

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

ESTONIA



Note by FAO

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EXECUTIVE SUMMARY

Systematic approach towards the *ex situ* preservation of plant genetic resources in Estonia was undertaken in the frame of collaborative Nordic-Baltic project “Conservation of plant genetic resources in the Baltic States” in 1994-1999. This conceptual project was initiated by the Nordic Gene Bank.

The Nordic Council of Ministers allocated appropriate funds to ensure accomplishment of tasks and to support active involvement of all counterparts into project.

Establishment of common Nordic-Baltic Working Groups of cereals, forage grasses, legumes, medicinal and aromatic plants, fruits, berries, potatoes and vegetables enabled participation of plant breeders and researchers of Baltic countries in the project.

The Nordic-Baltic initiatives created prerequisites for establishment of national network of collections of seeds, fruit trees and berries, expansion of *in vitro* preservation and active involvement of botanical gardens into preservation of plant genetic resources in Estonia.

To improve coordination of activities of different organisations involved into preservation of plant genetic resources the Estonian National Council on Plant Genetic Resources for Food and Agriculture was founded in 1997.

Estonia became a full member of the European Cooperative Programme for Plant Genetic Resources (ECPGR) in 1998.

The Genebank of Jõgeva Plant Breeding Institute was founded in 1999. A considerable impact on establishment of genebank had the Nordic-Baltic project allocating the financial support of the Nordic Council of Ministers for purchase of specific equipment for genebank. Status of the National Genebank on *ex situ* preservation was granted to the genebank by the Minister of Agriculture of Estonia in 2002.

The most important documents implementing activities on plant genetic resources are listed below:

- 2000: Memorandum of Understanding “Conservation of the safety duplicates of the Estonian *ex situ* genebank at the Nordic Genebank” was signed
- 2002: Estonian Government approved the National Programme “Collection and Conservation of Plant Genetic Resources for Food and Agriculture 2002-2006” and provided appropriate funding
- 2002: Memorandum on cooperation of the NGB, Estonian, Latvian and Lithuanian genebanks and Vavilov Institute
- 2002: Memorandum of Understanding regarding collaboration on the development of a European Plant Genetic Resources Search Catalogue (EURISCO)
- 2004: Accession of the International Treaty on Plant Genetic Resources for Food and Agriculture by Estonia
- 2007: Follow up National Programme “Conservation and Utilization of Plant Genetic Resources for Food and Agriculture 2007-2013” was approved by the Ministry of Agriculture
- 2009: Upgrading of the Memorandum of Understanding on Cooperation for Preservation and Utilisation of Plant Genetic Resources for Food and Agriculture - N.I. Vavilov Research Institute of Plant Industry (Russia), the Committee on Plant Genetic Resources for Food and Agriculture (Estonia), the Genetic Resource Centre (Latvia), the Plant Genebank (Lithuania) and the Nordic Genetic Resource Centre
- 2009: Estonia signed the Memorandum of Understanding for the establishment of a European Genebank Integrated System (AEGIS)

A well-structured national network for conservation of plant genetic resources for food and agriculture has been established in Estonia during the last decade.

The network activities are governed by the National Council on Plant Genetic Resources for Food and Agriculture under the auspices of Ministry of Agriculture.

The main goals and tasks are defined in National Programmes „Collection and Conservation of Plant Genetic Resources for Food and Agriculture 2002-2006” and “Conservation and Utilization of Plant Genetic Resources for Food and Agriculture 2007-2013”.

Information on plant genetic resources is maintained in common on-line database SESTO, which is supported by NordGen.

Estonia has deposited instrument of accession to the International Treaty on Plant Genetic Resources for Food and Agriculture.

Essential international activities are participation in European Cooperative Programme for Plant Genetic Resources and in implementation of An European Genebank Integrated System.

Estonian plant genetic resources network has been remarkably improved because of effective measures of ECPGR. Participation in the Nordic-Baltic cooperation ensures preservation and utilisation of plant genetic resources on the regional level. Purposeful and beneficial cooperation has been with the Latvian and Lithuanian genebanks.

Further participation in international cooperation is highly prioritized activity to ensure consistent enhancement of genebanks and versatile development of local networks.

Characterisation and evaluation of accessions is a main task for genebanks and shall result in further utilisation of collections.

Establishment the Garden of Medicinal and Aromatic Plants is a priority of Botanical Garden of the University of Tartu.

Conservation on plant genetic resources in protected areas, *in situ* conservation, management of ecosystems and on-farm management are the objectives which require serious consideration by the relevant stakeholders.

New conservation methods e.g. cryopreservation, DNA conservation of unique accessions shall be adapted. Collaboration with Latvian Genetic Resource Centre on fingerprinting of the germplasm of Estonian origin shall be initiated.



AN INTRODUCTION TO THE COUNTRY AND THE AGRICULTURAL SECTOR

The Republic of Estonia is located between the 57th and 60th latitudes and the 22nd and 28th longitudes. Estonia shares a common sea and land border with the Republic of Latvia and the Russian Federation (the latter is also the border of the EU) and a sea border with the Republic of Finland and the Kingdom of Sweden. Estonia stretches 240 km from north to south and 350 km from East to West.

The total area of Estonia is 45 227 km², including 43 200 km² of land area. More than a half of the land area is forest land, one third is agricultural land, and one fifth is covered by mires and bogs.

According to the Territory of Estonia Administrative Division Act, the territory of Estonia is divided into counties, rural municipalities and cities. A rural municipality, which is a unit of local government, is divided into settlements, which are villages, small towns, towns and cities without municipal status. According to governmental decree on types, names and division of administrative units, normally, administrative unit with less than 300 inhabitants is considered to be a village, with more than 300 inhabitants a small town and with more than 1 000 inhabitants a town or city without municipal status. The territory of rural municipalities is regarded as rural area. There are 15 counties and 227 local governments (33 cities and 194 rural municipalities) in Estonia.

1. Definition of rural area

The OECD definition distinguishes between two hierarchy levels – local and regional. At local level (LAU1/2), the OECD defines rural communities as communities with population density of less than 150 inhabitants/ km² (*Working Party...2004*).

