BELARUS:

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

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Table of Contents

CHAPTER 1
Introduction to Belarus and its Agricultural Sector

The Republic of Belarus is situated in Eastern Europe in the western part of the Russian Plain at the basins of the upper Dnieper, Western Dvina and Neman. The country's northern extremity is on 56810' N.Lat. (Dnieper River); the western one is on 23811' E.Lon. (Bug River); the eastern extremity is on 32854' E.Lon. and is located near a small town of Khotimsk. The configuration of the country's territory is shaped as a polygon slightly elongated from West to East. The greatest span of this territory makes 650 km from West to East and 560 km from North to South. The borders of the Republic of Belarus do not coincide with any clear natural boundaries and run mainly across flatland areas and highlands.

Only minor segments of the national border go along Dnieper and partly along Sozh in the South-East, Bug in the West, and Western Dvina in the East. In the North and in the East the Republic of Belarus borders on Russia, in the South on the Ukraine, in the West on Poland, and on the North-West with Lithuania and Latvia. The country occupies the total area of 207.6 thousand sq. km. Belarus is divided into six administrative provinces (Brest, Vitebsk, Gomel, Grodno, Minsk and Mogilev Provinces) which in their turn are subdivided into 117 administrative districts.

The Republic of Belarus is the country with moderate continental climate. However, the predominance of western and north-western maritime air masses makes the climate transitional from maritime to continental. Mean temperatures of January, the coldest month, vary in the southward directions from -48C to -88C, while those of June are between +188C to +19.58C. There are significant fluctuations of the sum of positive temperatures during the period of growth and development of agricultural crops (2100 to 2500) and of the duration of the period of active vegetation of cultivated plants (190 to 205 days). The mean annual rainfall is 600-650 mm in the central and north-eastern parts of the country and 500-600 mm in the southern and south-western parts. There are considerable dissimilarities between the Republic's regions in the characteristics of surface relief, vegetation, soil structure and water-logging level.

The population of the Republic of Belarus is 10.3 million people evenly distributed throughout the territory of the country. The density of the population is

relatively high (50 people per 1 sq. km). Belarus experiences the demographic processes typical for developed industrial countries: general slowing of population increase rates, decrease of the birth rate and swelling of the quota of aged people. Presently over 50% of the population are living in large towns (populated by over 50,000 people) and 15% in smaller towns (under 50,000). Rural population of Belarus inhabit 24.5 thousands of countryside villages and settlements. The changes in the structure of the national economy preconditioned by the progress in science and technology have resulted in modifying the population's employment pattern. From 1985 to 1992 the employment level declined from 51.3 to 47.5. Redistribution of the working population tended towards non-productive spheres. In the commodity production sphere the percentage of the people occupied in industry steadily grows, while that of the population employed in agriculture diminishes.

The total land area of the Republic of Belarus is 20.76 millions of hectares. Agricultural lands occupy 9.4 mln ha (45.2% of the total area), including 6.1 mln ha of arable lands (29.3% of the total area). Per capita land ratio is 0.9 ha of agricultural areas with 0.6 ha of arable lands.

Most of the arable lands in Belarus (88.7%) are soddy-podzolic soils (automorphous and semihydromorphous) with somewhat low natural fertility. 40% of the country's total area (8.1 mln ha) are water-logged. Over one million of hectares are exposed to erosion and about 10% are bouldery soils. 13% of the country's total area are lands sparsely used or completely unused in national economy (sands, shrubby areas, swamps, etc.). During the last 20 years the agricultural production has lost 600,000 ha including 258,000 ha after the Chernobyl accident. Achieving stable crop harvests requires continuous raising of soil fertility by regulating the air-water regime.

Table 1.1 Distribution of land areas (ha)*

Type of land utilization	Total area	Drained lands	Irrigated lands
Meadows and pastures	3130	1620	58
Ploughlands	6261	1211	73
incl. orchards	176	1	-
Afforestations	7415	219	-
Lands under water	467	-	-
Swamps and marshes	972	-	-
Other lands	2514	312	-
TOTAL	**20759**	**3324**	**131**

Collective and state farms form the basis of agricultural production in the Republic of Belarus. These types of farms are large, mechanized, multipurpose and simultaneously specialized agricultural enterprises. Most of the material resources are concentrated in them. The process of denationalization and privatization has been underway since 1989. Lands are municipalized, placed in ownership or possession of enterprises, or leased out with the right of future redemption, state farms are transformed into collective ones, large agricultural enterprises are disintegrated into smaller ones, and new agricultural co-operatives and individual farms are formed.

Table 1.2 Distribution of agricultural lands among the users (thous.ha)*

Land users	Total area	Agricultural lands	Ploughlands
Collective farms	7544	5683	3690
State farms	2788	2100	1408
Individual users (workers of collective farms, urban enterprises etc.)	1468	1432	901
Forestry enterprises	6783	49	9
Others	2176	127	76

Collective and state farms are equipped with basic production assets to 70% of their normative requirements. The deficiency of equipment hinders the process of formation of efficient technological systems. The level of mechanization is rated at 349 kWt per 100 ha of agricultural lands.

Agriculture is basically oriented towards meeting the domestic market demands for food products. It has a clearly expressed trend of animal production. In the food production structure the percentage of plant production is 27.3%. In plant production relatively high is the percentage of grain and forage crops. This has been preconditioned by the fact that the country's agriculture is basically focused on dairy and meat husbandry. Prevailing grain crops are barley, rye and oats. Potato and flax have special importance. Major vegetables in cultivation are carrot, beet and cabbage.

