

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

POLAND





Plant Breeding and Acclimatization Institute

Plant Genetic Resources for Food and Agriculture in Poland
Second National Report

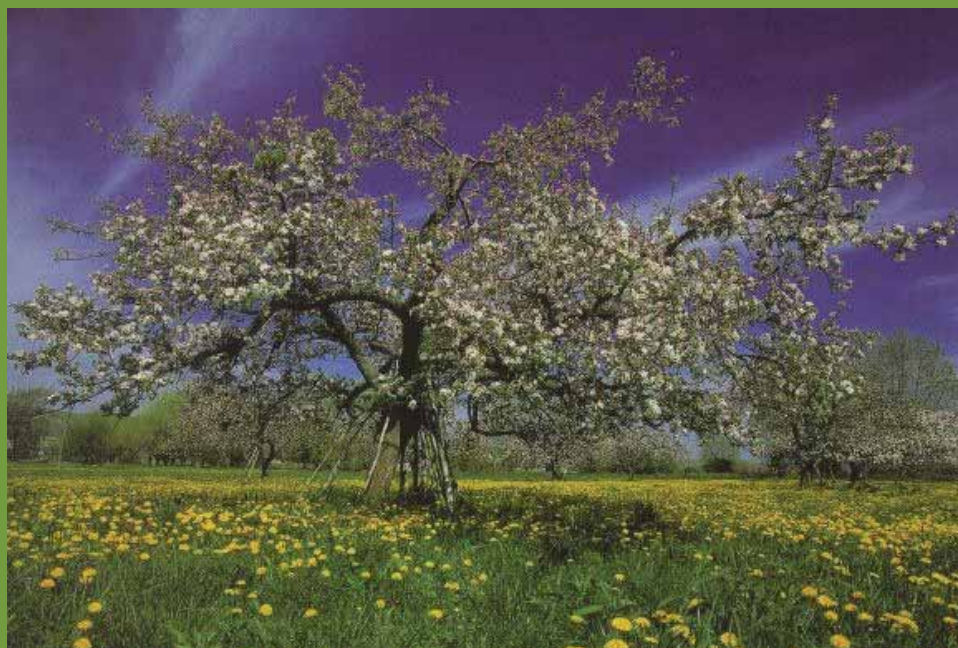


Photo: Association of the Chelminski and Nadwislanski Landscape Parks

Zofia Bulinska-Radomska, Boguslaw Lapinski, Edward Arseniuk
Plant Breeding and Acclimatization Institute, Radzików

Note by FAO

This Country Report has been prepared by the national authorities in the context of the preparatory process for the Second Report on the State of World's Plant Genetic Resources for Food and Agriculture.

The Report is being made available by the Food and Agriculture Organization of the United Nations (FAO) as requested by the Commission on Genetic Resources for Food and Agriculture. However, the report is solely the responsibility of the national authorities. The information in this report has not been verified by FAO, and the opinions expressed do not necessarily represent the views or policy of FAO.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned. The views expressed in this information product are those of the author(s) and do not necessarily reflect the views of FAO.

CONTENTS

EXECUTIVE SUMMARY	6
AN INTRODUCTION TO THE COUNTRY AND THE AGRICULTURAL SECTOR	8
1. Location and size of Poland	8
2. Climate and soil conditions	8
3. Characteristics of the agriculture and crop sector	9
4. Organic farming	11
CHAPTER 1	
THE STATE OF DIVERSITY	13
1.1 The importance of major field crops for food and agriculture	13
1.2 The importance of major horticulture crops for food and agriculture	14
1.3 The state of diversity of field and horticulture crops	16
1.4 The state of diversity of cultivars of field and horticulture crops	17
1.5 The state of diversity and importance of minor and underutilized crops for food and agriculture	17
1.6 The state of diversity of wild species for food and agriculture	18
CHAPTER 2	
ORGANIZATION OF THE NATIONAL PLANT GENETIC RESOURCES CONSERVATION PROGRAMME	19
CHAPTER 3	
THE STATE OF <i>IN SITU</i> MANAGEMENT	20
3.1 <i>In situ</i> conservation of wild plant genetic resources for food and agriculture	20
3.2 On-farm conservation of plant genetic resources for food and agriculture	21
3.3 On-farm conservation projects	21
CHAPTER 4	
THE STATE OF <i>EX SITU</i> MANAGEMENT	26
4.1 The state of collections	26
4.2 Collecting expeditions	27
4.3 Conservation facilities	29
4.4 Characterization, evaluation and documentation	30
4.5 Regeneration and multiplication	30
4.6 Distribution of accessions	31
CHAPTER 5	
UTILIZATION OF GENETIC RESOURCES	32
5.1 The importance of utilization	32
5.2 Utilization activities	32
5.3 Major constraints to the use of genetic resources	32
5.4 Assessment of needs to improve utilization	33

CHAPTER 6

THE REGIONAL AND INTERNATIONAL COLLABORATION

34

6.1 The European Cooperative Programme for Plant Genetic Resources	34
6.2 Council Regulation 870/2004	34
6.3 EC Framework Fifth Programme for Research	34
6.4 International agreements	34

EXECUTIVE SUMMARY

The following report describes the state of agricultural and horticulture plant genetic resources for food and agriculture with an emphasis on the changes that have occurred since 1996. This report includes information on the diversity of crop plants, the organization of the genetic resources conservation programme in Poland, *in situ* and *ex situ* conservation of plant genetic resources, as well as an overview of regional and international collaborations concerning these matters.

The state of the diversity of crops in Poland reflects trends and changes in the crop market and in the plant breeding sector. Over the last 12 years, the number of cultivated field crops has decreased, the number of cultivated vegetable crops have increased, and the number of cultivated fruit crops have remained more or less stable. Diversity of cultivars eligible for seed production and marketing has been complemented by a greater number of old traditional cultivars and landraces of vegetables, fruit trees, shrubs, berries and ornamental plants than in the past. The growing demand for healthy food and the recognition of importance of regional and traditional products has stimulated the reintroduction of agricultural crops withdrawn from cultivation years ago and has broadened the use of old cultivars and landraces.

***In situ* conservation efforts** encompass plant species occurring in nature and cultivated on-farms. Environmental protection regulations have led to increase the overall area of protected land in the last 20 years, with the most noticeable increases between 1980 and 2000. Over 428 plant species are currently covered by a strict form of protection and 51 species are partially protected; of which 14 can be harvested. On-farm conservation remains a marginal, though growing activity in Poland as it is regionally localized and includes mainly old varieties of vegetables and fruit trees and very few field crops. There are number of on-going projects which lead to the reintroduction of old plant cultivars and landraces and promoting traditional technology related to plant growing and processing.

Currently, ***ex situ* conservation** covers 7 3265 accessions of which 45% is of Polish origin. Current priority is given to preservation and sustainable use of diversity of crop plants, in particular marginal crops, old varieties and landraces. Since 1996, the crop collections were complemented with over 5 000 accessions of grasses, local varieties of vegetables, fruit trees, small and large seed legumes, ornamental, naturally occurring medicinal and aromatic, weedy and protected species. Since 1996, the total number of accessions in long-term storage has increased by 20 000 and is currently 65 104. Vegetatively propagated crops are maintained in field collection, *in vitro* and by cryopreservation methods. In 2008, a new centralized database system was installed in the National Genetic Resources Centre (NCPGR) of the Plant Breeding and Acclimatization Institute in order to improve accessibility, processing and data flow, as well as to facilitate the management of seed collections and activities. Currently over 90% of all accessions have passport data stored in the database. Since 2006, all passport data is available through the EURISCO web catalogue and a majority is available through the Global Biodiversity Information Facility (GBIF). From 1 000 to 10 000 samples of all collected genetic resources were distributed annually of which 50% to 70% were requested by the researchers, 5%–20% by the breeders, 5%–10% by gene banks.

Utilization of plant genetic resources through wide crossing and breeding enhancement of their products in cereals, *Solanum*, *Lupinus*, *Allium*, *Brassica*, *Capsicum*, *Rhododendron* *Nicotiana* and *Gentiana* has been carried out in agricultural universities and institutes. Recently, a new series of projects has been launched with the objective to fill the gap between biological science and breeding practice. Approximately 25% of these projects concern the introduction of new variations of breeding materials. Of 95 new projects initiated in 2008, twenty-three concern the identification and/or introduction of new variation from various collections into breeding populations, while seven concern wide crossing.

Within the framework of the National Plant Genetic Resources Conservation Programme, Poland pursues **regional and international collaboration**. At a regional level Poland participates in the European Cooperative Programme for Plant Genetic Resources; through involvement in the Working Groups work, in a European Gene bank Integrated System (AEGIS) and through maintaining central databases of *Secale*, *Dactylis*, *Festuca* and *Lupinus*. Poland collaborates with other European countries in two of the 17 co-funded projects of the Community programme on the conservation, characterization, collection and utilization of genetic resources in agriculture which was established under the regulation EC No 870/2004.

Within EC Framework Fifth Programme for Research, Poland participated in the PGR Forum (European Crop Wild Relatives Diversity Assessment and Conservation Forum) projects.

Poland as a member of the UN Food and Agriculture Organization and the Commission of Plant Genetic Resources for Food and Agriculture has contributed to the work of the above Commission. It is a member of the Intergovernmental

Technical Working Group for Plant Genetic Resources of the aforementioned Commission and chaired the last meeting of this group, in October 2005.

On October 15, 2004, Poland ratified the International Treaty for Plant Genetic Resources for Food and Agriculture, enforced on May 8, 2005. Currently, it is in a process of designation of the genetic resources material to the Multilateral System of Access and Benefit Sharing (MLS) and implementation of the Standard Material Transfer Agreement.



AN INTRODUCTION TO THE COUNTRY AND THE AGRICULTURAL SECTOR

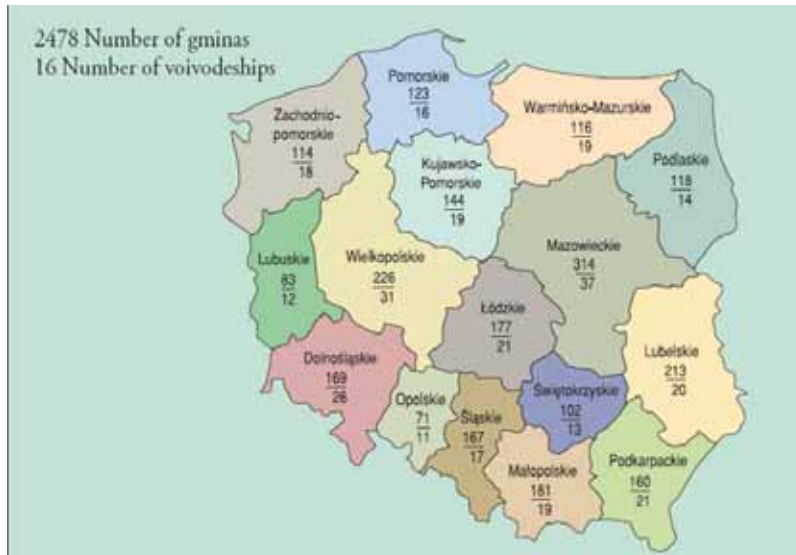
1. Location and size of Poland

Poland is situated in Central Europe between latitudes 49°00' and 54°50'N and longitudes 14°07' and 24°08'E. It borders seven countries: Germany, Czech Republic, Slovakia, Lithuania, Russia, Belarus and Ukraine. The Baltic coast constitutes the northern boundary. Polish territory covers 311.9 thousand km² of land area. It has a population of approximately 38 million inhabitants. Around 75% of Polish territory is lowland area covering the northern and central part of the country. Mountains cover only a small border region of Poland in its extreme south. A marshy area known as the Lake District is situated in the north of the country and has much wooded parkland. The capital of Poland is Warsaw.