Regarding counties, whole Estonia can be regarded as rural area, as even in Harju county with Tallinn, population density is 120,5 inhabitants/km². There is one rural municipality in Estonia with 6 towns and 5 cities with population density of more than 150 inhabitants/km², the total number of inhabitants is 22 275 there (5% of rural inhabitants, 1.6% of Estonian population).

According to the above methods, there are 11 predominantly rural (*PR*) counties in Estonia, where more than 50% of inhabitants live in rural municipalities. There are 260 321 inhabitants in the rural municipalities of those counties, which makes up 57.4% of rural inhabitants and 19,2% of Estonian population.

As the population density of most cities and towns under rural municipalities is less than 150 inhabitants/ km², the OECD methods do not reflect properly the definition of Estonian rural area. Therefore, for Estonia it is rational to use in the future the methods already introduced and used by Statistics Estonia, according to which residents of rural municipalities can be regarded as rural population. According to the data provided by Statistics Estonia, as of 1 January 2006, there were 447 663 residents in rural municipalities (33.3% of Estonian population). The average population density of rural municipalities was 10.6 inhabitants/ km². In addition, in case of Leader, small cities with a certain size of population (up to 4 000) have been considered to be rural area.

2. Population

The population of Estonia has decreased fast since the restoration of independence. This was mainly caused by emigration during the first years of the restored independence and by negative birth rate afterwards.

Decrease in the size of Estonian population has been slowing down in recent years. As of 1 January 2001, there were 1 367 000 inhabitants in Estonia. At the beginning of 2006, the respective figure was 1 344 700 (average annual decrease 0.33%). According to estimates, as of 1 January 2007, there were 1 342 409 inhabitants in Estonia. The share of women in Estonian population is 53.9%, in rural municipalities 51.7%.



The change in the age composition of the population is characterised by a decrease in the share of young people and by an increase in the share of older people. At the beginning of 2006, the share of people aged up to 15 years was 15.1% of the total population (in 2000, 18.3%) and the share of people aged 65 and older was 20.9% (in 2000, 15%). Throughout Estonia, the share of people of working age increased since 2003 by 0.7% and reached 68.2% by the beginning of 2006. Decreased mortality (longer expected age) has contributed to this.

The share of rural population has become more stable in the last years – in 2001 and 2002 32,6% and in 2003–2006 33,3–33,4% of total population. According to the data provided by Statistics Estonia, in 1989, there were 446 800 inhabitants in rural area, in 1999 – 437 566, and at the beginning of 2006 – 447 663. Positive population dynamics directly results from the movement of Tallinn and Tartu inhabitants to suburban areas, retaining close contacts (job, school, service) with the city.

In 2001, rural municipality population decreased by 0.56%, increased by 2,3% in 2002 and decreased in 2003 and 2004 by 0,46% and 0,31% respectively. Compared to the beginning of 2000, the population of rural municipalities has remained almost constant.

According to the data of the EUROSTAT for year 2003, 88.4% of all the people employed in Estonia were employed in rural area (using the OECD method).

According to the data of the Estonian labour force survey for 2003, there were 167 900 employed people in rural area, i.e. 28,3% of all employed people of Estonia.

3. Rural enterprise

The development of rural area is mostly influenced by low population concentration and persistent decrease in the share of agriculture in enterprise. By now, the share of agriculture in the structure of rural enterprise has decreased to approximately 50%. More machine power is used in agriculture, therefore many people have had to find occupation elsewhere. At the same time, the jobs created in the secondary and tertiary sectors have compensated for less than one third (28,9%). Therefore, in the rural areas, employment rate is lower than in cities and the number of employed has also decreased. Of statistical indicators, only falling unemployment rate is positive (7,0%) in rural area. At the same time, the small number of suitable jobs and unemployment are problems in rural area.

32% of the rural enterprises outside the primary sector are active in wholesale and retail trade and the repair of motor vehicles and household appliances. A half of the enterprises are active in the following fields: processing industry (17%), real estate, rental and business activities (14%), transport, storage and communication (11%) and fishing (8%). Construction and hotel services are each making up 6%, other community, social and personal services and health and social care make up 2% each, and the shares of power, gas and water supply and mining industry are both 1%. All the other fields of activity, i.e. financial intermediation, education, public administration and national defence, obligatory social insurance, and activities of households with paid labour are represented by approximately 0%.

The survey "Need for support in the sector of rural enterprise" indicated that micro-enterprises have the biggest potential for the creation of suitable jobs as 7,9% of micro-enterprises have become small scale enterprises. A bigger part of small scale enterprises (17,9%) have reduced the number of jobs and only 3,9% of those enterprises have moved on to the next size group. Of medium-sized enterprises, 19,9% have fallen to the level of a small scale enterprise as for the number of employees.

Considering the low competitiveness of agricultural producers and lack of enterprise promotion plans, the existence of ancillary activities, which enable to manage risk, to earn additional income and to move over into another field of activity, if necessary, is important. Of the approximately 37 000 agricultural holdings, 2 746 holdings receive income from non-agricultural activities. They make up 7,5% of all agricultural holdings. The EU-25 respective indicator is about 10 percentage points higher (17%). Therefore, it is important to give more attention to the diversification of agricultural holdings, particularly in less-favoured areas. As 82,7% of people are employed in secondary and tertiary sectors in rural area (92,4% throughout Estonia, 94,9% in EU-25), those sectors have the biggest potential as regards the creation of new jobs. By the promotion of tertiary sector it is possible to alleviate the problem of the outflow of services from rural areas. At present, 66% of value added is already created in services sector.

Due to the changes, which have taken place in agriculture within the last decades, there are many buildings in rural area, which are unoccupied, undercharged and without purpose. To save resources, it would be important to find those buildings a new function either in production and services or as residential buildings. In particular, this provides an opportunity to find a solution to the scarcity of jobs caused by low density area, concentrating on traditional village structure and promoting settling down in the country. Modernisation of those buildings and finding new purpose and

additional functions for their use create an opportunity for the improvement of the quality of life and help to increase the competitiveness of rural undertakings in the recruitment of new employees.