Diagram 1 The structure of market plant production

- Cereals
- Potato
- Sugarbeet
- Flax products
- Vegetables
- Fruits and berries
- Other

Table 1.3 Production of major crops (thous.tons)

Crop/group of crops	1990-1992	1994
	(mean)	
Grain (weight after processing)	6854	6095
wheat	318	230
rye	2559	
barley	2944	3013
Legumes	226	
Potato	8844	8241
Vegetables	835	1029
Flax fibre	63	49
Sugarbeet	1249	1078
Fruits and berries	388	

CHAPTER 2
Indigenous Plant Genetic Resources

The natural flora of the Republic of Belarus encompasses 1,650 species of vascular plants. Among them there are valuable arboreal, ornamental, pasture, medicinal and food plants.

2.1 FRUIT AND BERRY CROPS

Indigenous for the Republic of Belarus are the following fruit species: *Malus silvestris*, *Malus domestica*, *Pyrus communis*, *Prunus domestica* and *Cerasus vulgaris.*

Local forms of M. *sylvestris* (L.) Mill. are distinguished by their high winter-hardiness and have a short vegetation period. Winter-hardy crab apple-tree forms still retain their major value as seedling stocks, especially for such apple varieties as Antonovka and its derivatives.

In this country's environments the following species have the greatest importance of all *Malus spp.* as progenitors: crab apple (*Malus sylvestris* Mill.), common apple (M. *pumila* Mill.), plumleaved apple (M. *prunifolia* Borkh.), prairie crab apple (M. *noensis* Britt.) and Siberian crab apple (M. *baccata* (L.) Borkh.). All of them possess the same diploid chromosome number 34. Their hybrids demonstrate normal fruit productivity.

There is a great diversity of wild forest pear (P. *communis* var. pyraster Burgsd.). Landraces and old traditional varieties of pear, which have still being cultivated in the country's plantations and orchards, include Bere Slutskaya, Duchesse Letny, Vinevka, Sapezhanka, Ilyinka, Tonkovetka, Bere Zolotaya, Aleksandrovka, Bergamot Osennyi, Burachnaya and Limonka. They are valued for their winter-hardiness and high yield, and some of them also for good fruit taste. Such varieties as Duchesse Letny, Limonka and Bere Zolotaya are also of commercial value.

Common plum (*Prunus domestica* L.) does not occur as wild forms and is represented by local varieties and forms of bullace possessing high winter-hardiness and productivity.

Sour cherry (*Cerasus vulgaris* L.) does not exist as wild forms. There is a rich diversity of the forms of this species, many of which are characterized by high yield, winter-hardiness and resistance to coccomycosis. Cherry var. Glubokskaya which in addition yields fruits of high quality is one of the selected local forms of common cherry.

In the country's forests there exist the following wild species of fruit and berry plants of breeding value: whortleberry (*Vaccinium myrtillus* L.), small or bog cranberry (*Oxycoccus quadripetalus* Gilib.) (*Oxycoccus palustris* Pers.), cowberry (*Vaccinium vitis-idaea* L.), European raspberry (*Rubus idaeus* L.), wild strawberry (*Fragaria vesca* L.), European mountain ash (*Sorbus aucuparia* L.), bird cherry (*Padus racemosa* Gilib.), green strawberry (*Fragaria viridis* Duch.), pubescent currant (*Ribes pubescens* Hedl.), European cranberry (*Viburnum opulus* L.), blueberry (*Vaccinium uliginosum* L.), cloudberry (*Rubus chamaemorus* L.), European dewberry (*Rubus caesius* L.), European blackberry (*Rubus nessensis* W.Hall.), cinnamon rose (*Rosa cinnamonea* L.), dog rose (*Rosa canina* L.), tormentose rose (*Rosa tormentosa* Smith.), bloomystem rose (*Rosa mollis*), recurved sepalum hawthorn (*Crataegus curvisepala* Lindm.) (C. ryrtostyla Pojark.), common barberry (*Berberis vulgaris* L.), common elder (*Sambucus nigra* L.), crowberry, black crowberry (*Empetrum nugrum* L.), and stone-berry *(Rubus saxarilis* L.).

Due to heedless drainage of upper forest swamps many cranberry-type plant species are under a threat of vanishing: for example, bog cranberry and cowberry. In the forests there are forms of bog cranberry bearing fruits twice as large (or even more) as the fruits of large cranberry varieties from America. This is a promising material for plant breeding. The named berry species have certain prospects if used in breeding for disease resistance, winter-hardiness, increased content of bioactive substances, etc.

The country's specialized farms refuse to grow many berry varieties, especially those of black currant which, on the contrary, deserve large-scale introduction into practice (Minay Shmyrev, Byelorusskaya Sladkaya, Kantata-50, Pilot A.Mamkin, Partizanka, Pavlinka and others). This happened because of groundless promotion of West European cultivars, for example, var. Titania from Sweden, which under our local conditions performs more than worse than the local varieties in terms of productivity and several other parameters. This is also valid for a number of other small fruit crops.

2.2 VEGETABLES

There are hardly any natural genetic resources of vegetable plants in the Republic of Belarus. Their gene pool has been created basically by the efforts of Belorussian vegetable breeders and plant scientists in the last 80 years of breeding and genetics research on the basis of the former USSR's global collection of germplasm, and by now has been quite successfully utilized in breeding new varieties and heterosis hybrids.

Indigenous vegetable genetic resources are not at all numerous in Belarus and do not represent any significant value for agricultural production. Among them there are dock, horse-radish, thyme, wild onions, wild charlock and other spicy and aromatic plants. The population make small-scale collecting of wild vegetable, spicy and aromatic plants, though the genetic diversity of wild vegetables is now at the brink of vanishing due to extensive irrigation works and cutting of forests.