The administrative division of Poland (Fig. 1) includes 16 voivodeships, 314 counties (powiat), 65 cities, and 2 478 communes (gmina). A rural population of approximately 14 765 thousand constitutes 38.7% of the total Polish population.

FIGURE 1

Administrative division of Poland



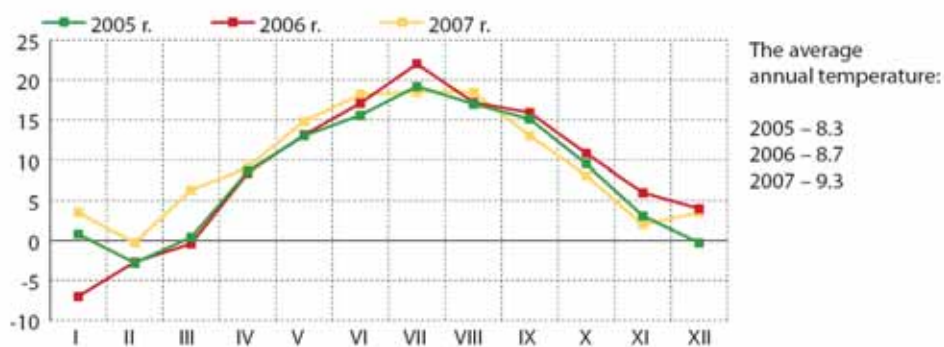
2. Climate and soil conditions

The climate of Poland is temperate, though experiences greater weather fluctuations than the relatively moderate climates of the EU countries to its west. Annual average temperature ranges from 5°C to 7°C. Annual precipitation also fluctuates within the country but is mostly between 500–750 millimeters per year. The driest zone lies in a wide band across central Poland where precipitation averages just 450–550 millimeters. The precipitation most suitable for agriculture falls along the southern border with annual amounts of 600–700 millimeters (in the mountains up to 1 000 millimeters). Rainfall is minimal during the early growing season (April through June) and typically wet during much of the harvests in July and August.

Soil conditions in Poland vary extensively across the country, and prove even more varied on a local level as high quality soils coexist adjacent to poor quality soils. In general however, Polish soils are poorly suited for agriculture. Around 70%

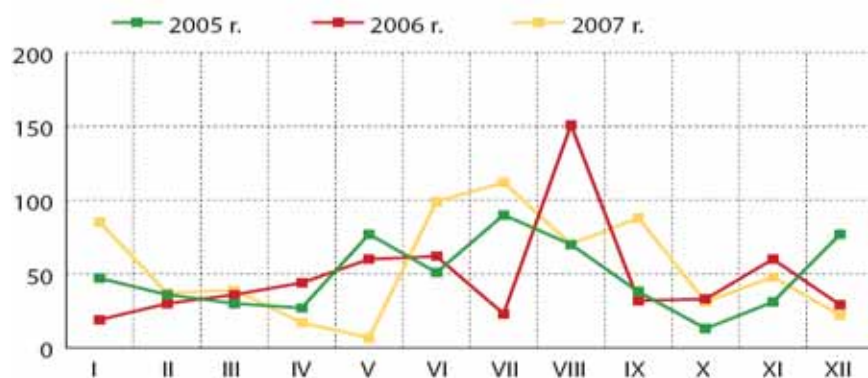
are loose, light, sandy soils which dry rapidly in times of little rainfall. These soils demand intense organic and mineral fertilization as well as special agro-techniques. Only one-quarter of Polish land is rated high quality with much of that being concentrated in the southwest and to a lesser extent, the southeast. The most common soil type is of medium quality, not suited to wheat production, which is the most commonly grown cereal in Poland.

FIGURE 2
Average monthly temperatures in Poland (in °C)



Source: Institute of Meteorology and Water Management.

FIGURE 3
Average monthly precipitation in Poland (in mm)



Source: Institute of Meteorology and Water Management.

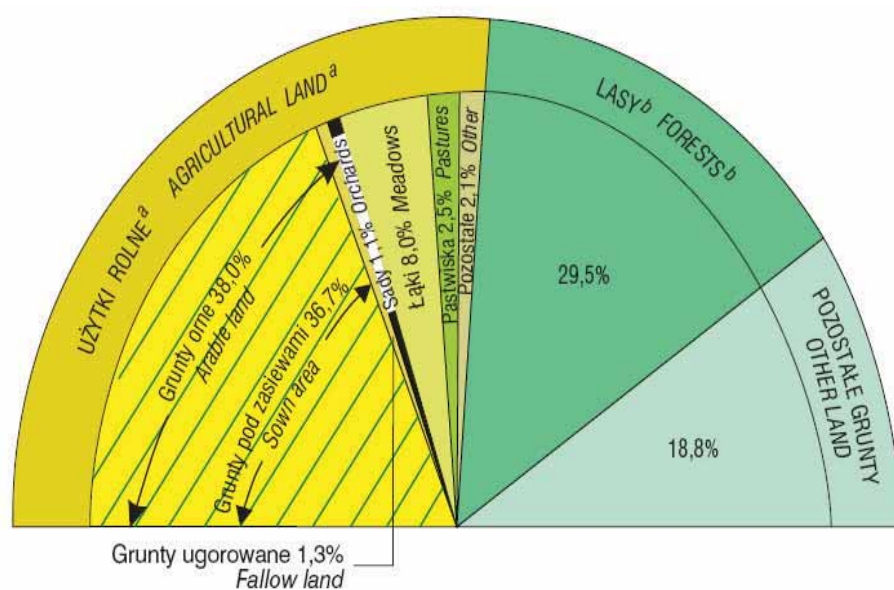
3. Characteristics of the agriculture and crop sector

Over 50% of the total area of Poland (i.e. 16.2 million hectares) is used for agriculture. Orchards cover 337 thousand hectares, meadows 2 497 thousand hectares and pasture 774 thousand hectares. The use of total land is given in Fig. 4. Polish agriculture is characterized by a large fragmentation of holdings, large number of employees, relatively low use of industrial means of production, and as already mentioned, poor to average quality soils.

Polish agricultural products, however, are distinguished as high quality regarding parameters related to human health due to clean environment, unique methods of production and, relatively low use of fertilizers, pesticides and herbicides during the production process.



FIGURE 4
Land use in 2007



Source: Concise Yearbook of Poland (GUS), Warsaw, 2008.

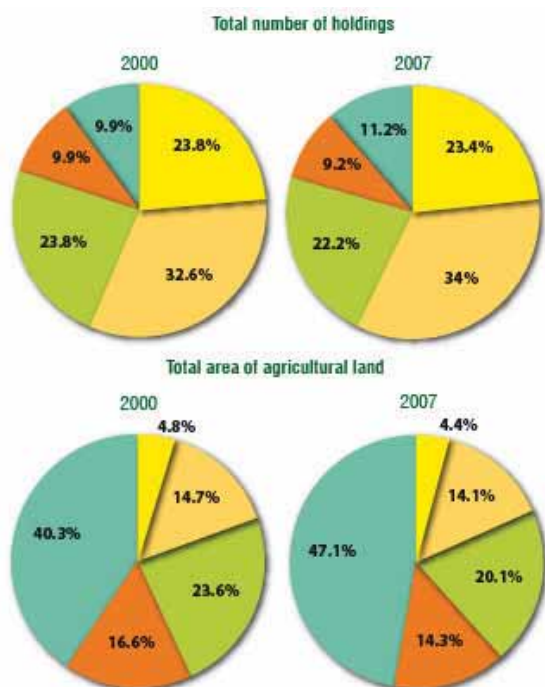
Poland is a large producer of wheat, rye, triticale, mixed grains, barley, maize, berries (strawberries, raspberries and currants), outdoor vegetables (onions, cabbage and cauliflower), as well as products of animal origin. It holds the leading position in the EU in apple production.

Agricultural production conditions differ in Poland compared to those of EU countries. A considerable part of farmers, especially those who own small holdings, apply traditional production technology and allocate agricultural products for family use. Animal production involves small scale breeding, which contributes to the protection of the natural environment. However, there does exist a number of market-oriented holdings, including those specializing in production for export.

Almost 96% of agricultural land is used by the private sector. The remaining 4% consists of State Treasury holdings, the holdings of state legal persons and the holdings partly owned by the State Treasury. The diversity of agricultural holding sizes as illustrated in Fig. 5 is regarded as a specific feature of Polish agriculture.

The soil and climatic conditions, as well as agricultural traditions in the respective areas of Poland determine plant production in the regions. This is exemplified by the concentration of crop cultivations of relatively high soil and climatic requirements such as wheat, sugar, beet and rape in the South-Eastern, Western and Warmia district in the North part of the country and less demanding rye or potato crops in central and Eastern Poland, where the agricultural conditions are less conducive for agriculture.

FIGURE 5

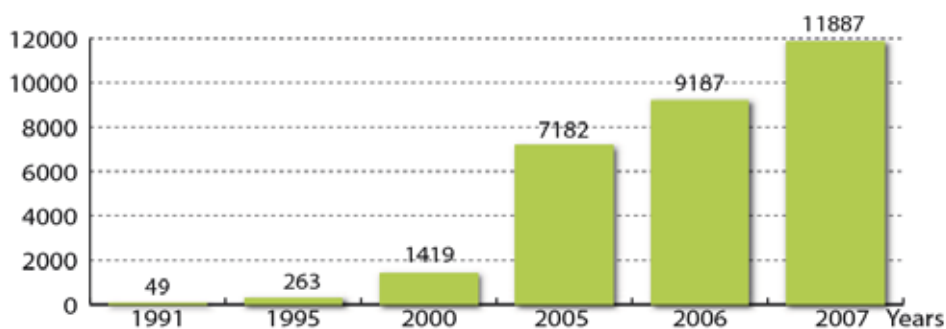
Breakdown of total number of holdings and the total area of agricultural land by size of holdings in 2000 and 2007

Source: Agriculture and Food Economy (Ministry of Agriculture), Warsaw, 2008.