On the opinion of entrepreneurs, lack of qualified labour impedes employment most of all. If employees are ready to move away from their home regions in order to find (better) employment, then it is difficult to find employees locally. At the same time, it becomes necessary to offer additional labour force living space in the region. Another problem that the entrepreneurs are facing is the payment of the salary level demanded. Seasonality is the problem of the companies related to construction, accommodation catering and carriage of goods.

One of the important hindrances to development is weak investment capacity. Many non-agricultural fields of activity are not supported. Many entrepreneurs expect the state or a local government to deal more actively with rural labour force matters. The state or a local government should help to keep young people in the country or to invite young specialists from elsewhere; support employed people in getting a place of residence; help organise the transport of employed people; create opportunities for in-service training, etc. In a situation with a background of competing jobs in cities and abroad, the lack of skilled employees and recently also the lack of unskilled workers is a problem in all regions. Thus, expenses for motivating the staff are very much needed.

The decrease in younger generation is also a serious problem. Presently, a half of the rural entrepreneurs are middle-aged. Therefore, it is important to implement measures for ensuring management potential in rural area.

The survey "Preferences of the consumers of rural tourism products and services and needs of rural tourism entrepreneurs" indicates that tourism is rather seasonal in Estonia – the average annual fill of accommodation establishments is 32,2%. In the peak-season, the average fill is 46,1%, and in the off-season it is 12,7%. Many rural accommodation and other tourism establishments are providing products and services, which introduce the local natural and cultural heritage. Utilisation of the tourism potential of cultural heritage can contribute to the diversification of enterprise and to the creation of non-agricultural jobs in rural area.

4. Land improvement

The purposeful use of more than a half of agricultural land and of about a half of forest land is only possible ensuring the proper functioning of land improvement systems on those lands. 420 000 ha or about a half of the Estonian usable agricultural area have been drained, in forest land, there are drainage networks on 600 000 ha. About 400 000 ha of forest (mostly private forest) still suffer from over moisture. Compared to temperately humid soils, the cultivation value of soil on aforementioned lands is lower and its usability more limited. With land improvement, the risk of crop failure is avoided in the areas with the soil hydrological regime unfavourable for plant growth, prerequisites are created for the purposeful use of profit-yielding land and production conditions on agricultural and private forest land are unified, compared to temperately humid areas.

5. Agricultural production

Agriculture is the sector of the economy, which has undergone the deepest changes during the transition period. Regardless of the decreased share of agriculture in Estonian economy, its significant role in supplying rural population with food, in rural enterprise and in shaping cultural landscape has survived.

For nine successive years (1994–2002), value added of agriculture and hunting at constant prices decreased by 5% a year on an average. Only in 2003 and 2004, value added in the sectors mentioned started to increase, by 2,0% and 6,2% respectively. In 2005, this number decreased by 0,2% again, compared to the previous year. Negative real growth of value added in agriculture has also influenced the share of agriculture and hunting in overall value added of areas of activity. If in 1997, agriculture made up about 3,9% of the total value added of Estonia, by 2005, it had decreased to 2,4%.

If in 1997, value added produced per person engaged in agriculture was about 27% lower than in overall economy, in 2005, value added per person engaged in agriculture was already about 54% lower than in overall economy.

According to the data of the structure survey made in 2005, there are 27 747 agricultural holdings in Estonia. The share of agricultural holdings smaller than 2 European Size Units (ESU) is relatively big in Estonia (about 75,8% of holdings). If the agricultural holdings who have applied for the Single Area Payment for agricultural production or landscape maintenance are regarded as active agricultural holdings, there are about 19 000 applicants for the SAPS in Estonia. At the same time, we have to consider that according to the FADN database we only have about 7 000 professional commercial enterprises, which receive most of their income from agricultural production (bigger than 2 ESU).



More than a half of agricultural producers (64,1%) belong to the size group of 2–6 ESU, in case of which it can be presumed that their estimated return on sales will be less than 200 000 EEK a year. Adding the size group of 6–25 ESU (whose estimated return on sales can be about 200 000–1 000 000 EEK a year), we shall find that the return on sales of 88,6% of Estonian agricultural producers is not bigger than 1 million EEK. At the same time, the total revenue of those two size groups makes up 28,3% of the standard gross margin of Estonian sector of agriculture, they use 36,1% of agricultural land and 43,8% of labour in annual work units. 10,4% of agricultural producers belong to the size group of 25–250 ESU (the producers with the return on sales of 1–10 million EEK), but they produce 43,7% of standard gross margin and use 45,4% of agricultural land and 30,6% of labour in annual work units. Somewhat more than 1,0% of agricultural producers belong to the size group of over 250 ESU, but they produce 28,0% of standard gross margin and use 18,5% of utilized agricultural land and 25,6% of labour in annual work units.

According to preliminary information, the output of the agricultural industry, including refunds, was BEEK 8.0, of which 6.5% (MEEK 528.3) were product refunds for crop and livestock farming. The value of the output decreased by 2% in base prices and 4.5% in producer prices compared to the previous year. The difference is due to the fact that output in base prices includes production related refunds (complementary national direct payments for field crops, suckle cows, bovine animals and ewes), which increased by 56.1% in 2006. The volume of total output decreased by 6.3% and prices rose by 1.9% on the average.

According to preliminary estimations for 2006, crop production and livestock production formed 34.6% and 53.7%, respectively, of the total agricultural output in terms of value, that is 2.3 percentage points less and 2.1 percentage points more, respectively, than last year. Agricultural services formed 2.2% of the output of the agricultural industry and inseparable non-agricultural secondary activities formed 9.4%.

6. Number of animals and poultry

According to the Estonian Statistical Office's preliminary data, and the Ministry of Agriculture's estimates, the number of bovine animals, including dairy cows, pigs, and poultry decreased in 2006. As of 31 December 2006, there were 245 000 bovine animals, including 108 900 dairy cows; 341 200 pigs, 61 500 sheep and goats, and 1 592 200 poultry in Estonia. Compared to 2005, the number of bovine animals had decreased by 2%, dairy cows 3%, pigs 2%, and poultry 15%; the number of sheep and goats had increased by 17%.