Indigenous wild vegetables were never used in breeding practice for expanding or improvement of the existing range of vegetable crops.

For vegetable production purposes the population use landraces and old varieties of vegetable crops. These are:

white cabbage	Byelorusskaya-85
beans	Byelorusskiye Belye
radish	Zimnyaya Chernaya Kruglaya
dill	Krupnosemyannyi Mestnyi
tomato	Peremoga 165, Talalikhin 186
cucumber	Dolzhik
common onion	Terekhovsky Mestnyi
garlic	Ozimyi Fioletovy
phaseolus	Motolskaya, etc.

2.3 POTATO

Wild potato species and forms do not occur in the territory of Belarus. Of old varieties the following ones are still cultivated: Loshitsky on more than 30,000 ha (in the former USSR the areas under this variety exceeded 150,000 ha) and Temp on over 60,000 ha (400,000 in the former USSR). Continuous cultivation of these varieties is due to their high content of starch, good consumption qualities, resistance to phytophthora and other diseases and high productivity. Their

utilization depends solely on the interest of the users. The Government is not involved in regulating such issues.

2.4 ORNAMENTAL AND MEDICINAL PLANTS

Wild relatives of cultivated ornamental and medicinal plants that are widely used in landscaping and breeding practices are represented in the country's flora by the following species:

- *Lilium martagon* L. (martagon lily). This species is under the threat of genetic erosion and has been included in "The Red Book of Belarus".
- *Tulipa sylvestris* L. (wild tulip). The area of distribution has been abruptly narrowed. The species is recorded in "The Red Book of Belarus". It has certain prospects for breeding practice.
- *Iris aphylla* L. (leafless iris). It has outstanding ornamental qualities and ever-flowering character. It is used in plant breeding for obtaining short-stemmed, winter-hardy and ever-flowering varieties. It is included in "The Red Book of Belarus".
- *Iris sibirica* L. (Siberian iris). It was the progenitor of many varieties with high ornamental qualities and high resistance. It is distinguished for frost resistance, but is numbered among rare, vanishing species.

At present 156 species of rare plant and those with diminishing area of natural distribution are under the threat of vanishing. Main causes of the reduction of the areas of natural distribution of rare plants in Belarus are as follows: large-scale irrigation and reclamation activities undertaken in 1960-1980's in both agricultural areas and forests, ploughing of the territories, construction of roads, etc.

In our opinion, the Government of the country is able to control the process of genetic erosion. This is evidenced by the concern and care displayed by the government authorities as regards protection of rare and vanishing plant species and by the ever expanding network of natural reserves.

In landscaping and breeding practice in Belarus the landraces of cultivated dahlia are used (Dahlia x cultorum Thorst. et Reis). The collection of the Central Botanical Gardens of the Academy of Sciences of Belarus (CBG ASB) preserve the following varieties: Kenar, Perepelochka, Russky Pereplyas and 8 Marta. All the varieties are of breeding value due to their high resistance during the storage of tuber roots.

The modern governmental policy in the sphere of land cultivation takes into account the need to protect and preserve wild plant genetic resources. The legislation of the Republic of Belarus concerning protection and utilization of the plant world provides a legal and economic basis for plant biodiversity preservation in the Republic.

CHAPTER 3
National Conservation Activities

Prior to the disintegration of the Soviet Union all the work with plant genetic resources was basically performed by the Vavilov All-Union Research Institute of Plant Industry (VIR). For the last 20 years (1972- 1991) a branch station of VIR was functioning at the Belorussian Research Institute of Agriculture and Forages (BRIAF) in the town of Zhodino. 33,425 plant accessions were studied there: 14,600 of barley, 12,800 of oat, 3,900 of wheat and 1,800 of rye. 50,000 seed samples submitted to plant breeders formed the base for breeding 49 new cultivars of cereal crops which later underwent State Trials. Regretfully enough, in 1992 this branch of VIR was closed.

Due to the disintegration of the USSR Belorussian breeding institutions were deprived of direct access to the global plant genetic diversity collected by several generations of scientists and stored at VIR. Efficient breeding of new plant varieties and hybrids is deemed unattainable without purposeful examination of the initial germplasm.

Up to the present moment the country lacks a research centre of studying and preservation of plant genetic resources. There is neither a unified database on plant genetic resources, nor appropriate conditions for storage of seeds and planting materials, etc.

At present the country's plant genetic resources are divided among various research institutes and higher education colleges which are involved in breeding activities. For example, breeding work with such crops as rye, wheat, triticale, barley, oats, maize, buckwheat, lupin, pea, vetch, flax, rapeseed, forage beet, clover and perennial grasses is concentrated in the Belorussian Research Institute of Agriculture and Forages where the major genetic resources of these crops are accumulated. A large stock of these crops is also held by the Belorussian Agricultural Academy (town of Gorki).

Genetic resources of potato, fruit plants and vegetables are clustered in specialized research institutions and experiment stations. There is also a plant germplasm collection at the Institute of Genetics and Cytology of the Belorussian Academy of Sciences and at the Belorussian State University.

The Central Botanical Gardens (CBG ASB) have at their disposal an extensive germplasm collection of flower and ornamental plants, medicinal plants, forage crops, subtropical and tropical species and other crops.