4. Organic farming

Polish records regarding the organic farming sector are not impressive compared to those in other EU countries. In 2005 organic farms constituted approximately 0.97% of all farms in Poland and covered about 0.37% of all farming area. The average size of an organic farm in Poland is approximately 20 hectares, whereas the average size of a non-organic farm is approximately 7 hectares. The number of organic farms varies between regions. Most are located in South-East Poland, where traditionally farms are small in size and run by families. The sector is steadily growing in terms of number of farms (Fig. 6), total acreage and agricultural production as well as the development of the market for organic products.

FIGURE 6

The number of organic farms inspected in Poland in 1991–2007

Source: Agriculture and Food Economy (Ministry of Agriculture), Warsaw, 2008.



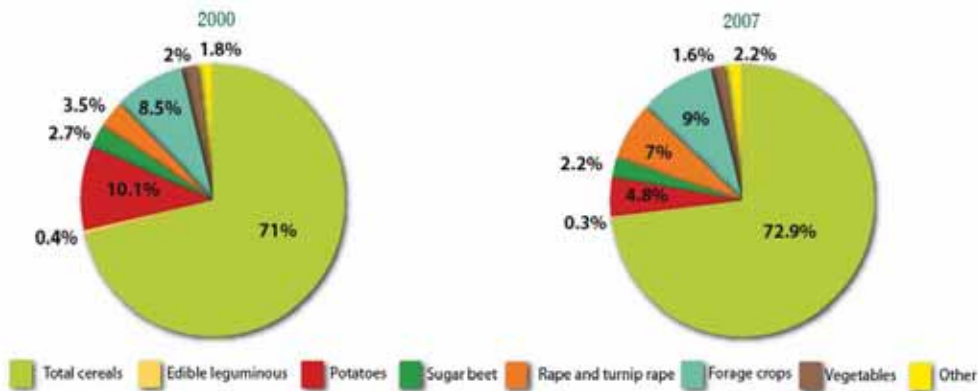
THE STATE OF DIVERSITY



1.1 The importance of major field crops for food and agriculture

In Poland, field crops cover approximately 90% of agricultural land of which five main cereal crops, potato, industrial and oil bearing plants take up approximately 89% of all 11 456 thousand hectares under cultivation in 2007. Cereals were cultivated almost on 73% of the total sown area in 2007 and their acreage displays a growing tendency (Fig. 9).

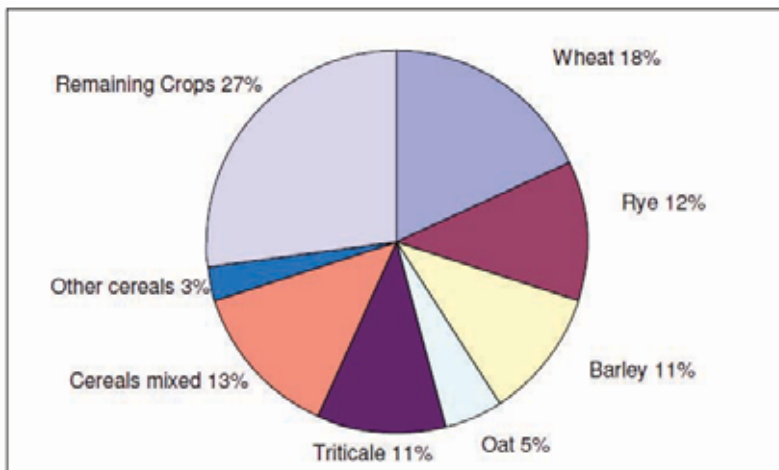
FIGURE 7
Crop cultivation area in 2000 and in 2007 (in %)



Source: Agriculture and Food Economy (Ministry of Agriculture), Warsaw, 2008.

Wheat is the most extensively grown cereal in Poland. In 2007 it covered 18% of the total crop area and 25% of the total cereal cultivation area. Barley, rye, triticale and cereal mixtures occupied 12%, 11%, 11%, and 13% of cultivation area, respectively (Fig. 8). Poland is an important producer of cereals for local and international markets. In 2006 total export of wheat, rye, barley, oat and maize amounted to 1 176.7 thousand tones.

FIGURE 8
Cultivation area of main cereals relative to the remaining crops



Source: Concise Yearbook of Poland (GUS), Warsaw, 2008.

TABLE 1
Area of cultivation, yields and harvest of main field crops from 1996 to 2007

Type of crops		1996-2000	2001-2005	2006	2007	1996-2000	2001-2005	2006
		annual average				=100	=100	=100
Total cereals	A	8 796.0	8396.7	8 381.1	8 352.9	95	99	99.7
	B	28.6	31.9	26.0	32.5	114	102	125.0
	C	25 189.4	26 758.3	21 775.9	27142.8	108	101	124.6
Total wheat	A	2 576.8	2375.6	2175.7	2112.0	82	89	97.1
	B	34.0	38.0	32.4	39.4	116	104	121.6
	C	8 772.0	9 022.0	7 060.0	8317.3	95	92	117.8
Rye	A	2 275.4	1601.0	1 318.0	1316.2	58	82	99.9
	B	22.7	24.4	19.9	23.7	104	97	119.1
	C	5 160.0	3 910.0	2 621.0	3125.6	61	80	110.2
Total barley	A	1 142.6	1053.0	1221.0	1232.4	108	117	101.0
	B	29.9	31.7	25.9	32.5	109	103	125.5
	C	3 420.0	3 337.0	3 161.0	4 008.1	117	126	126.8
Oats	A	590.0	544.4	539.1	582.6	99	107	108.1
	B	24.4	24.7	19.2	25.1	103	102	130.7
	C	1 437.5	1 346.0	1 035.0	1.462.3	102	109	141.3
Total triticale	A	663.4	1 004.4	1 194.3	1 260.2	190	125	105.5
	B	30.2	32.2	26.8	32.9	109	102	122.8
	C	2006.0	3 237.0	3 197.0	4 147.1	207	128	129.7
Potatoes	A	1 292.0	813.0	597.2	569.6	44	70	95.2
	B	183.0	180.0	150.0	207.0	113	115	138.0
	C	23 620.0	14 600.0	8 982.0	11 791.1	50	81	131.3
Rape and turnip rape	A	409.6	479.4	623.9	796.8	195	166	127.7
	B	20.7	24.6	26.5	26.7	129	109	100.8
	C	846.7	1 178.0	1 652.0	2 129.9	252	181	129.0
Sugar beet	A	395.4	298.0	262.0	247.4	63	83	94.4
	B	377	411	438	513	136	125	117.1
	C	14 920.1	12 236.0	11 475.0	12 681.6	85	104	110.5

A-area in thousand ha, B-yield of 1ha in dt, C-harvest in thousand tones.

Source: Concise Yearbook of Poland (GUS). Warsaw 2008.

Potato, an important food crop in Poland, presently occupies half of the acreage of its cultivation in 2000. The industrial oil plants are important cash crops in Poland. Since 1996, the cultivation area of rape and turnip rape, increased due to their ties to biofuel production while the cultivation area for sugar beet and forage species decreased.

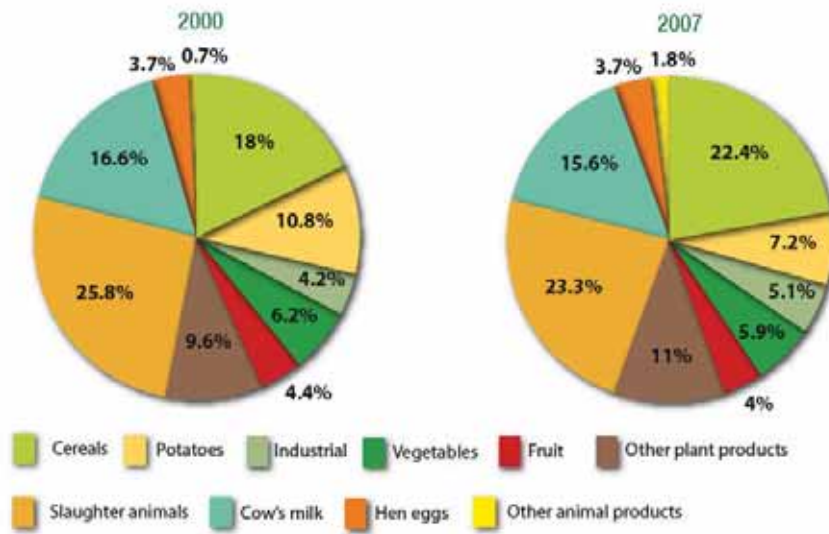
1.2 The importance of major horticulture crops for food and agriculture

The production of vegetables and fruits, another important commodity exported to the EU market, covers a small fraction of total of agricultural land (1.6% and 2% respectively) relative to cereals, yet horticultural plants contribute substantially to agricultural diversity. Their share of 10% in global agricultural production was half of that of cereals, yet a 11% share in commercial agricultural production in 2007 is comparable to that of cereals (Fig. 10). Vegetable production is based on outdoor and undercover cultivation. Major crops grown outdoor include: cabbage, onion, carrot, cucumber, beetroot and tomato (Fig. 11), while under cover cultivation concentrate on tomato and cucumber. These two methods of cultivation rely on different cultivars with different requirements and parameters.



FIGURE 9

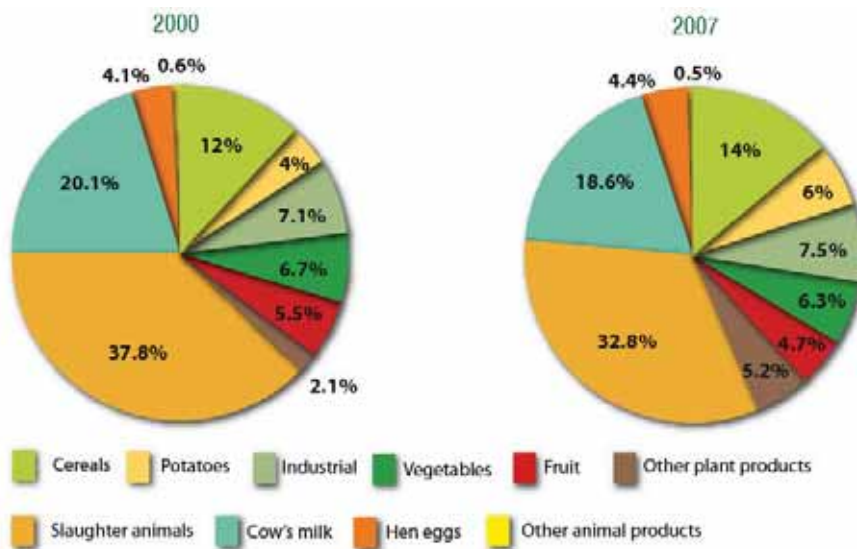
Structure of global agricultural production in 2000 and 2007 (in % of current prices)



Source: Agriculture and Food Economy in Poland. (Ministry of Agriculture), Warsaw, 2008.