7. Growing areas and yields of agricultural crops

According to the Estonian Statistical Office, the growing area of field crops was 529 400 ha in 2006, which is 31 300 ha or 6% less than in 2005. Cereals were grown on 273 900 ha or 51.7% of the total growing area, fodder crops on 32.5%, industrial crops on 11.8%, and potatoes, legumes, and other crops on 4% of the total growing area.

8. Cereal cultivation

Cereals were grown on 273 900 ha in 2006, which is 8 200 ha or 3% less than in 2005. Summer cereals were grown on 240 500 ha or 87.8% and winter cereals were grown on 33 400 ha or 12.2% of the total growing area.

The growing area of rye was only 7 300 ha; the growing area of barley was the largest – 137 600 ha. The growing area of summer wheat has increased in recent years: 55 200 ha in 2004, 65 800 ha in 2005, and 66 300 ha in 2006.

The total harvest of cereals was 605 500 ha; the average yield was 2211 kg per hectare of growing area. The total harvest of cereals decreased by 154 600 t or 20% compared to 2005, and the yield decreased by 483 kg/ha or 18%.

Winter wheat had the highest yields – 2 796 kg/ha, and buckwheat yielded the least – 645 kg/ha. The rye yield was 2 454 kg/ha and the total harvest was 17 900 t. Estonia's annual food rye need is 40 000–42 000 t. Considering that a part (up to 50%; exceptionally only 5% in 2006) of the rye produced every year does not meet the quality requirements for food rye, the annual rye production should reach at least 75 000–80 000 t. Rye falling short of the quality requirements for food rye is bought in by distillers.

According to the ARIB, there were 6 790 cereal farmers in 2006, including 580 rye farmers.

Rye farmers broken down by rye growing area are as follows: 324 producers with 0.1–3 ha, 88 producers with 10.01–50 ha, 130 producers with 3.01–10 ha, and 27 producers with 50.01–100 ha. Only 11 farmers grew rye on 100 ha or more and one farmer grew rye on 560 ha.

Farmers growing rye on small areas do so in order to prevent fields from being subjected to the intensive weed invasion common for shorter cereals. Rye is also sown for green fallow, so as to destroy weeds, particularly wild oats, and to enrich the soil with organic matter.

There are only a few rye farmers who sell food rye to the milling industry. Few farmers are able to sell to the industry food rye obtained from small growing areas, as experience shows that the industry wishes to buy larger lots of homogeneous quality.

9. Cereal production

Owing to varying growing areas and yields, cereal production in Estonia ranged from 400 000 t to 700 000 t from 1996–2006. The only exception was the year 2005, when 760 000 t of cereals were harvested. The growing area was mainly influenced by demand; yield was influenced by weather, and the development of agricultural technology. The substantial decrease in the growing area of cereals occurred after the year 2000. The growing areas of cereals have decreased from over 300 000 ha before 2000 to 250 000–280 000 ha after 2000. Cereal yields increased after 2003. Increased use of plant protection products, as well as increased investments in production and harvesting technology, have contributed to the higher yields.

10. Legumes cultivation

The growing area of legumes was 4 400 ha in 2006, i.e. the same as in 2005. The total harvest was 5 400 t and the average yield was 1 227 kg/ha. Over the past two years, consumption has broken down as follows: 18–25% for human consumption, 45–54% for animal feed, and 24–29% for seed. The share of own produced legume species used for animal feed may be assumed to increase and the growing area of legumes to somewhat extend in the forthcoming years in order to satisfy the protein need.

11. Rape cultivation

The growing area of rape was 61 800 ha in 2006, which is 15 200 ha or 33% more than in 2005. Rape yields were low due to the summer drought, only 1 352 kg/ha, but since the growing area of rape increased significantly, the total harvest of 83 500 t was on the same level as in 2005.

12. Production of cereal products

According to the Statistical Office, Estonia's total output of cereal products was 311 300 t in 2006, which is 1.3% more than in 2005. 66 600 t of cereal flour was produced, which is 6.1% more than in 2005. The output of milling industry products other than flour increased 10.3%, that of flour confectionery 1.3%, and that of bakery products 1%. Only the production of compound feedings tuffs decreased (4.3%).

13. Trade

Cereals were imported in 2006 for MEEK 95.9. The volume of imported cereals and cereal-based products was 112 300 t (in grain equivalents), which is 1.2 times (17 500 t) less than in the same period during the previous year. The import of cereals (as grain) formed 25% of this (28 000 t).

The relative share of cereals in the import of cereals and cereal-based produces has decreased 8.6%. The bulk of imported cereals (99%) came from EU Member States. Wheat had the largest share – 38% (42 700 t) of imported cereals, followed by barley – 31.3% (35 100 t) and maize – 15.3% (17 200 t).

42 700 t of wheat and wheat products (in grain equivalents) were imported into Estonia in 2006. Wheat (as grain) accounted for 14.2% (6 000 t) of the total import of wheat and wheat products. Out of the wheat and wheat products imported to Estonia in 2006, 82% came from Latvia and 12% from Germany.



The import of rye and rye products (in grain equivalents) amounted to 12 100 t in 2006. The import of rye (as grain) decreased 34% (6 200 t) compared to the same period last year. Rye (as grain) accounted for the bulk (88.5%) of the import of rye and rye products (in grain equivalents). Most of the rye and rye products were imported from Latvia (96.3%), and to a lesser degree from Lithuania (3.7%).

35 100 t of barley and barley products (in grain equivalents) were imported into Estonia in 2006. Most of it was processed barley products. Only 4 t of barley was imported as grain. The import of barley and barley products (in grain equivalents) was 31 200 t in the same period of the previous year, that is 12.5% (3 900 t) less than this year. Barley and barley products were imported mainly from Sweden (54.1%), Lithuania (29.7%), and Germany (16.2%).

Oats and oat products (in grain equivalents) were imported to Estonia in a volume of 3 300 t in 2006, which is 17.1% (483 t) more than at the same time last year. Oats as grain formed 22.6% of the total imported oats and oat products. Oats and oat products were mainly imported from Latvia (77.2%), Finland (21.1%), and Lithuania (1.6%).