Presently in Belarus there is a network of national natural reserves, botanical and floristic protected natural zones and national parks containing natural landscapes of different status. They maintain the safety of the genetic diversity mostly of rare and threatened plants of the country's natural flora. The network of such reserves aggregately represents 75% (1,250 spp.) of the total natural plant diversity (1,650 spp.) of the country. Populations of 49 species (58%) of rare and vanishing plants are preserved in these reserves. 70% of all commercially valuable plant species of the Republic's natural vegetation grow within the protected territories.

Taking into account protected zones of various functional purposes, the total representability of wild plants within the guarded natural territories amount to 85-90%. The areas where wild plant genetic resources are preserved remain under the control of either republican, or local government authorities. The level of such control is determined according to the status of this or that reserve.

3.1 FRUIT AND SMALL FRUIT CROPS

In situ Preservation of Plant Genetic Resources.

In Belarus there are no projects of small fruit germplasm preservation, nor of berry landraces in the field. The country has neither a repository, nor a comprehensive programme of saving varietal and specific diversity of small fruit plants.

There is only one unique collection of berry-bearing plants in the Department of Small Fruit Crops of the Belorussian Research Institute of Fruit Growing.

The collection of Fragaria ananassa Duch. contains 140 varieties representing initial materials for breeding for winter-hardiness, simultaneity and differing periods of ripening, suitability for mechanized harvesting, high yield, large fruit, firm berry and solid skin, easily removable calyx, increased content of bioactive substances and resistance to *Phytophthora cactorum, Verticillium dahliae, Botrytis cinerea, Sphaerotheca macularis.* There are interspecific hybrids *F. ananassa* Duch. x *F. moschata* Duch. and var. *F. vesca* L.

The collection of gooseberry and currant (Ribes) numbers 110 varieties of *Ribes nigrum L.*, such species as *R. petiolare* and *R. altissimum*, and 10 interspecific hybrids. This germplasm is mainly used as initial materials for breeding for

winter-hardiness, high yield, large berry, high content of vitamin C and other bioactive substances, resistance to *Cecidophyopsis ribes* Westw. and reversion disease *Sphaerotheca mors-uvae* (dry detachability), simultaneity, different ripening periods and adaptability for mechanized harvesting. The collection of *Ribes grossularia* consists of 90 varieties. Among them there are sources of resistance to Sphaerotheca mors-uvae, weaker degree of prickliness, high yield, large fruit and higher content of bioactive substances. There are also collections of *R. rubrum* (40 varieties) and *R. aureum* Rursh. (8 varieties).

The collection of raspberry and dewberry (*Rubus*) numbers 84 varieties, among which there are sources of resistance to *Didymella aphlanata* Sacc., *Botrytis cinerea* Pers., *Elsinoe veneta* Burk., *Septoria rubi* Sacc., *Verticillium albo-atrum* Rein et Berth.

The collection of sea buckthorn (*Hippophae ramnoides*) includes 15 varieties which have been used for breeding winter-hardy, high-yielding and *Verticillium* resistant forms with an increased content of bioactive substances.

The collection of viburnum (*Viburnum opulus* L.) consists of 7 varieties and a number of promising elite forms with a short bush, fruit raceme up to 10 cm in diameter and dark-coloured berries.

The following species are also available in the collections: *Sambucus nigra* L., *Berberis vulgaris* L., Amelanchier vulgaris Moench., *Amelanchier canadensis* L., Elaeagnus multiflora L., *Schizandra chinensis* (Turcz.) Baill., *Actinidia arguta*, *Actinidia kolomicia*, *Cornus mas*, *Morus nigra* L., *Padus racenrosa* (Lam) Jilib. and *Padus virginiana*.

The collection of dog rose contains 10 varieties of *Rosa hybrida* and such species as *R. rugosa*, R. *multiflora* and R. *pomifera* which are the sources of increased and decreased seed yield, large fruit size, high productivity, resistance to diseases and higher content of bioactive substances.

The collection of honeysuckle (*Lonicera*) numbers 35 varieties of *Lonicera* hybrida and the species L. *altaica*, L. *regeliana*, L. *hispida*, L. *turczaninowii*, L. *pallassii* and L. *edulis*.

The exchange of fruit and grape genetic resources is going on continuously with the states of the C.I.S. The collections of the Vavilov Institute (Russia) remain the major external source of germplasm. The collections are supported by comprehensive documentation. Published catalogues of the varieties studied and promising hybrids are available for plant germplasm experts. The accessions are furnished with certain data of agricultural assessment. Evaluation is based on the COMECON international descriptors. Primary assessment of plant materials is carried out by the researchers of the Institute of Fruit Growing who include in

such evaluation basic economic and biological parameters (winter-hardiness, disease and pest resistance, productivity, taste qualities and technological properties of fruit). The samples promising for breeding practice and commercial production are presented in publications. In our opinion, the *in situ* preservation techniques are expedient, though it is very difficult to apply these methods under our conditions because of the shortage of funds.

Ex situ Preservation of Plant Genetic Resources

The Belorussian Institute of Plant Growing stores a collection of wild species and varieties of apple-tree numbering over 300 accessions and 1500 selected hybrids received by crossing wild forms with cultivated varieties. Wild species are represented by such forms as *Malus sieboldii*, *M. prumifolia*, *M. pumila* var. *paradisiaca*, *M. pumila* var. *praecox*, *M. robusta*, *M. baccata*, *M. micromalus*, *M. coronaria* and *M. floribunda*.

Scientists, breeders and amateur horticulturists used annually up to 30% of this genepool in their research.