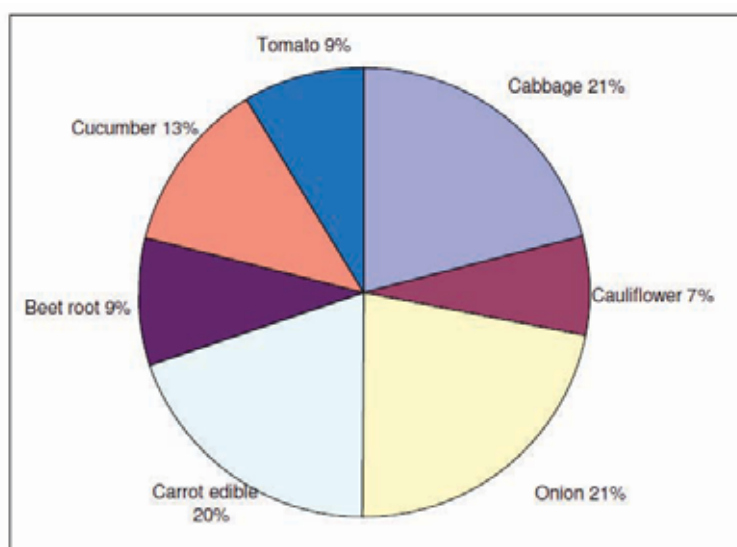
FIGURE 10

Structure of commercial agricultural production in 2000 and 2007 (in % of current prices)



Source: Agriculture and Food Economy in Poland. (Ministry of Agriculture), Warsaw, 2008.

FIGURE 11
Structure of outdoor cultivation of main vegetable crops

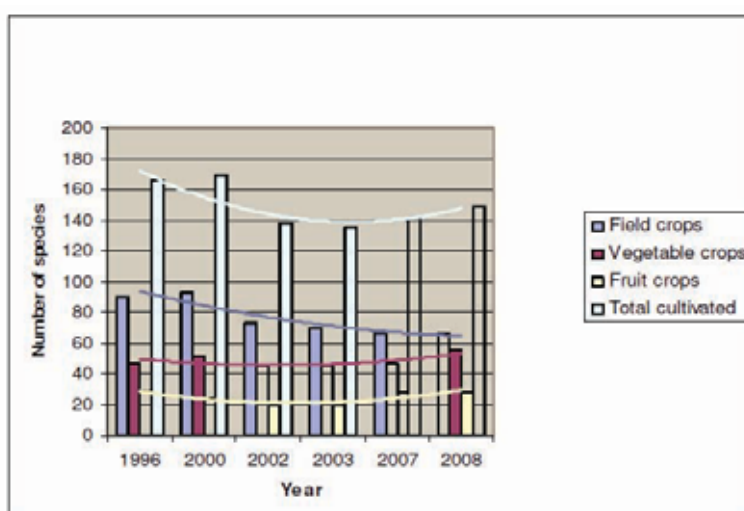


Fruit production is dominated by apples, pears, plums, sour cherries and sweet cherries, strawberries, raspberries, currants and gooseberries. Up to 80% of total fruit harvest comes from apple orchards, with apple trees making up 52.5% of the total area of orchards and fruit plant plantations. The commercial production of apples comprises of approximately 20 old and new varieties. However, older varieties are disadvantaged in large scale production in terms of number and acreage.

1.3 The state of diversity of field and horticulture crops

The diversity of major groups of crop species grown in Poland is reflected by the total number of species included in the National Register for field, vegetable and fruit crops. In total, 149 species, of which 66 are field, 55 are vegetables and 28 are fruit species, were certified for cultivation in 2008. Over the last 12 years, the number of registered species decreased from approximately 90 to 66 for field plants, increased for vegetable plants and remained approximately the same for fruit crops (Fig. 12).

FIGURE 12
Number of species in the National Register in 1996–2008



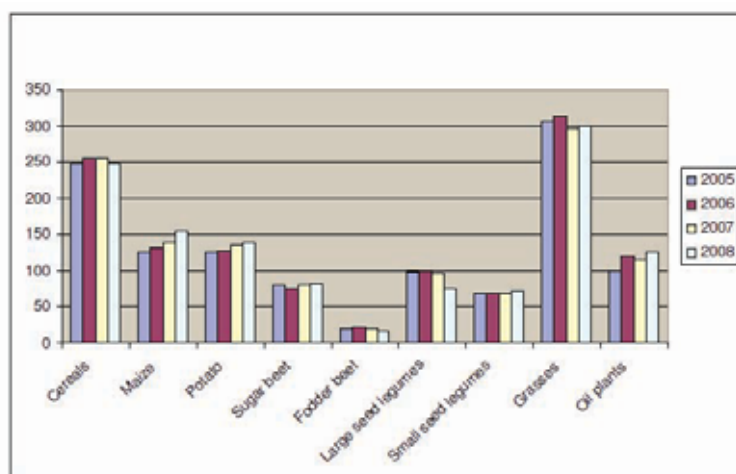
In recent years, a growing demand for healthy food has raised the recognition of regional and traditional products that create new value and complement the human diet. This notion has stimulated the reintroduction of primitive species of wheat, oil crops, legumes, and other agricultural plants, thereby broadening diversity in the crop sector. This new trend reinforces the cultivation of vegetables, fruits, herbs and medicinal species that are traditionally grown for household use or small-scale trade, thus resulting in a growing niche on the market for such goods.

1.4 The state of diversity of cultivars of field and horticulture crops

The diversity of field crops at the cultivar level has not changed much in last four years. The number of certified cultivars whose seed material is eligible for production and marketing in Poland increased for maize and potato, fluctuated for cereal and oil crops, and decreased for large seed legumes and grass cultivars (Fig. 13).

FIGURE 13

Number of registered cultivars of main field crops from 2005 to 2008



Source: Rynek środków produkcji i usług dla rolnictwa. Analizy rynkowe. (Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej PAN) Warsaw. 2008.

In total, 1 230 cultivars of field crops, 925 of vegetable and 316 of fruit plants were registered in 2008, though there remain numbers of unregistered cultivars of vegetable and fruit plants grown in gardens, small plantations and orchards. It is estimated that as many as 500–700 old varieties of apples, pears, sweet and sour cherries and plums are grown in Poland, but only a small proportion of these cultivars have a market value. Of 100 old varieties of apple, approximately 20 are commercialized and are most often sold in local markets, thus supplementing the diversity of officially recommended cultivars. The total number of traditional cultivars and landraces of vegetables, fruit trees and shrubs, berry and ornamental plants and field crops grown in Poland is difficult to estimate.

1.5 The state of diversity and importance of minor and underutilized crops for food and agriculture

Poland is an important producer of medicinal and aromatic plant (MAP) raw materials. About 70 species are cultivated on approximately 25 000–30 000 hectares on 20 000 farms.

Approximately 10 000–20 000 tones of MAP raw materials are obtained annually from cultivation. The main cultivated species are: *Aronia melanocarpa*, *Hypericum perforatum*, *Thymus vulgaris*, *Oenothera spp.*, *Borago officinalis*, *Silybum marianum*, *Mentha piperita*, *Matricaria chamomilla*, *Valeriana officinalis*, *Melissa officinalis*, *Aronia melanocarpa*, *Cynara scolymus* and *Salvia officinalis*.

Since 1990, selected medicinal and aromatic plant species have been cultivated on organic farms in Poland. In large Polish cities (Warsaw, Kraków, Poznan and Gdansk) shops specializing in organic food offer MAP products of Polish and foreign origin. Such products are also sold in some grocery stores, under the special control of the Polish Ecological Club in the town of Gliwice. There are about 2 500 herbal medicinal products on the Polish market with an estimated value of



250 million euro per year. These include simple medicinal forms (dried herbs, herb mixtures, granulates), processed forms (e.g. tablets, capsules, dragees) and half-finished products for pharmaceutical, cosmetic and food industry (extracts and essences)¹.

Slightly more than 3% of agricultural land in Poland are meadows and pastures, while approximately 19% of land which remains outside the cultivation regime is grassland and is gradually increasing. Grassland encompasses an abundance of cultivated and non cultivated species, including a variety of grasses and leguminous herb plants. This plant variability is an important for food and agriculture and complement diversity that is found in cultivation.

1.6 The state of diversity of wild species for food and agriculture

FIGURE 14

Two species of naturally occurring edible mushrooms – *Boletus luridus* (photo: W. Łopieński) and *Almillaria* sp. (photo: R. Dejtrowski)



Source: Przyroda Polska nr 9/2003, (<http://www.przyroda.polska.pl>).

In Poland, the diversity of wild plant species is subject to nature conservation and is within the competence of the Ministry of Environment. Wildly growing species that are important for food and agriculture include mushrooms, herbs, berries, and medicinal plants, traditionally hand gathered for personal use and/or sale.

Of approximately 100 mushroom species which grow in Polish forests, 42 are eligible for market sale by the decision of the Polish Minister of Health on December 19th, 2002. It is estimated that approximately 500 tons of various species of mushroom are gathered for commercial purposes every year.

The diversity of naturally occurring and collected medicinal and aromatic plants is estimated at 200 species, of which 80-100 are used for commercial purposes. The average annual harvest of raw materials from natural sites is approximately 3 000–5 000 tons. Around 30% of this annual harvest is exported. It is expected, however, that the level of collection of medicinal and aromatic plants from natural sites will decline with time and cultivation of these plants became the main source of raw material for the industrial use and commerce. The most important MAP collected from natural sites include: *Urtica dioica*, *Tilia* spp., *Frangula alnus*, *Equisetum arvense*, *Betula* spp., *Quercus* spp., *Vascum album*, *Aesculus hippocastanum*, *Taraxacum officinale*, *Crataegus* spp., *Sambucus nigra*, *Equisetum arvense*, *Achillea milefolium*, *Tusilago farfara*, *Viola* spp. and *Salix purpurea*.

The distribution of medicinal plants growing in the wild is irregular throughout Poland. Most of them, with respect to the number of species and the size of sites, occur in the eastern part of the Poland. This part of the country is one of the ecologically cleanest in Poland, lacking heavy industry, large urban agglomerations, and large agricultural farms.

¹ Z. Weglarz, A. Geszprych, 2002. The status of medicinal and aromatic plants in Poland. Report of a Working Group on Medicinal and Aromatic Plants, ECPGR, IPGRI, Rome, Italy.