17 200 t of maize and maize products (in grain equivalents) were imported into Estonia in 2006. Compared to the same period last year, the import of maize and maize products (in grain equivalents) decreased 31.2% (7 800 t). Maize and maize products were mainly imported from Hungary (61.6%), Lithuania (29.7%), and Poland (8.3%).

The total import of cereals and cereal-based products (in grain equivalents) amounted to 184 300 t in 2006. Compared to the same period last year, the import of cereals and cereal products (in grain equivalents) increased 1.4 times (53 100 t). Cereals as grain formed 84% of total exports. 71.7% of cereals exported as grain and 84.6% of first degree processed products were of Estonian origin. 127 500 t (69.1%) of the overall quantity of exported cereals and cereal products were exported to EU Member States.

47 400 t of wheat and wheat products (in grain equivalents) were exported from Estonia in 2006. 54.8% of this was wheat exported as grain. The export of wheat and wheat products (in grain equivalents) has decreased 1.1 times (2 400 t) compared to last year. The main destinations were the Netherlands (86.4%) and Sweden (12.3%).

The export of rye and rye products (in grain equivalents) from Estonia amounted to 3 600 t in 2006, which is 1.5 times (1 300 t) more than at the same time last year. 1 500 t of rye was exported as grain. No rye was exported as grain during the same period last year. Rye and rye products were exported to Latvia (100%).

The export of barley and barley products (in grain equivalents) from Estonia amounted to 106 800 t in 2006, which is 1.8 times (49 900 t) more than at the same time last year. 104 500 t of barley was exported as grain. The main destinations for barley and barley products were Saudi Arabia (47.4%), the Netherlands (26.7%), and Germany (25.1%).

Oats and oat products (in grain equivalents) were exported from Estonia in 2006 in the amount of 25 300 t, of which 90.2% (22 900 t) was oats exported as grain. Compared to the same period last year, the export of oats and oat products (in grain equivalents) increased 1.4 times (7 700 t).

14. Food security and trends

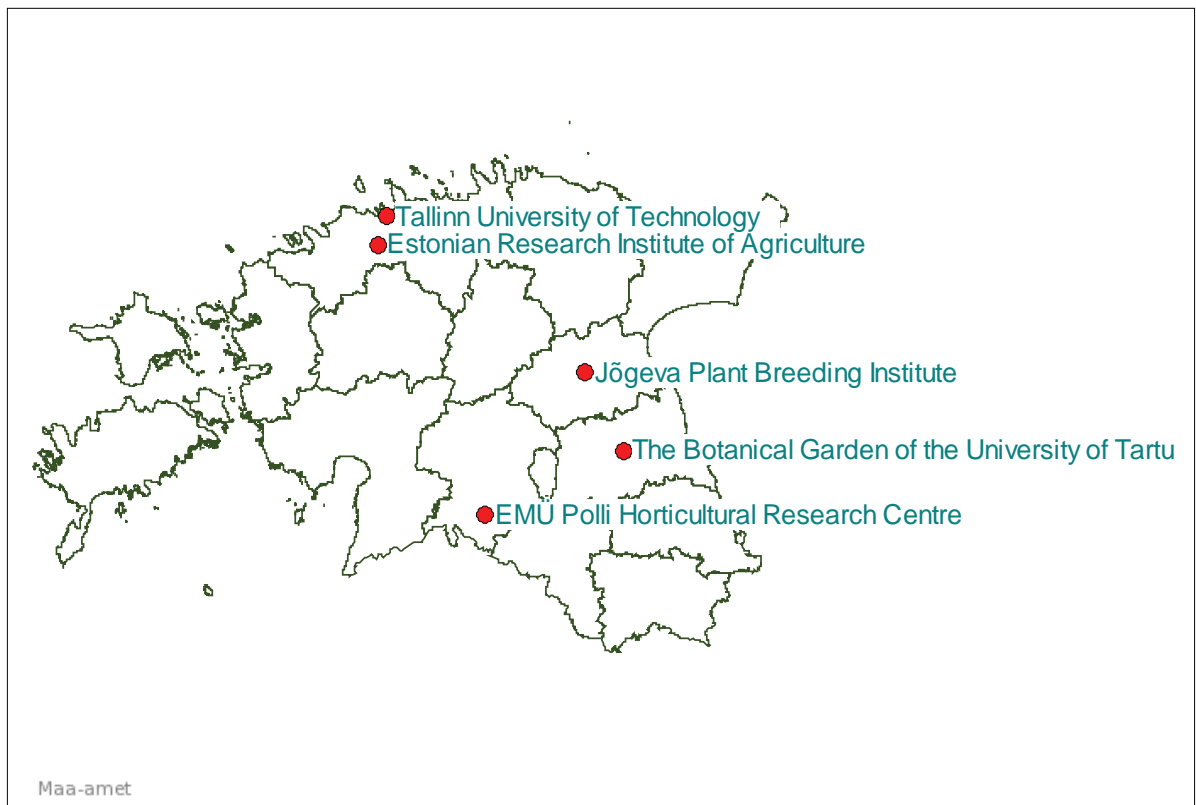
Estonia expressed its wish to join the scheme for the first time in 2006 and for the distribution year 2007, about 324 000 Euros were allocated for Estonia to implement the food aid scheme. This sum comprised of 3 000 tons of intervention grain and support for buying 2 tons of skimmed milk powder and 3 tons of rice from the market + 1% administrative expenses and 4% transport expenses. The Agricultural Registers and Information Board (ARIB) announced public procurements to find the cheapest industry, tenders for skimmed milk powder and rice were not successful, since the amounts were small and they did not attract interest. OÜ Malsena won the tender for the making of macaronis, where 505 tons of macaronis were produced from 2 012 tons of intervention grain (793 tons of these were located in the Estonian intervention warehouses and the rest in Finland). Three charity organizations participated in the 2007 programme (the biggest of these was the Red Cross), who had macaronis transported to their chosen locations.