About 150 pear varieties of various origin are currently cultivated in the country. Among them regional domestic forms and Russian varieties prevail. Each year approximately 10% of the collection are used in breeding practice. The collection of plum numbers over 200 samples, including more than 80 forms of interspecific origin: *P. spinosa* x *P. domestica*, *P. cerasifera* x *P. salicina var. ussuriensis* (*P. cerasifera* x *P. ussuriensis*) x *P. brigantiaca*, *P. coccomilia*, *P. pissardii*. About 160 sour cherry varieties, 20 sweet cherry cultivars, 120 promising hybrids of these plants and 25 forms of cerapadus (hybrids of cherry with Japanese birdcherry) are currently being studied.

The apricot collection contains 42 varieties bred in Belarus, Ukraine, Russia, Latvia and Lithuania. They undergo biochemical evaluation. A part of the studied accessions are used in by breeders to enhance such properties as winter-hardiness and resistance to fungi.

The collection of grapes consists of 270 of super-early and early varieties and forms which require 1,800-2,400°C of aggregate active temperatures for fruit ripening. This is the most northern ampelographic collection of world diversity of early-ripening grapes in Europe. It includes varieties of Vitis vinifera and interspecific hybrids.

Persian walnut (Juglans *regia* L.) is represented by 480 *J.* regia accessions, for the most part, of local origin. There are also 120 samples of *J. regia var. racemosa* characterized by their earliness and such interspecific hybrids as *J. regia x J. cinerea*, *J. regia x J. mandschurica* and others.

3.2 VEGETABLE CROPS

The country's genetic resources of vegetables are concentrated mainly in the Research Institute of Vegetable Production (RIVP) and are presently represented by the global varietal diversity of white head cabbage, tomato, cucumber and onion. Selection and evaluation are carried out by the following parameters: yield, production quality, disease resistance, adaptability, ecological stability, etc., with the purpose of definitely targeted breeding. However, in the past 5 years the Institute was forced to wind up the work on expanding the collection of vegetable crops due to the fact that the Institute's links with the C.I.S. and foreign countries have been ruined and because of the deficiency of funds earmarked to scientific research. This has resulted in reducing the scope of breeding programmes, which may affect the quality of newly bred cultivars and hybrids.

Of late, regeneration of a part of vegetable crop accessions has been carried out by the RIVP breeders only in the Institute's experimental fields, glasshouses and laboratories. Under such conditions it is sometimes very difficult to attain genetic integrity of the plant materials because of the loss of valuable traits, especially when abiotic factors are present during reproduction.

In view of this, it seems expedient to organize a national centre for forming and preserving plant genetic diversity. This would make it possible to improve germplasm storage conditions, arrange a computerized database and make the agricultural information on the accessions more accurate and freely available.

3.3 POTATO

In the Republic of Belarus potato genetic resources are accumulated, first of all, at the Belorussian Research Institute of Potato Production (BRIPP). It preserves a global collection of potato varieties numbering 640 accessions which are reproduced annually by tuber planting. Besides, a collection of wild species and another one of 20 commercial varieties are maintained *in vitro*.

Materials representing the diversity of potato from different countries prevail in the global collection. Duplicates of the global collection and of that of wild species are preserved in VIR (Russia, St.Petersburg). VIR is the major source of new materials for replenishing the national collections.

Major users of germplasm are the breeders. The available collections can not meet all the demands of national breeding programmes. The collection materials

are preserved in full. Transfer of materials for storage in other places is undesirable.

Storage Facilities

Conditions of storing the breeding materials meet the international standards. The global collection is stored in a storehouse in wooden tare at +2C - +4C and 75% to 80% humidity. The *in vitro* collections of wild species and commercial varieties are preserved at +18C to +23C, 70% to 80% humidity and illumination of 3 to 5 thousand Lux. Maintenance of the present storing conditions is guaranteed.

Documentation

The global collection of varieties and that of commercial varieties are documented completely. A computerized database contains descriptions, agronomic evaluation data, accessions passport data, as well as those on biochemistry, physiology, resistance to diseases and pests. Catalogues of the commercial varieties have been published. The data on evaluation of the accessions from the global collection are published in a series entitled "Potato Production".

Evaluation and Characterization

The "International List of Descriptors for potato species of the section tuberarium (DUN) Buk., Solanum L." is used for evaluating and characterizing the collection accessions.

Regeneration

Regeneration of the *in vitro* wild species and commercial varieties is carried out from autumn till spring. The necessary materials and equipment are available. The method used for this purpose allows for preserving genetic value and integrity of accessions and for avoiding the admixes.

3.4 ORNAMENTAL, MEDICINAL AND OTHER CROPS

The major collections of these groups of crops are accumulated at the Central Botanical Gardens of the Academy of Sciences of Belarus (CBG ASB). These collections number over 10 thousand taxa and cover a wide range of diverse economically valuable plants. The richest are the collections of arboreal species, ornamental flowers, medicinal plants, aromatic and spice plants, and of rare and protected species.

The collections of arboreal species include 2,110 taxa of 59 families and 165 genera. Most richly represented are the following genera: hawthorn (150 species), honeysuckle (85), spirea (80), barberry (60), cotoneaster (54), juniper (74), arbor-vitae (60 taxa), fir (17), larch (14), pine (28), etc.

The collections of ornamental flowers number around 6,500 species, variants, forms and varieties, including 425 of tulip, 396 of daffodil, 251 of lily, 115 of small bulbiferous plants, 53 of hyacinth, 308 of iris, 102 of day lily, 131 of dahlia, 204 of peony, 400 of gladiolus, 196 of common chrysanthemum, 606 of rose, 525 of rare perennial herbaceous ornamental plants, 583 of annual herbaceous ornamental plants, and 2,051 of subtropical and tropical greenhouse plants.