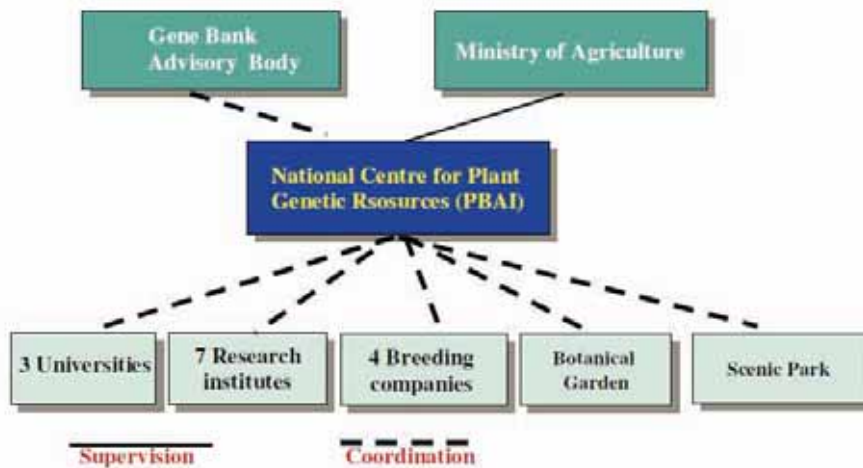
ORGANIZATION OF THE NATIONAL PLANT GENETIC RESOURCES CONSERVATION PROGRAMME



The National Plant Genetic Conservation Programme for food and agriculture was established in Poland in the late 1970s. Over the years, it has undergone transformation in terms of its organization, objectives and scope. The programme is supervised by the Ministry of Agriculture and is financed from the state budget. Its implementation involves cooperation of several institutions. These institutions are entrusted with the task of curating specific crop collections, as well as collecting, characterizing and evaluating the accessions. They remain responsible for crop documentation and conservation through methods other than the long term preservation of seed material. The activities undertaken within the programme by the cooperating institutions are coordinated by the National Centre of for Plant Genetic Resources of the Plant Breeding and Acclimatization Institute. The centre maintains a central database for all genetic resources collection and provides storage facilities within a controlled environment. The organizational structure of the programme is illustrated in Fig. 17.

FIGURE 17

Organization structure of the Plant Genetic Resources Programme in Poland



THE STATE OF *IN SITU* MANAGEMENT

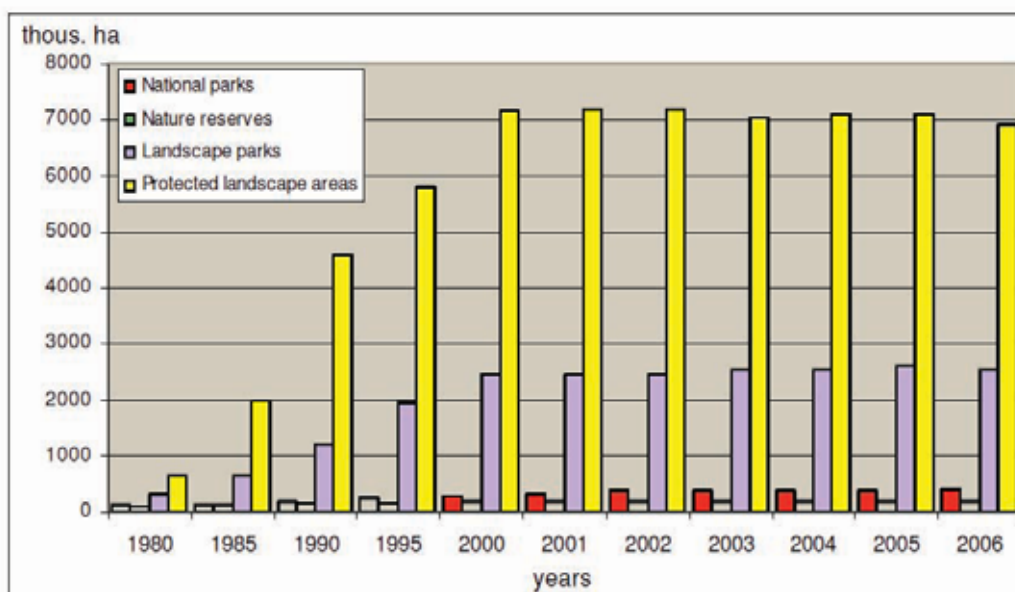
3.1 *In situ* conservation of wild plant genetic resources for food and agriculture

In situ conservation is a domain of nature protection. The legal protection of wildlife in Poland is regulated by the Act on Nature Protection, enacted on April 16, 2004 (Dz. U. Nr 92, item 880), which implements the following Council Directives of the European Commission: 79/409/EEC of April 2, 1979 on the protection of wild birds, 92/43/EEC of May 21, 1992 on the conservation of natural habitats and fauna and flora, 1999/22/WE of March 29, 1999 on animals maintained in zoo, and the Environmental Protection Law Act of April 2001 (Dz. U. 62 item 627) with its later amendments of 2003 (Dz. U. 2003.190.1865) and 2005 (Dz. U. 2005.113.950).

In Poland, protection of wild flora is ensured through various forms of environmental protection, including: national parks, nature reserves, landscape parks, protected landscape areas, Natura 2000 network areas, nature monuments, ecological areas and natural and scenic complexes. These different categories aim to provide protection of the landscape and to maintain elements of ecosystems which are important for sustaining biological diversity. Over the last 20 years, protected areas have increased, however, the most noticeable increase took place between 1980 and 2000. Changes in area covered by various forms of wildlife protection since 1980 is illustrated by Fig. 15. Regarding Natura 2000 network 184 sites of unique habitat covering 1 176 000 ha were under protection in 2007.

FIGURE 15

Area covered by various forms of wildlife protection



On July 9th, 2004, the Minister of the Environment, in consultation with the Minister of Agriculture established a system of plant and animal species protection (Dz. U. Nr 168, item. 1764) in Poland. This regulation specifies a list of protected species, whether this protection is complete or partial, which species require active protection, which species may be harvested and the correct methods of harvesting. Decision on species protection can also be issued by the virtue of vovoidship regulation. By the decree of the Minister of Environment, over 428 plant species are currently covered by a strict form of protection, 51 species are partially protected, and 14 species are eligible for harvesting.

More than 30 species of herbaceous medicinal plants (include *Lycopodium* sp., *Gypsophila paniculata*, *Cimicifuga europaea*, *Aconitum* sp., *Adonis vernalis*, *Drosera* sp., *Archangelica officinalis*, *Polemonium coeruleum*, *Echium rubrum*,

Atropa belladonna, *Gentiana* sp., *Arnica montana*, *Veratrum* sp., *Colchicum autumnale*, *Leucoium vernum*, *Ledum palustre*, *Arctostaphylos uva-ursi*, *Polypodium vulgare*, *Centaureum umbellatum*, *Gentiana asclepiadea* and *Galanthus nivalis*) are covered by strict protection regulations in Poland. Approximately sixteen other medicinal and aromatic plant species are partially protected (include *Cetraria islandica*, *Ribes nigrum*, *Ononis spinosa*, *Frangula alnus*, *Viburnum opulus*, *Nymphaea alba*, *Nuphar luteum*, *Asarum europaeum*, *Primula elatior* and *P. officinalis*, *Asperula odorata*, *Helichrysum arenarium*, *Convallaria maialis*, *Hierochloe odorata* and *Hierochloe australis*). These plants are not only used in the medical drug industry, but also are important for household use. Their harvesting is only possible in defined amounts, within specific time frames, and with the permission of the Provincial Conservatories of Nature.

Wild-growing species are endangered as a result of two main factors: irreversible abiotic changes of the environment (e.g. lowering of ground water level, pollution of the environment and eutrophication of natural water reservoirs) and uncontrolled and excessive harvesting. Information on the distribution of wild growing species including those for food and agriculture is available in the Atlas of Distribution of Vascular Plants in Poland.²

3.2 On-farm conservation of plant genetic resources for food and agriculture

On-farm conservation and management is a marginal, yet growing activity in Poland. As in other industrialized countries, a majority of arable land growing major agricultural crops is sown with modern cultivars. In Poland, traditional agricultural crop plants and cultivars, including land races, remain in cultivation mainly in the mountain regions of Beskidy and the Tatras in the southern part of the country. Minor areas for cultivation are Podlasie and the basin of Sandomierz. These regions are characterized by harsh climate, short growing period and undulating land surface conditions, which are not conducive for industrial agricultural and horticultural production. A relatively high abundance of vegetable diversity is maintained in house hold gardens, particularly in southern and eastern Poland. With regard to old orchards, fruit trees and shrubs, a recent survey of the Research Institute of Pomology and Floriculture at Skierniewice showed that Western and Northern Poland remains a source of many valuable varieties of fruit trees maintained in old orchards. Apart from valuable old cultivars and landraces of such crop plants as wheat, oat, broad bean, tomato, garlic, onion, tomato, pepper, pumpkin, dill, cucumber, garlic, parsley, some relic crops, such as *Camelina sativa*, *Raphanus sativus* var. *oleiformis*, *Panicum miliaceum* are still found in small secluded farms in the aforementioned regions.

Due to the growing awareness of the gradual loss of crop plant diversity, measures to slow down this process and to restore lost variability were initiated a few years ago in Poland. In 2002, the Ministry of Agriculture and Rural Affairs introduced the first Rural Development Programme which promoted and facilitated *in situ* genetic conservation activities in the agricultural sector through projects financed from the budget of the latter Ministry. The last edition of this Programme, covering 2007 to 2013, includes packages with objectives to promote, maintain, and preserve the diversity of valuable agricultural habitats such as extensive meadows and pastures. Other packages lead to preservation of landraces of field, vegetable crops and fruit trees through the involvement of farmers in the cultivation and production process for effective preparation of these goods for market sale.

3.3 On-farm conservation projects

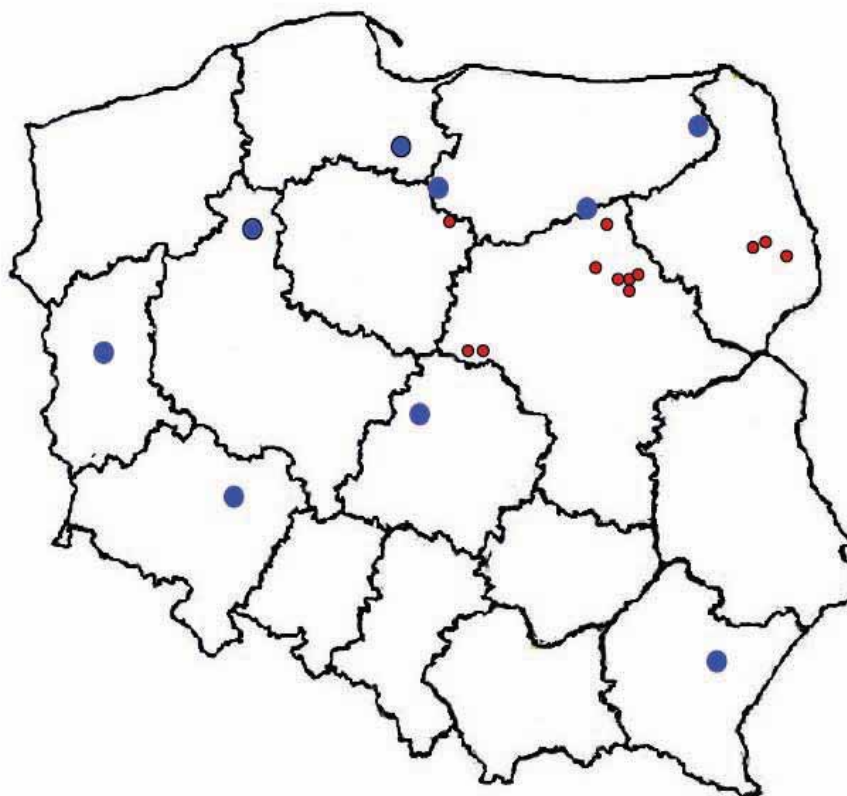
In Poland, on-farm conservation projects were initiated in the late 1990s by non governmental organizations (NGOs). This movement has subsequently developed into collaborative activities between various NGOs and public institutions. The following projects are currently being implemented within the framework of the National Plant Genetic Resources Conservation Programme and by landscape and national parks:

² Zajęc, M. Zajęc, 2006. Distribution Atlas of Vascular Plants in Poland. Jagiellonian University, Kraków, Poland.