192 388 Euros were allocated for Estonia for 2008. Through charity organizations, 94 tons of wheat flour and 185 tons of macaronis will be given to deprived persons in 2008, averagely, 4 kg of flour and 7 kg of macaronis is given per every person in need. Such charity organizations as the Estonian Red Cross, Rapla Free Congregation and Dharma Charity Centre were engaged in the distribution of flour and macaronis.

Based on the applications of charity organizations, the amounts needed for 2009 were determined, which were totalized by ARIB. Necessary amounts are the following: 264 tons of macaronis, 146 tons of wheat flour, 136 tons of grain flakes, 125 kg of semolina and 105 kg of crisp bread. The applicants were the Estonian Red Cross, Rapla Free Congregation and the Christian home Petruša. The draft legislation is currently under discussion at the S CMO committee (Joint Committee for Market Organization), according to the draft legislation, Estonia is given 320 646 Euros to buy the named products from the market, since intervention warehouses are empty.

The biggest engaged charity organization in Estonia has been the Red Cross. Their representative has always participated at food aid related discussions in Brussels. The position of the Red Cross that has been presented to the Commission is the following: „The situation in Estonia is not critical, there is no real starvation, but there are people, who are living in difficulty. The programme demands tight cooperation between local governments, ARIB and the Ministry of Agriculture. In 2007, the Red Cross distributed macaronis to more than 35 000 people in need. Feedback from them has mostly been positive.“

FIGURE 1

Institutes involved in PGRFA activities in Estonia

THE STATE OF *IN SITU* MANAGEMENT

A total of 17.9% of Estonia's territory is under protection (18.9% including Lake Peipsi and Võrtsjärv). In Estonia not only wild nature is protected, protected areas include also semi-natural communities and farmlands. Protected farmlands are most common in landscape protection areas. Maintaining and restoration of traditional semi-natural communities (for example grazed coastal meadows with important plant communities) are supported by payment of subsidies since 2001. In years 2003-2006 government has allocated yearly 18.2 to 30.1 million Estonian kroons for these subsidies. Recovery from damage caused by certain species under protection are also practiced, for example damage to crops by migrating cranes, geese and Brent geese and expenses made on measures taken to prevent such damage are partly compensated.

In Estonia 570 species are under protection (64 of them fall into the first or the most strict protection category). Although Estonian nature has no wild ancestors of crops species, there has been tradition of foraging (mainly mushroom and wild berry picking). Several species of edible mushrooms are protected and edible plant Ramsons (*Allium ursinum*) is also protected, but this species is grown in small scale in private gardens.

Semi-natural habitats or traditional biotopes (wooded meadows, wooded pastures, coastal meadows, flooded meadows, paludified and fen meadows, alvars, juniper thickets, heaths and grasslands on mineral soil) are the natural habitats transformed by people and standing like this thanks to moderate human influence, in particular to mowing and grazing. Upon the cessation of human influence, traditional biotopes tend to turn into natural habitats again in the course of long-time natural change. In addition to high aesthetic value, the semi-natural habitats of Estonia have one of the most diverse flora and fauna in the world when compared to other regions north of the 57th parallel.

Transition to large-scale production, discarding of traditional management methods, and leaving the lands of lower productivity out of use has significantly decreased the total area of semi-natural habitats in Estonia during the last half a century.

Protection of semi-natural habitats is regulated by several conventions – Estonia has joined the Biodiversity Convention, the Bern Convention and the Ramsar Convention and is about to join the Bonn Convention and the related AEWA Agreement.

For the preservation, incl. restoration and maintenance, of semi-natural habitats being a part of a protected area, a special conservation area or a species protection site, nature conservation payments administered by the Ministry of the Environment have been paid in Estonia since 2001.

Natura 2000 support for agricultural land has been implemented from the year 2006 from the Estonian Rural Development Programme 2004-2006 and 2007-2013.

The overall objective of Natura 2000 support for agricultural land is to ensure conformity with nature protection requirements in Natura 2000 network areas, to maintain agricultural activity in those areas and to contribute to coping with handicaps, resulting from the implementation of Council Directive 79/409/EEC on the conservation of wild birds and Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, in order to ensure the efficient management of Natura 2000 areas. There are approximately 55 000 ha of agricultural lands in Natura 2000 area in Estonia. For the assurance of the favourable nature conservation condition of the Natura 2000 area habitat types and species referred to in the birds and the habitats directive, those areas have been placed under national protection. Protected areas and special conservation areas are placed under protection with a Government regulation and species protection sites with a regulation of the minister of the environment. In Estonia, Natura 2000 network areas were approved by Order of the Government of the Republic of Estonia, according to which there are 66 species protected areas (SPAs) and 509 pSCIs in Estonia.

In 2005, 17 500 ha of semi-natural habitats were maintained and 1 900 ha were restored under the nature conservation support paid from the state budget.

Semi-natural habitats with high nature value outside of Natura 2000 areas will be supported in the current programming period after they have been precisely designated or included into Natura 2000 area.



THE STATE OF *EX SITU* MANAGEMENT

2.1 The state of collections

Systematic approach to ensure *ex situ* preservation of plant genetic resources in Estonia was undertaken in the frames of collaborative Nordic-Baltic PGR project in 1994-1999.

Nordic-Baltic initiatives supported formation of national PGR network aimed towards creation of collections of seeds, fruit trees and berries, expansion of *in vitro* preservation and involvement of botanical gardens into PGR activities in Estonia.

To improve coordination of activities of different organisations involved into preservation of plant genetic resources the Estonian National Council on Plant Genetic Resources for Food and Agriculture was founded in 1997.

The mandate of the Estonian institutions responsible for the plant genetic resources activities is collection, conservation, documentation, characterization and evaluation of PGRFA of Estonian origin.

There are following *ex situ* collections held in Estonia:

2.1.1 Genebank of the Jõgeva Plant Breeding Institute

The genebank of Jõgeva Plant Breeding Institute was founded in 1999. A considerable impact on establishment of genebank has had Nordic-Baltic PGR project allocating the financial support of the Nordic Council of Ministers for purchase of specific equipment for genebank.

Status of the National Genebank on *ex situ* preservation was granted to the genebank by the Minister of Agriculture of Estonia in 2002.