Also rich are the collections of medicinal plants (ca. 100 species), of aromatic, spice and food plants (350 *spp.*). Forages are represented by 60 species. The above collections reflect, first of all, the global diversity of economically valuable plants. Local (breeding) materials are represented in the collections of lilac (12%), dahlia (30%), tulip (2.5%). The collection of rare and endangered aboriginal species numbers 93 species. This is a regional collection, a most valuable one, representative of a certain part of coenopopulations.

Many plant groups of the live collections representing the global diversity are unique for the region of Belarus and in most cases are not duplicated anywhere in the republic. Collections maintained in the botanical gardens of some higher educational institutions are much poorer in terms of diversity. Duplicate collections of rare and protected species are maintained in botanical gardens of the Belorussian State University, Pedagogical Institutes in Brest and Vitebsk, at the Republican Ecological Centre for Schoolchildren, and at some regional stations of young amateur nature explorers.

These collections serve as a basis for scientific research in the sphere of plant introduction and acclimatization, as a source of new useful plants to be introduced in the republic, as well as for teaching botany to schoolchildren and training experts in biology. Besides, among the users of the collections at CBG ASB are the breeders from the plant industry centres of the country, researchers from various scientific institutions, and the international agricultural research centres.

Live plant collections are formed by means of collecting planting/seed materials in natural habitats, and through exchanges with counterparts. At present, the latter methods dominates, as collecting missions are rare these days due to scantiness of finances. Each year, CBG ASB receives by Delectus lists about 1,824 seed samples from 310 botanical institutions of 60 countries of the world and dispatches in exchange from 700 to 800 seed samples.

The global plant collections at CBG ASB are pretty rich. The taxonomic composition of the collections of arboreal and shrub species is sufficiently rich. For 25 families, replenishment is hardly possible any more. Some groups of ornamental flowers (e.g., bulbiferous, bulbo-tuberiferous, and rare perennials) are well represented.

The collection of rare and endangered species of the republican flora is representative enough, but still it does not meet all the needs associated with practice and research. Some species are represented by a small number of individual plants from just one or two natural coenopopulations, and therefore the diversity of a species is far from being fully reflected.

Naturally, there are some species and varieties in the collections which are not used currently. But, they will undoubtedly be used in future breeding programmes thanks to the presence of certain valuable properties in many of them.

There is no need in transferring the materials preserved at CBG ASB for storage somewhere else. Within the republic, not a single organization or private person are able to provide better storage conditions for the live plant collections. Since the collections accumulated at CBG ASB make a part of the national treasure, their transfer outside the republic is impermissible.

The abundant collection materials may be exchanged for other germplasm, either insufficiently represented in the collections of CBG ASB, or completely absent in them. Discarding of the least valuable collection materials is carried out permanently thus facilitating the work with the collections.

Storage Conditions

Germplasm collections at CBG ASB are predominantly collections of live plants. For their maintenance, qualified experts and significant inputs are required. First of all, it refers to the collections of subtropical and tropical plants for the protected grounds. Glasshouse facilities of the Botanical Gardens have deteriorated and are unable to provide for the maintenance of ecological parameters necessary for the growth of thermophylous plants. As a result, the partial loss of valuable germplasm occurs during severe winters.

Storing conditions of seed accessions also don't meet the international standards. The required temperature and humidity cannot be maintained. The seeds are kept at room temperature in cardboard boxes, and due to this loose germinating ability very quickly. Assistance is required in setting up a modern seed laboratory that would provide for the proper storage of seeds.

Documentation

There exists a card-catalogue for the collections of CBG ASB. Compilation of a computerized database has been started. Documentation includes passport data, object's description, phenology, and evaluation data (i.e., resistance to abiotic and biotic factors). Documentation has been compiled for all collection accessions. For separate groups of plants, information is duplicated in a computerized database, as well as in log-books kept by collection curators.

Evaluation and Characterization

Germplasm evaluation yields a record of results obtained in course of introduction tests of a new taxon carried out over a period of many years under the conditions of a botanical gardens. Negative and positive object's characters, it's adaptive potential and ecological plasticity, as well as useful properties and potential spheres of application are recorded.

Biochemical evaluation data have been accumulated for some species and varieties of fruit, small-fruit and medicinal plants, namely actinidia, aralia, hawthorn, barberry, buckthorn, sour cherry, honeysuckle, June-berry, viburnum, Japan quince, apple, mulberry, cranberry, blueberry, cowberry, etc. For some objects, the data on resistance to unfavourable wintering conditions and to draughts are available. The collection of arboreal and shrub species has been studied thoroughly enough as regards their resistance to such pollutants of abiotic nature as sulphur compounds, nitrogen oxides, ammonia, and gas absorption potential of accessions has been evaluated. Practically all range of economically valuable plants have been evaluated for susceptibility to diseases and pests. For separate plant groups, ornamentals for instance, resistance to major pathogenic organisms has been determined.

Description of an accession contains information on the taxonomic belonging on the object, its origin, time of incorporation into the collection, major biometric values, phenology, major stages of onthogenesis, and the process of reproduction. Both international and the previously devised in the USSR descriptor lists are used for PGR evaluation and characterization. This work is performed by curators of collections. Results of evaluation and characterization have been published just partially.

Regeneration

Regeneration of live plant collections is carried out taking into consideration biology of a certain accession. Annual plants are regenerated each year by seeds. Perennial plants, especially arboreal species, are regenerated when necessary. Regeneration is performed in special nurseries.

Vegetative regeneration provides for the genotype preservation completely. Reproduction by seeds does not ensure genetic integrity of the initial accession, as free pollination is characteristic of many species, while plant isolation during fertilization is not provided.