FIGURE 16

Localization of on-farm conservation activities conducted by NGOs (blue dots), and the Landscape Parks and the National Centre for Plant Genetic Resources of the Plant Breeding and Acclimatization Institute (red dots)



A project led by the National Plant Genetic Resources Centre (PBAI), has assessed the value of old, uncultivated crops such as *Triticum diccocom*, *Triticum monococum* and *Triticum spelta* as well as old and modern varieties of bread wheat, barley, oat, potato, some legume and forage crops on 10 organic farms in Kurpie region. This project's aim is the reintroduction of the most suitable crops and cultivars into current day organic farming. An important aspect of this project is the education of local farmers of new seed production technologies and effective management of organic farms.

A number of projects undertaken by the Research Institute of Pomology and Floriculture, the Arboretum and Institute of Physiography in Bolestraszyce, the Association of the Chelminski and Nadwislanski Landscape Parks - Swiecie, Brodnicki Landscape Park, Hills of Łódź Landscape Park, Valley of Barycza Landscape Park and Wigierski National Park aim at the restoration of old trees and old local orchards, as well as the promotion of traditional technology related to fruit growing and processing.

The reintroduction and promotion of local landraces of vegetable crops on small Southern Polish farms in six villages (Stryczowice, Tenczyn, Sulkowice, Wolica, Wysokie and Letownia) is currently being conducted by the Research Institute of Vegetable Crops, Skierniewice. Information on reintroduced landraces and those already cultivated at each site is given below along with photographic documentation from the sites³.

It is projected that these projects will increase the awareness of the value of crop diversity and thus will lead to greater levels of old cultivars and landraces throughout the area.

³ T. Kotlinska. 2006. Annual Report on Collecting Characterization, Evaluation and Conservation of Vegetable Crops. Research Institute of Vegetable Crops, Skierniewice, Poland.



➤ **village Stryczowice:** introduced form the gene bank collection : garlic, shallot, pumpkin, bean, millet
landraces already maintained: dill, rhubarb, mustard, tomato, parsley, horse radish.



Photo: T. Kotlińska

➤ **village Wolica:** landraces already maintained : soybean, bean, broad bean, sunflower, red beet, cabbage, parsnip, rutabaga
introduced form the gene bank collection : onion, bean, pumpkin, dill, tomato, cucumber, garlic, shallot, lettuce, chives.

Photo: T. Kotlińska

➤ **village Sulkowice:** landraces already maintained : bean, broad bean, pumpkin, tomato, garlic, cucumber.
introduced form the gene bank collection : bean, broad bean, radish, red beet, peas, cucumber, carrot, lettuce, garlic, shallot.



Photo: T. Kotlińska

➤ **village Wysokie:** landraces already maintained : dill, bean, peas, shallot, rutabaga, sunflower, bunching onion, parsley, cucumber, lettuce, zucchini, garlic, broad bean.



Photo: T. Kotlińska

- **village Lętownia:** landraces already maintained : broad bean, bean, peas, dill, lettuce, parsley, carrot, cucumber.
introduced form the gene bank collection : bean, broad bean, onion, cucumber, garlic, shallot, bunching onion, chives.



Photo: T. Kotlińska

- **village Tenczyn:** landraces already maintained peas, flax, garlic, dill, carrot, parsnip, rutabaga, herbs.
introduced form the gene bank collection : bean, red beet, broad bean, carrot, tomato, cucumber, garlic, shallot, chives, lettuce, horse radish.



Photo: T. Kotlińska



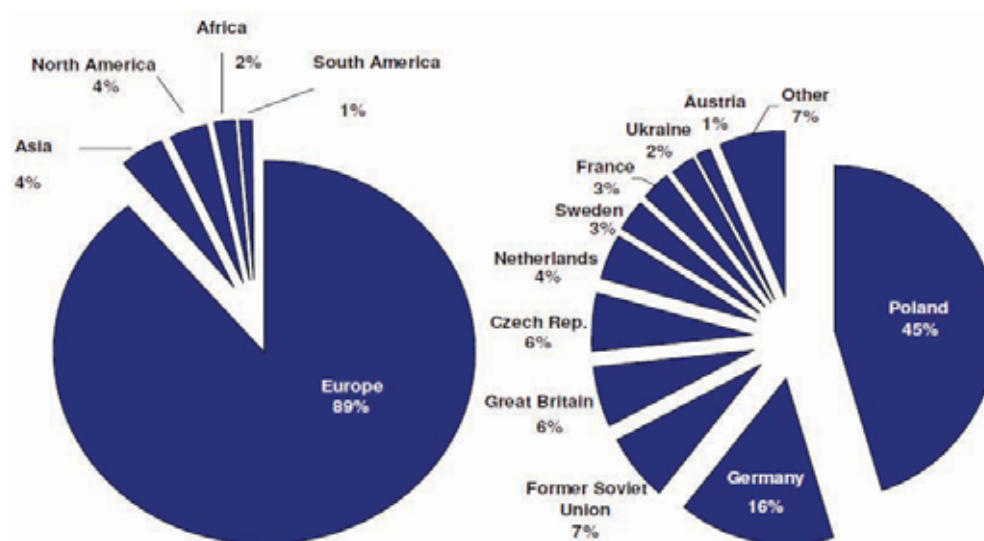
THE STATE OF *EX SITU* MANAGEMENT

4.1 The state of collections

Ex situ collections maintained within the framework of the National Genetic Resources Programme cover crop plants, their wild relatives, and weedy species that are imperative as a food source and/or significant for the agricultural sector of the economy. They are organized into crop collections which altogether make up the national collection of plant genetic resources. The national collection is composed of 89% of European accessions, of which 45% are of Polish origin (Fig. 18). This division reflects a past policy that aimed to cover the broadest possible range of variability of particular crop from as many sources as possible. Current priority, however, is the collection and preservation of national crop plant diversity, focusing on older varieties and landraces.

FIGURE 18

Breakdown of national collection by the country of origin of accessions



The national collection covers the following crop categories/ plants and their wild relatives:

- Cereals (*Triticum* spp., *Secale* spp., *Hordeum* spp., *Avena* spp., *Panicum* spp., *Zea mays*, *Fagopyrum* spp., *triticale*)
- Large seed legumes (main are: *Pisum* spp., *Vicia* spp., *Glycine max*, *Phaseolus* spp.),
- Small seed legumes (main are: *Medicago* spp., *Trifolium* spp. and other minor species)
- Grasses (pasture, lawn and ornamental)
- Oil plants (*Brassica napus*, *Helianthus annuus*, *Papaver somniferum* and other minor spp.)
- Sugar and pasture beet plants
- Potato
- Industrial plants (*Humulus* spp., *Nicotiana* spp., *Linnum* spp.)
- Fruit trees, shrubs and herbaceous plants (main are: *Malus* spp., *Prunus* spp., *Cerasus* spp., *Persica* spp., *Corylus* sp., *Juglans regia* L., *Fragaria* spp., *Ribes nigrum* spp., *Rubus* spp., *Vitis* spp., *Vaccinium* sp., *Oxycoccus* spp.)
- Vegetable plants and mushrooms (main vegetables are: *Allium* spp., *Brassica* spp., *Raphanus* sp., *Asparagus* sp., *Lactuca* spp., *Antheum* sp., *Daucus* sp., *Cucumis* spp., *Cucurbita* spp., *Phaseolus* spp., *Anethum* sp., *Lycopersicon* sp.)
- Medicinal and aromatic plants (main are: *Hyssopus officinalis* spp., *Satureja montana* L., *Thymus* sp., *Origanum vulgare* L., *Hierochloë austral* Roem. & Schult., *Armoracia rusticana*, *Rheum rhaponticum* L., *Archangelica officinalis* Hoffm.,

Centaurium umbellatum Gilib., *Arnica montana* L., *Convallaria majalis* L., *Asarum europaeum* L., *Arctostaphylos uva-ursi* L., *Spreng.*, *Adonis vernalis* L., *Colchicum autumnale* L., *Asperula odorata* L., *Helichrysum arenarium* sp.)

- Ornamental plants (main are: *Lilium* spp., *Narcissus* spp., *Tulipa* spp., *Gladiolus* spp.)
- Alternative plants (for use as source of energy, for recultivation of devastated lands by industry)
- Weedy endangered species

TABLE 3

The number of accessions in crop collections and their share in 2007

Crop/Group of crops	Number of accessions	Percentage	Curator*
Cereals	26 085	35.6	PBAI, ULR, OB, IGR
Grasses	16 369	22.3	PBAI
Vegetables	9 668	12.2	IVC
Large seed legumes	1 080	1.5	PBAI, IGR
Small seed legumes	6 921	9.5	PBAI
Oil and industrial crops	4 103	5.6	ISSPC, INF
Fruit trees	4 500	6.1	IPF, SP, OB, ARB
Fruit shrubs	1 032	1.4	IPF, SP, OB, ARB, ULSP
Potato	1 334	1.8	PBAI
Ornamentals	1 002	1.4	IPF
Medicina	780	1.1	IMP, SGGW
Other	1 128	1.5	PBAI

* Plant Breeding and Acclimatization Institute - Radzików, (PBAI), Research Institute of Vegetable Crops Skierniewice, (IVC), Research Institute of Pomology and Floriculture - Skierniewice, (IPF), Research Institute of Medicinal Plants - Poznan, (IMP), Institute of Natural Fibres - Poznan, (INF), University of Life Science - Lublin, (ULS), University of Life Science - Poznan (ULSP), Warsaw University of Life Science - Warsaw (SGGW) Botanical Garden of Polish Academy of Science - Powsin (OB), Institute of Soil Science and Plant Cultivation - Pulawy (ISSPC), Institute of Plant Genetic of Polish Academy of Science - Poznan (IGR), Arboretum and Institute of Physiography in Bolestraszyce (ARB), Association of the Chelminski and Nadwislanski Landscape Parks - Swiecie (SP)

The number and percentage of accessions maintained in *ex situ* collections by curating institutions are given in Table 3. Since 1996, crop collections were complemented with over 5 000 collected accessions of grasses, local varieties of vegetables, fruit trees, small and large seed legumes, ornamental, naturally occurring medicinal, aromatic, weedy and protected species. Very few samples of cereal landraces were collected as they are practically no longer cultivated in Poland.