Genebank holds the long-term seed collection of cereals, forage grasses and legumes, oil crops and vegetables.

After the genebank was established, the initial material was obtained from breeders and other genebanks. Obsolete varieties of Estonian origin were repatriated from N.I. Vavilov Research Institute of Plant Industry (Russia), the Nordic Gene Bank, Leibniz Institute of Plant Genetic and Crop Plant Research (Germany) and the Centre of Genetic Resources of the Netherlands.

In addition to the material of Estonian origin, accessions of foreign origin adapted to local eco-climatic conditions and breeders' collections are conserved in the genebank.

Around 2 000 accessions of 57 species are stored in the genebank in 2009, half of which are of Estonian origin. The largest share of collection takes cereals (32%) followed by oil and fibre crops (18%), and then forage grasses and legumes (17%).

Safety duplicates of the most valuable accessions of Estonian origin are preserved at the Nordic Genetic Resource Center.

Collecting missions of forage grasses and legumes to Estonian natural and semi-natural grasslands have been organized within the framework of the Nordic-Baltic project and a National Programme since 1999.

Characterization and evaluation, as well as regeneration and multiplication are carried out in cooperation with the breeding departments of the Jõgeva Plant Breeding Institute.

2.1.2 Department of Plant Biotechnology EVIKA of the Estonian Research Institute of Agriculture

In the Department of Plant Biotechnology EVIKA of Estonian Research Institute of Agriculture we have collected and preserved potato and horticulture crops *in vitro* as a meristem plants more than 25 years. The priority of our gene bank activities is to preserve advanced cultivars, initial material for breeding, breeding lines and land races of Estonian origin as well as the most valuable accessions of foreign origin to provide easy access to the gene pool for plant breeders. At present *in vitro* gene bank there are 410 potato cultivars, breeding lines and land-races, and 865 potato meristem clones.

Gene bank also includes 34 plum, 21 sour cherry, 26 sweet cherry, 7 apple, 5 pear, 10 dwarf apple root-stock, 9 raspberry, 25 strawberry, 49 chrysanthemum, 52 carnation etc genotypes. There are 1 021 accessions from 16 species all together in the gene bank.

Our common activities are to collect material, to eradicate from different plant diseases, multiply and preserve *in vitro*, but also to evaluate and distribute most valuable accessions. The most important research areas are: study of different *in vitro* preservation methods and the influence of long-term preservation *in vitro* on the morphological characteristics and agronomical traits of varieties.

The plant material preserved *in vitro* could be used as initial material for breeding, research, for propagation of disease-free material for seed production and for establishment of field collections.

2.1.3 Polli Horticultural Research Centre of Estonian University of Life Sciences

The collections of fruit and berry cultivars date back to the beginning of the breeding work at the institute established at Polli in 1945.

Almost one thousand accessions have been planted into the field collections including registered varieties, landraces and some selections of 17 tree fruit and small fruit crops. The accessions include 370 apple, 80 pear, about 100 plum, 60 cherry, 55 strawberry, and 75 black currants. Among these there are 253 accessions of Estonian-origin including 43 apples, 7 pears, 23 plums, and 17 cherries.

The landraces of fruit trees have been collected from private gardens but not all of those accessions have been identified. The information about the landraces and old cultivars has been fragmented and based rather on personal communication than systematic approach. With a more systematic approach still more material could be collected and saved from erosion. Using molecular markers could be a valuable tool for identification of some unlabelled accessions and might reveal duplicates in the collections.

Besides Estonian cultivars the collections include foreign cultivars that were introduced for producing fruits, using in breeding programs as parents and for screening for prospective cultivars in both aspects. Polli Horticultural Research Centre is the only institution in Estonia, which is engaged in circumstantial investigation of fruit and small fruit cultivars. The repository has a common mission: to collect, maintain, distribute and evaluate genetic resources. The most important characteristics investigated are: resistance to frost and some economically important diseases, yield potential, blooming time, self-compatibility, ripening time, storage ability, attractiveness of fruits, their flavour and chemical composition, also plant size and growing habit. The collections are being used for both research and teaching purposes.

2.1.4 Botanical Garden of the University of Tartu

The main tasks of botanical garden within the conservation activities of plant genetic resources for food and agriculture is to find out, collect and conserve local cultivars and species of medical and aromatic plants and ornamentals. In total 390 taxons (50 species and 340 varieties) are included to the collection.

In addition, botanical garden is responsible for the coordination of activities with private collectors and breeders. Information about 300 varieties of Estonian origin from private collections is included to the database. Clematis collection of varieties of Estonian origin collected from private breeders was established in 2006.

2.1.5 Private collections

Field collections of forest berries (cranberries, blueberries, lingberries).

Altogether majority of accessions of Estonian origin of different crop groups and species are preserved in *ex situ* plant genetic resources collections. All holding institutions meet the international requirements and standards. Despite repatriation activities some historical cultivars confessedly are not available any more.

More efforts shall be made to involve private breeders into PGR activities to ensure long-term preservation and utilization of their collections.

Germplasm collected on collecting missions, as well as varieties and breeding lines of Estonian origin and are considered to be the most valuable source for further expanding of *ex situ* collections.



2.2 Collecting

The collecting missions of grasses and forage legumes to Estonian natural and semi-natural grasslands restarted in 1999 after a gap of two decades. The new collecting missions were encouraged by the ECPGR initiatives imposed on every participating country that is responsible for the conservation of its plant biodiversity. Another motivator of more practical character was that the former collections and created lines had simply reached their boundaries of wanted traits. Therefore the formulated goal of missions is to obtain new initial germplasm and widen gene pool of genetic resources for further use in breeding programmes, which is well adapted to local ecological and climatic conditions. Three collecting missions to forage crop ecotypes were organized in Estonia until 2002 within the framework of the Nordic-Baltic project. Native and semi-natural grasslands of the western, northern and north-eastern part of Estonia were visited. Several accessions were collected from the unique plant communities on previous Soviet military bases, which were restricted for civilians for more than 60 years. Any agricultural intervention was precluded on these habitats at that time. These collecting missions resulted in 183 samples of forage grasses and 81 samples of forage legumes, which will be subjected to either characterization and evaluation or multiplication. The determination of the new habitats of *Medicago* sp. in Estonia was the goal of another expedition. The new accessions are being preserved in the long-term storage and examined on the field for the traits that could be introduced to new varieties.