The genebank of the Botanical Gardens is represented by collections of live plants and seeds. For many plant species, several progenies obtained in the conditions of the Botanical Gardens are maintained. Seeds of different progenies are stored separately. The aged material is discarded and replaced with new reproductions.

CHAPTER 4
In-country Uses of Plant Genetic Resources

Genetic resources of the republic represented in the collections of crop research institutes, the Botanical Gardens, and experiment stations are used in national breeding programmes, as well as initial materials for mass distribution of new plants within the republic. Breeders from various research institutions of the republic are the main users of PGR.

4.1 FRUIT AND SMALL-FRUIT CROPS

The use of genetic resources of fruit and small-fruit crops is in compliance with the "Fruits and Berries" Programme aimed at improving a complex of characters in new varieties in order to improve fruit quality, keeping ability, and attain higher economic efficiency of production. Another objective of breeding is the widening of genetic basis of hybrids aimed at improving their resistance to unfavourable conditions, diseases and pests, as well as at increasing the bioactive substances content.

Research on breeding fruit and small fruit crops adapted to local conditions is necessary due to the fact that planting of the unadapted foreign varieties in 1984-1986 gave negative results. Farms where these varieties are cultivated bear great losses, and land utilization is inefficient.

4.2 POTATO

The major user of potato collections in the Republic of Belarus is the Belorussian Research Institute of Potato Production where the state breeding programmes are carried out. Commercial potato breeding is not carried out in the republic. The frequency of using wild species (including those lacking in the national collections) will increase in the future due to the variation in the races and strains of disease causative agents and appearance of new diseases and pests in the region.

Breeding programmes

Potato breeding is carried out for certain characters, namely:

- resistance to such diseases as phytophthora, viral and bacterial diseases, nematode, potato canker, etc.;
- high content of dry matter and starch;
- high productivity combined with good cooking and consumer qualities;
- suitability for industrial processing;
- resistance to mechanical damage, etc.

The ultimate objectives are the increased volume of production and quality of the end product, a wider genetical bases of varieties, and the reduced susceptibility to a complex of unfavourable factors. In the first place, the breeding programme pursues the objectives of improving the situation with foodstuffs in the country and increasing the export potential of the table and seed potatoes produced in Belarus. It should be mentioned that in early 1990's the varieties bred by BRIPP occupied 1/3 of all lands under potato in the USSR (ca. 700 thousand ha), and Belarus exported over 500 thousand tons of table potato and from 200 to 300 thousand tons of seed potato.

4.3 ORNAMENTAL FLOWERS, MEDICINAL AND OTHER CROPS

For breeding purposes, the most often used genetic resources of ornamental flowers are of tulip, lily, dahlia, and annual plants; from the group of small-fruit crops - of sea buckthorn, cranberry, blueberry, mountain cranberry; of Dazyphora, a medicinal plant, and of alfalfa, goat's rue (Galega) and clover from the group of forages.

During the last 3 years, the following groups of plants were of the highest demand for wide cultivation in the country: - arboreal and shrub species; - conifers (forms of *arbor-vitae*, *juniper*, *falsecypress*, spruce); - attractively flowering shrubs (weigela, mockorange, *Forsitia*, *hydrangea*, lilac); - *lianas* (actinidia, clematis, grape).

Among the major users are the municipal services for planting trees and shrubs, industrial enterprises, healthcare institutions, schools, kindergartens, and amateur gardeners.

Ornamental herbaceous plants: tulips, astilbe, Hosta, primrose, peony, narcissus, lily, dahlia, iris, and perennials for flower beds. The users are: municipal services for planting trees and shrubs, amateur gardeners, and stations of young amateur nature explorers.

Food, aromatic and spice plants: common origanum, common balm, hoary basil, hyssop, holy grass, lovage, catnip (catmint), peppermint, Tanacetum balsamiferum, tarragon (estragon), winter savoury; etc. Users: meat processing and alcoholic beverage industries, collective and state farms.

Fruit and small-fruit plants: large cranberry, highbush blueberry, sea buckthorn, actinidia, Japan quince, myrobalan plum. Users: agricultural enterprises, forestries, amateur gardeners.

Medicinal plants: ginseng, common valerian, garden sage, pot-marigold, Jacob's ladder, quinquelobate motherwort, common St. John's wort. Users: Forestries, agricultural enterprises.

Forage plants: Galega orientalis, amaranth. Users: agricultural experiment stations, agricultural enterprises.

It should be noted that a considerable part of collected species (up to 30%) still has not found application in the country, though their commercial value leaves no doubts. There is no assuredness that the rate of their utilization may increase in the nearest years.

Breeding programmes on ornamental crops pursue the objectives of developing forms with high ornamental quality and increased disease resistance. Breeding of fruit and small-fruit varieties is aimed at widening their genetic basis, decreasing susceptibility to biotic and abiotic factors, and adapting them to cultivation techniques.

The volume and quality of scientific breeding of ornamental and rare fruit and small-fruit plants are not up to the national demands. The limiting factors are as follows: insufficient financing of breeding programmes, lack of proper materials and equipment, and lack of skilled experts.

Obviously, the country is benefiting from the use of the introduced species preserved in the collections, as many of them are economically valuable plants of high importance for the national economy.

CHAPTER 5
National Goals, Policies, Programmes and Legislation

There is no special National Programme on preserving and utilizing the available plant genetic resources. No special finances are provided for the maintenance of germplasm collections. Money for the purpose is drawn from the allocations to various research institutes made by the Academy of Agricultural Sciences for breeding research. Certainly, it is not enough to ensure safety and regeneration of PGR. Other ministries and Departments which should be interested in PGR use and preservation, show, in fact, no interest in the matter and are not eager to finance the projects associated with the use of the most valuable plants available in Belarus.