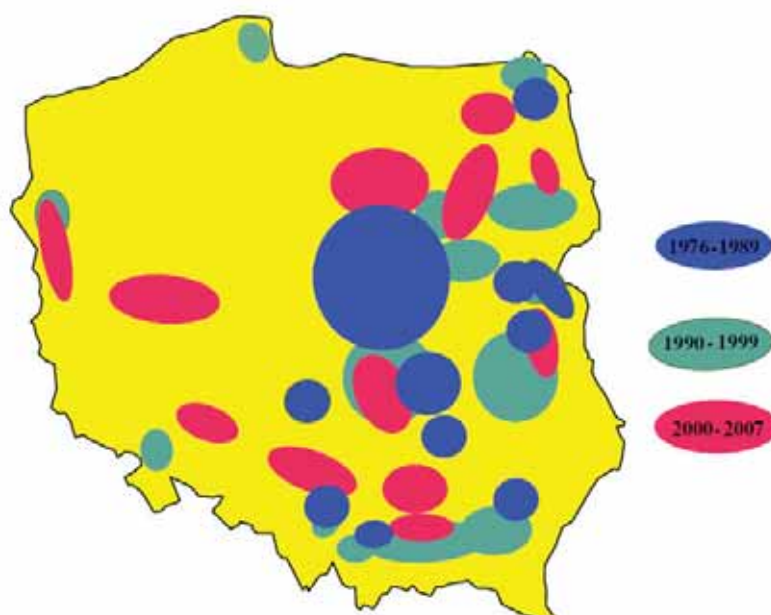
The structure of national *ex situ* collection portrays plant breeders' expectations in terms of the categories of genetic resources they need, nature and the breeding history of the species. In major crop collections such as wheat, rye, oat, barley, maize, triticale, potato industrial and oil crop plants, modern cultivars predominate over other categories of genetic resources. For example, cereal collections comprise 60%–80% of advanced cultivars and lines. Collections of vegetable crops, in majority, maintain variability represented by old Polish cultivars and land races. Indicative examples of this are collections of *Cucurbita* spp., *Allium* spp. and *Anethum* sp., of which over 90% of accessions are old cultivars and landraces. *Cucumis* spp. collection contain 61% of old cultivars and landraces accession. Fruit tree collections comprise of 90% cultivated old and new varieties and lines, 8% of local forms and 2% of related wild species of the total number of accessions. Grass, aromatic and medicinal plant collections consist mainly of landraces and natural populations.

4.2 Collecting expeditions

Collecting missions to less agriculturally developed regions of Eastern Poland are traditionally carried out every year to safeguard existing regional diversity of local landraces and old varieties of crop plants. Western and northern parts of the country are sources of genetic material of old traditional fruit crops.



FIGURE 19

The regions of the collecting missions in Poland

Collecting expeditions were made by the Plant Breeding and Acclimatization Institute and the following collaborating institutions: the Botanical Garden of the Polish Academy of Science, the Research Institute of Pomology, Floriculture and the Research Institute of Vegetable Crops and the Arboretum and Institute of Physiography. The overview of regions where collection occurred since 1976 and where expeditions were carried out abroad is given in the Fig. 19 and the Table 4.

Seed samples and reproductive material were most often obtained from farmers or on local markets. Home gardens and orchards were the most frequent source of horticultural crops. Wild relatives of crop plants, medicinal and aromatic plants were predominantly collected from natural sites. For grass accessions and forage plants, old pastures and meadows were the target sites. A majority of accessions collected were of the following genera: *Phaseolus*, *Allium*, *Cucurbita*, *Cucumis*, *Anethum*, *Petroselinum*, *Capsicum*, *Lycopersicon*, *Pyrus*, *Malus*, *Prunus*, *Lactuca*, *Pisum*, *Daucus*, *Panicum*, *Zea mays*, and several species of grasses. Since 2004, the collection of weedy species was initiated after recognizing that many traditional weeds of agricultural crop fields had already disappeared and others were endangered. For this reason, scientific projects aimed at raising awareness of the importance of the plant diversity of weedy species were undertaken.

The foreign collecting expeditions were multi-crop oriented. Altogether, 6 546 accessions were collected from 1996 to 2008. National expeditions in the same period yielded 570 accessions of a broad range of cultivated species of cereals including their wild relatives, legumes, vegetables, ornamental, fruit, medicinal, aromatic and oil plants, grasses, wild and weedy species.

TABLE 4

Foreign collecting expeditions from 1997 to 2007

Year	Country	Number of accessions collected	Description of collected accessions
1997	Ukraine	730	Large seed legumes, vegetables, fruit plants
1998	Moldova	878	Large seed legumes, vegetables, fruit plants, grasses
1999	Georgia and Russia	1 128	Medicinal, ornamental plants, wild species of cereals, small seed legumes, grasses, oil plants, large seed legumes, vegetables
2000	Kyrgyzstan	408	<i>Allium</i> (tubers and seeds), <i>Rheum</i> , <i>Aegilops</i> , grasses, large seed legumes

Year	Country	Number of accessions collected	Description of collected accessions
2001	China	704	Wild species affined to cultivated plants, grasses, small seed legumes
2002	Russia	95	Cultivated and wild <i>Allium</i> species
2003	Romania	135	Wild grasses, landraces of cultivated plants
	India	112	<i>Zea mays</i> . and <i>Phaseolus landraces</i>
2004	Iran	547	Cereals, large seed legumes, wild species of grasses and large seed legumes
2005	Ukraine	250	Cereals and vegetables landraces, old fruit plants, cultivars, wild vegetables species, grasses
2005	Mongolia	58	Medicinal and aromatic plants
2006	Ukraine	1 239	Landraces of cereals, vegetables, wild, medicinal and aromatic plants, grasses
2006	Romania	262	Landraces of grasses, weeds, vegetables and fruit trees

4.3 Conservation facilities

The main seed storage facilities consist of two chambers for long-term conservation of base collection and four chambers for medium-term storage of an active collection. These facilities are located in the Plant Breeding and Acclimatization Institute in Radzików (Table 5). By 2008, the total number of accessions in long-term storage increased by 20 000 since 1996 to amount to 65 104 accessions total. The accessions belong to 520 species and 225 genera.

TABLE 5
Long-term seed storage parameters

Type of facility	Base collection	Active collection
Temperature	20°C	0°C
Relative Humidity (%)	5–6% MC in seeds stored under vacuum conditions	5–6% MC in seeds stored under vacuum conditions
Packing material	Hermetically closed glass jars under vacuum conditions	Hermetically closed glass jars under vacuum conditions

Routine activities related to long and medium-term preservation include seed cleaning and drying, testing seed germination prior to deposition and during storage. Methodology of these activities was modified since 1996 and is given in Table 6.

TABLE 6
Methodology of seed samples processing prior and during long term preservation

Activity	Description of quality control
Germination tests	Viability control every 5-10 years. 3 × 25 seeds on Petri dishes, control after 1, 2, 3, 4, 7, 14, 28, 56 days of test
Seed drying	With warm air 20°C and 14% of humidity drying down to 3–7% seed water content
Regeneration	Only if viability drops below 80% for crop species and below 65% for wild species and landraces

The storage facilities have a total capacity of 100 000 seed samples. All crop collections except for fruit trees, vegetatively propagated vegetables (onion, garlic, asparagus and potato), hop and potato are maintained as seeds in cold chambers in Radzików. Fruit genetic resources are preserved in orchards by the Research Institute of Pomology and Floriculture in Skierniewice, the Arboretum and the Institute of Physiography in Bolestraszyce and the Association of the Chelminski and Nadwislanski Landscape Parks - Swiecie and the Botanical Garden of Polish Academy of Science. The collection of *Vitis* is maintained by the University of Life Science in Poznan. Some collections of perennial plants (grasses,



bee plants, ornamental, aromatic and medicinal species) are also maintained as field collections. Genetic resources of potato are preserved in field and *in vitro* collections. Criopreservation is used to preserve the most valuable accessions of rye collections at the Botanical Garden of Polish Academy of Science and is currently under development for the *Malus* accessions.

4.4 Characterization, evaluation and documentation

In 2008, a centralized database system was installed in the National Genetic Resources Centre (NCPGR) of the Plant Breeding and Acclimatization Institute in order to improve accessibility, processing and data flow among curators, NCPGR employees and other institutions involved in the National Programme of Plant Genetic Resources Conservation, as well as to facilitate management of seed collections and activities. This system integrates passport, evaluation, collecting and seed storage data into one database system operated by a web server. It consists of seven basic modules which compile relevant specific data. These modules are:

- Institutions module – compiles information concerning institutions and private persons that cooperate with the gene bank. It contains correspondence addresses, names and positions of employees, history of correspondence, as well as additional information.
- Seed quality module – compiles information on seed samples deposited in the seed bank such as viability, germination, moisture content, regeneration and multiplication dates. This module stores the history of sample tests.
- Seed storage module – compiles information about storage of accessions. Localization of accession sample (number of storage chamber, number of set of shelves, number of shelf), date of reception, type of collection (core, active, black box).
- Passport data module – allows curators to introduce and modify passport data.
- Expedition module – compiles detailed information concerning accessions collected during expeditions.
- Acquisition/distribution module – compiles data related to acquisition and distribution of accession samples and records movement of samples for the accessions.
- Taxonomy module – compiles taxonomic information on accessions and includes a function that makes it possible to add synonyms and include Polish and English common names.

Of all of the 73 265 accessions maintained in the national collection, 69 425 have passport data included in the database. Passport data is recorded in EURISCO format. Although all collections were characterized and evaluated according to agreed descriptor lists and protocols, only a few: *Triticum durum*, *Beta*, vegetables, aromatic and medicinal plants have evaluation data for the entire collections stored in the central databases in NCPGR. Other collections such as: *Pisum*, *Lupinus*, *Humulus*, *Cannabis* have more than 50% of the accession data included in the data bases. Remaining collections have less than 50% of accessions documented in the data bases and require further work in this regard.

Since 2006, all passport data has been available through the EURISCO web catalogue and is updated once or twice a year. Passport data is also available through the Global Biodiversity Information Facility (GBIF), as well as another backup format, for safety purposes. Documented data collections are available as Excel spreadsheets or MS Access databases. Data can be sent upon request via e-mail or CD.

