.	"
42.	- *wittrockii* Lundstr.	"

	Species	Genera
43.	*Ribes atropurpureum* C. A. Mey. - a currant	*Grossulariaceae*
44.	- *janczewskii* Pojark.	"
45.	- *nigrum* L.	"
46.	- *rubrum* * L.	"
47.	- *saxatile Pall.*	"
48.	*Rosa acicularis* Lindl. - a dogrose	*Rosaceae*
49.	- *canina* L.	"
50.	- *corymbifera* Borkh.	"
51.	- *laxa* Retz.	"
52.	- *majalis* Herrm.	"
53.	*Rubus caesius* L. - a blackberry	*Rosaceae*
54.	- *idaeus* L. - a raspberry	"
55.	- *sachalinensis* Levl.	"
56.	- *saxatilis* L.	"
57.	*Rumex acetosa* L. – a dock	*Polygonaceae*
58.	- *crispus* L.	"
59.	*Sorbus persica* Hedl. - a mountain ash	*Rosaceae*
60.	- *sibirica* Hedl.	"
61.	- *tianschanica* Rupr.	"
62.	*Vaccinium myrtillus* L. - a bilberry	*Ericaceae*
63.	- *uliginosum* L. - a blueberry	"
64.	- *vilis idaea* L. - a cowberry	"
65.	*Vigna radiata.* (L). Wilczek – a mung bean	*Fabaceae*
66.	- *unguiculata.* (L). Walp.	"
67.	*Vitis vinifera* L. - a grapes	*Vitaceae*