CHAPTER 6
International Collaboration

Belorussian research institutes and other holders of PGR collections are involved in extensive exchange with germplasm materials with foreign institutions and maintain collaboration with their counterparts in Russia, Poland, Baltic states, etc. pursuing the objectives of enriching the national crop genepools and introducing the most valuable plants into cultivation in the republic. Within the framework of the Biodiversity Convention, research projects have been launched in order to preserve genetic diversity of the aboriginal flora by means of the introduction method, a means of obtaining more information about rare and vanishing species and providing for their protection.

The Institute of Potato Production has for a long time collaborated in the sphere of potato breeding and germplasm exchange with the Institute for Potato Research in the former GDR (Gross Lusewitz), the Potato Research Institute in Bonin (Poland) and the Research Institute for Potato Growing and Breeding in Havlickuv-Brod in Czech Republic. This collaboration has been disrupted.

The Institute of Horticulture has no joint breeding or PGR exchange programmes. Only sporadic reciprocal visits are made by the institute's researchers and their colleagues from CIS countries, Latvia, Lithuania, ARS (USA), Academy of Agricultural Sciences in Warsaw (Poland), and the University of Bologna (Italy). The institute is open to cooperation on breeding new varieties and forms, and is eager to start exchanges with germplasm of fruit and small-fruit crops with its counterparts abroad which may feel interested in the research carried out at the institute.

CBG ASB carries out extensive PGR exchange with botanical gardens of the world and collaborates with similar research institutions in Poland, China and Vietnam.

CHAPTER 7
National Needs and Opportunities

The Republic of Belarus is not rich in plant genetic resources, and therefore shall be interested as in preservation and rational utilization of its aboriginal plant resources, so in enriching national PGR diversity by means of introducing valuable genetic materials from abroad.

The first task may be fulfilled by applying national efforts alone. All necessary means are available in the republic. Governmental bodies should express more concern about the matter and be more involved in solving the problems. Besides, consistent national policy on the issue shall be developed.

The programme of enriching the cultivated flora with new valuable plants introduced from other floras of the world can not be realized without proper functioning of the institutions-holders of these genepools. In the first place, these are the centres of genetic resources and botanical gardens. At present, all breeding institutions and other PGR holders of the country experience hard times and are unable to perform properly their responsibilities as of PGR-keepers. First of all, security and preservation of genetic resources shall be ensured, and a modern system for regenerating accessions shall be set up. Solution of these problems requires assistance on the part of international organizations. Among major priorities is the setting up of the national genebank and creation of a computerized database for aboriginal and introduced PGR.

The Belorussian Research Institute of Agriculture and Forages in Zhodino (BRIAF) has developed a project of creating in the Republic of Belarus of a United Centre for PGR Research which would coordinate and perform the work on studying and preserving the initial breeding materials of cultivated crops and their wild relatives. (Authors of the Project: Acad. S.I. Grib, Dr. V.F. Burdus').

Major objectives of the Centre will be as follows:

1. Collection, inventory and preservation of PGR of the crops cultivated in Belarus and their wild relatives with the aim of introducing this specific and varietal diversity into research breeding programmes;
2. Study and identification of the global PGR diversity in order to select sources and donors of commercially-valuable characters and properties necessary for developing new high-yielding, quality, genetically protected varieties and hybrids for different zones of the republic;

3. Formation of a computerized database that would contain genetical and breeding data on PGR available in the republic; development of trends of utilizing the available genetic resources in breeding programmes;

4. Supply of information on the breeding and genetic value of the initial materials, and of seeds/other planting materials to research, breeding and experiment institutions both in the republic and abroad.

This Project had been submitted for approval and financing to the Belorussian Academy of Agricultural Sciences, but was declined due to the shortage of the state funds. Nevertheless, the necessity of setting up such a centre in Belarus has been stressed. In conclusion it should be mentioned that the situation with genetic resources in Belarus is critical and a possibility of partial loss of them can't be ruled out. We address the international PGR community with a request to render technical and financial assistance in setting up the National Genebank of the Republic of Belarus.

The institutions involved in PGR activities in Belarus are in bad need of establishing contacts with international PGR centres in order to learn their experience and new approaches to PGR preservation.

In their turn, botanical and plant industry institutions of the republic are ready to establish mutually beneficial cooperation in the form of providing foreign breeding centres with both indigenous PGR and those collected from other floras of the world, as well as to organize reproduction and wide-scale testing of new foreign varieties in the republic.

The Institute of Horticulture addresses the international community with a request to render possible financial assistance in purchasing the following equipment: "Gester", "Plasma-100" spectrometer, "Spekol" and "Kjeltec Auto" spectrophotometers, and the following reagents: Amygdalin, Guaicol, Pyrocatecol, Thymolphthalein, Thyrosin. Any accessions from the institute's collection can be provided on mutually beneficial conditions.

CHAPTER 8
Proposals for a Global Plan of Action

1. Inventory and mapping of the global PGR using unified methodology; creation of a global databank with free access of all countries in the world to the stored data (IPGRI, national centres).
2. Organize under the aegis of FAO an international conference devoted to saving rare and vanishing species of the world.
3. Reconstruct national genebanks so they would meet international germplasm storage standards.
4. Organize under the aegis of FAO international collecting missions to the world's regions of difficult access (mainly mountainous ones) in order to search for and collect new species and plant forms.