Presently, evaluation data is accessible via internet for collections of cereals (barley, oat, common wheat, durum wheat, triticale) and grasses. Work is being advanced to further include hop, poppy, buckwheat and tobacco accessions. For maize, flax, beet, vine and fruit trees, evaluation data are only accessible from curators of the collections. Linking the data with the information system is in progress, with the uniform descriptors prepared for watermelon, beet, hop, pumpkin, buckwheat, barley, oregano, cucumber, common wheat, durum wheat, triticale, thyme, tobacco, vine, rye, oil plants and protected wild plants.

4.5 Regeneration and multiplication

Regeneration and multiplication of accessions maintained in the seed bank were made when seeds began to lose viability or the seed samples for distributions for a given accessions were exhausted. Methodology of seed regeneration and multiplication followed standard protocol for a given species. Field collections of fruit plants require regeneration every few years. For example, field collection of hop is regenerated every 10–15 years, collection of potato *in vitro* collection,

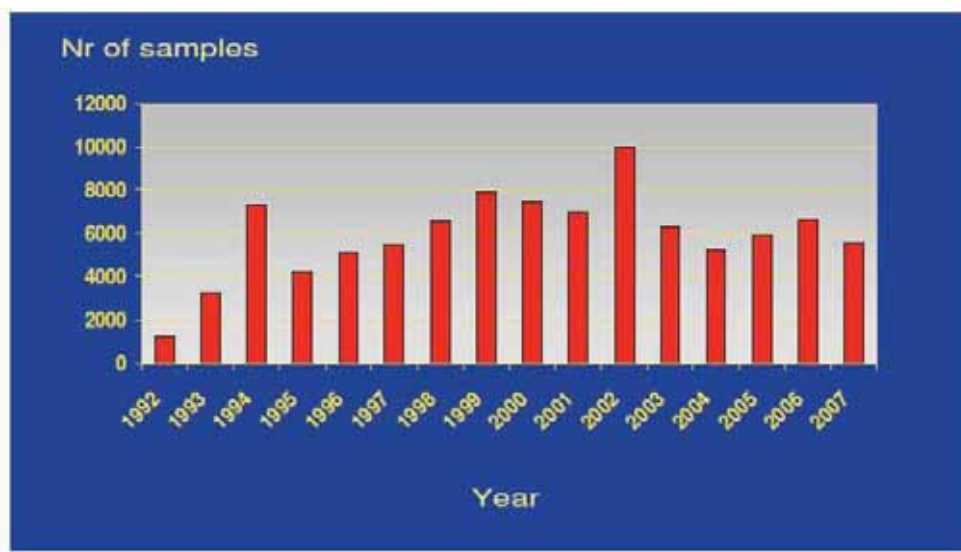
every 6 months, and vegetatively reproduced vegetables are regenerated every year (some Allium and Solanum) others in few year intervals (some Allium, Asparagus and Rheum).

4.6 Distribution of accessions

From 1 000 to 10 000 samples of all collected genetic resources were distributed annually since 1992. (Fig. 20). Between 50% and 70% of those samples were requested by the researchers, 5%-20% by the breeders, 5%-10% were sent to other gene banks. Samples of beet plants, vegetables and fruits were most often provided to individual farmers, gardeners, housekeepers and plant amateurs.

FIGURE 20

Annual distributions of samples



UTILIZATION OF GENETIC RESOURCES

5.1 The importance of utilization

Working on a narrow genetic base is a common strategy in plant breeding. Such strategy allows for the maintaining of epistatic effects of genes controlling yield and its stability as well as easy production of cultivar bundles, which are sufficiently different in morphology, yet similar in substantial virtues and faults. In such breeding, variation is generated mainly through recombination of a limited number of genes, and is occasionally supported by naturally occurring or artificially induced mutations. However, over a longer time span, the aforementioned strategies are not sufficient, nor successful, in breaking adverse correlations, the main constraint in the production of a more valuable cultivar.

Gene banks preserve thousands of genotypes that contain sufficient variation for continuation of the green revolution. The use of various genotypes will depend on the demand of breeders, who should ideally hold on to the optimal rates of gene flow from outside genetic material to their breeding populations.

The demand for the resources of other species, which are neglected and are used in breeding, depends also on the creativity of potential users. Supporting this creativity is crucial for increasing the number of species utilized in the course of development of new varieties.

5.2 Utilization activities

Utilization of plant genetic resources through wide crossing and breeding enhancement of their products in cereals, *Solanum*, *Lupinus*, *Allium*, *Brassica*, *Capsicum*, *Nicotiana*, *Gentiana*, *Rhododendron* has been carried out in agricultural universities and research institutes.

Recently, a new series of projects has been launched to fill the gap between biological science and breeding practice. Approximately 25% of these projects are concerned with the introduction of new variation to breeding materials. A majority of these projects operate within a species gene pool. However, some projects are oriented at alien gene transfer, and others concentrate on the resistance to a biotic stress.

Among 95 new Polish projects initiated in 2008, 23 are related to the identification and/or introduction of a new variation from multiple collections into breeding populations; 15 are oriented at phytopathology; and 7 on wide crossing. Table 7 demonstrates the inclusion of major agricultural crops in these projects and the allocated funds towards genetic resources components.

5.3 Major constraints to the use of genetic resources

The controlled utilization of genetic resources in breeding programmes remains a rather slow process, constrained by a variety of imperfect breeding procedures. They are caused, to some extent, by the nature of evolutionary processes in plant populations.

Polish breeding companies, although rich in tradition, skills and successes, are uncertain of the future. Recent adjustments of the national policy to implement E.U. standards created a critical situation in plant breeding, as an effective financing system was not established to replace previous state budget support. Creation of a market system to ensure profit from the released cultivars requires more time. In this situation, breeders are more likely to reject any activities which will not deliver new cultivars in relatively short period of time.

Breeders, expecting high quality enhanced materials, usually demand a back crossing series completed with certain desired characters separated from the negative side effects and correlations. Otherwise, they tend rather to reject the material than to continue its improvement and take a risk.

TABLE 7

Projects related to the utilization of genetic resources and their financing in 2008

	Crop	Number of projects				Funds in 2008, for the genetic resources component (PLN)
		Total number	Related to genetic resources			
			New variation	Phytopathology	Wide crossing	
1.	Wheat	16	7	6		1 175 000
2.	Barley	8	1	1		200 000
3.	Oat	8	3	2	2	220 000
4.	Triticale	13	4	3	1	330 000
5.	Rye	8	2	2		150 000
6.	Rape	11	2	1	2	180 000
7.	Maize	6	1	1		180 000
8.	Potato	10	2		2	850 000
9.	Beet	3				
10.	Grasses and legumes	7				
11.	Pulses	5	1	1		30 000
	Total	95	23	15	7	3 585 000

5.4 Assessment of needs to improve utilization

With the current situation, a stable system of financing support for breeding programmes remains the most essential factor in development and could trigger demands for new variation from gene banks. A stable financing system would further encourage breeders to take risks and engage in more difficult crosses between distant plant parents.

In Poland, awareness of breeders' rights to profits from their cultivars is far from adequate. In cereals, a major part of the seed market remains uncontrolled and does not bring money to breeders. The regulations imposed by the State are often ignored by illegal seed producers, and lack any serious risk of penalization. Therefore, the establishment of an effective persecution system and control of the seed market remains a fundamental factor for creating demand for genetic resources.

Breeders tend to underestimate the value of genetic resources and limit its role to a few characters, or genes, most frequently related to resistance to diseases or pests. More often than not, breeders maintain high level of epistasis in their isolated populations and reluctantly accept more genetically distant accessions from gene bank collections. For this reason, raising awareness among breeders is an essential factor for the broader use of genetic resources and institutions in direct cooperation with breeders should implement awareness campaigns. Fine tuning of the characterization and evaluation of the collections conveyed to the breeders would additionally contribute to the efficient use of germplasm reserves.



THE REGIONAL AND INTERNATIONAL COLLABORATION

6.1 The European Cooperative Programme for Plant Genetic Resources

Poland is a member of the European Cooperative Programme for Plant Genetic Resources (ECPGR). The Programme involves most European countries and is aimed at facilitating long-term conservation on a cooperative basis as well as increasing the utilization of plant genetic resources in Europe. It operates through broadly focused networks dealing with groups of crops or general themes related to plant genetic resources. Polish representatives are nominated for most of Working Groups and they are actively involved in their work. Out of 60 European central databases, *Secale*, *Dactylis*, *Festuca* and *Lupinus* are maintained by Polish institutions. Poland was also involved in the development of AEGIS (An European Genebank Integrated System for plant genetic resources for food and agriculture) and participated in the elaboration of operational considerations for *Avena* as one of model crops for AEGIS.

6.2 Council Regulation 870/2004

The Second European Community regulation on agricultural genetic resource (EC NO 870/2004) established the Community programme on the conservation, characterization, collection and utilization of genetic resources in agriculture in 2004. Ten projects related to plant genetic resources were co-funded. Poland participates in two of the ten projects—*Allium* and *Avena* (“Vegetative *Allium*, Europe’s Core Collection, safe and sound” and “*Avena* Genetic Resources for Quality in Human Consumption”).

6.3 EC Framework Fifth Programme for Research

From 2003 to 2005, Poland participated in the PGR Forum (European Crop Wild Relatives Diversity Assessment and Conservation Forum) project. The objective of this project involved the assessment of taxonomic and genetic diversity of European crop wild relatives and the development of appropriate conservation methodologies through a series of five workshops. The project brought together 23 partners from 21 countries: Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Romania, Russia and the United Kingdom, with the addition of partners representing IUCN – The World Conservation Union and the International Plant Genetic Resources Institute (IPGRI). Advisory and stakeholder panels provided additional input and feedback on project activities and deliverables. PGR Forum has created an information system providing access to European crop wild relatives data.

6.4 International agreements

Poland, as a member of the UN Food and Agriculture Organization and the Commission of Plant Genetic Resources for Food and Agriculture, participated in the negotiations of the International Treaty on Plant Genetic Resources for Food and Agriculture and further contributes to the general work of the Commission. It is a member of the Intergovernmental Technical Working Group for Plant Genetic Resources of the aforementioned Commission and chaired the last meeting of this group in October 2005.

On October 15, 2004, Poland ratified the International Treaty for Plant Genetic Resources for Food and Agriculture which was enforced on May 8, 2005. Poland is supportive of the treaty's objectives and is committed to the implementation of the legal framework for the conservation of genetic resources. The main pillar of the treaty, the Multilateral System of Access and Benefit Sharing (MLS) refers to selected crops contained in Annex 1 of the treaty. Poland is currently in the process of designating the genetic resource material to the MLS and implementing the Standard Material Transfer Agreement.