Altogether nine collecting missions have been performed in Estonia within the Nordic-Baltic project and National Programme since 2002. All, with the exception of the ones in 2006 and 2007 have been jointly conducted together with Latvian and Lithuanian colleagues. Estonian forage crop breeders took part in joint collecting mission organised in Latvia in 2004. The number of collected grass and legume species is 21 and 7, respectively. In total 394 samples were obtained, mainly consisted of *Dactylis glomerata* (52), *Poa pratensis* (52), *Phalaris arundinacea* (44) and *Trifolium pratense* (42).

Collecting missions to natural habitats of Estonia, Latvia and Lithuania shall be continued. The possibilities for joint missions with N.I. Vavilov Research Institute of Plant Industry to North-West region of Russia are currently in consideration.

2.3 Storage facilities

2.3.1 Long-term seed storage

The genebank of the Jõgeva Plant Breeding Institute has all the essential equipment for management of the collection: seed-processing laboratory, drying facilities, seed moisture content analyzer, germination cabinet and deep freezers. All samples are cleaned and graded before drying. Seeds are packed into laminated aluminium foil bags and stored in bulk bags and distribution bags in deep freezers at the temperature of -20°C. Viability of conserved seeds is regularly controlled by germination tests in the genebank. Regeneration and multiplication is carried out by the breeding departments of the Jõgeva Plant Breeding Institute, if needed.

2.3.2 *In vitro*

In Department of Plant Biotechnology EVIKA of ERIA the potato cultivars are preserved as meristem plants *in vitro*. All accessions are disease-free and are tested for virus infection for several times. For the disease eradication the technology created in EVIKA is used. The eradication system consists of 3 cycles: 1) selection of initial material, thermotherapy, cultivation of meristem tips and testing for virus infection; 2) re-eradication and field-testing on varieties identity, quality and disease resistance; 3) renewing the material.

The plants regenerated from meristems are initially transferred on a propagation medium containing no growth regulators. In every 3.5-4.5 months the collection is renewed by microcuttings. In every subculture 20 plants per accession are transferred to a fresh medium and the whole collection is duplicated in two storage rooms with different temperature and light regime. The regeneration of the plants from the microcuttings is going on in the following conditions: 16h 22...24°C, 2,4 Klux, 8h 18...20°C, dark. The preservation conditions are as following: EVIKA medium without growth hormones, average temperature 4-5°C, photoperiod 16h / 8h. All accessions, preserved *in vitro* have been preserved for the safety reason in the form of tubers too.

The cultivars and breeding lines of horticultures are preserved as micro plants. First three weeks plants are regenerated at the temperature 18...23°C and photoperiod 16 h. After regeneration the plants are transferred into slow growth

conditions (temperature 4...5°C, photoperiod 16 h). Under these conditions plants are stored depending on genotype 16...20 weeks. In order to establish the plant's vitality after preserving in slow growth conditions, the microshoots are grown three to six weeks under favorable growth conditions. From each species, cultivars and breeding lines 30...40 micro plants in any time are preserved *in vitro*.

2.3.3 Field collections

Field collection of fruits and berries at the Estonian University of Life Sciences Polli Horticultural research Centre.

The collection is located in the area with soils suitable for growing horticultural crops. Fields are surrounded with fences to protect the collections. The accessions are being renewed periodically with vegetatively propagated material originating from the collection with the frequency depending on the species. Appropriate cultivation practices are applied in the field and diseases and pests control used only if necessary. The research facilities include also laboratory for basic biochemical analysis and storage facilities for cold and CA storage.

Field collection of medicinal and aromatic plants and ornamentals is held by the Botanical Garden of the University of Tartu.

2.4 Security of stored material

According to the agreement signed in 1999 safety duplication of all unique accessions of seed collection has been carried out in cooperation with the Nordic Genetic Resource Centre (Sweden). Preparations for delivery of the most unique accessions to the Global Seed Vault in Svalbard are planned to start in 2010 if finances will be allocated.

All accessions conserved by the Department of Plant Biotechnology EVIKA of ERIA *in vitro* are stored in two rooms – at room temperature 18-20 C° in two replications and at 4-5 C° in two replications. Field collection consisting of 200-250 *in vitro* preserved accessions is established every year. Estonian *in vitro* genebank is responsible for safety duplication of Lithuanian potato collection.

A duplicate collection of stone fruit accessions of Estonian origin has been created at the private garden in the western part of Estonia where climate is more appropriate. Some accessions of fruit trees are preserved by State Horticulture Plant Breeding and Experimental Station "Dobele" (Latvia).

As a matter of fact around 200 unique accessions are not safety duplicated due to financial limitations. However, relevant activities shall continue to find opportunities for safety duplication of these important accessions.

Ornamental plant collections in the botanical garden have safety duplications in other botanical gardens and in private collections. Establishment of the Garden of Medicinal and Aromatic Plants in Botanical Garden of the University of Tartu is foreseen to secure the accessions.

An important task is to prevent genetic erosion in collections during regeneration. All holders of collections shall comply with the common preservation standards. New conservation methods e.g. cryopreservation, DNA conservation of unique accessions shall be adapted. It is essential to continue modernisation and improvement of the genebank equipment.

The first accessions entered into seed genebank collection in 1999. Therefore a minor need for regeneration of cereals has occurred. Viability of seeds conserved in freezers is tested regularly. As the genebank is a department of the plant breeding institute, regeneration and multiplication of all crops is conducted by the relevant breeding departments in a most appropriate regeneration environment.

Regeneration of forage grasses and winter rye has already been carried out in accordance to the FAO/IPGRI regeneration and multiplication guidelines.

For regeneration of *in vitro* conserved accessions the Department of Plant Biotechnology EVIKA of ERIA has elaborated specific guidelines. Only evaluated accessions are chosen for regeneration. However these accessions are maintained *in vitro* as well.

Field collections of fruit and berry cultivars are constantly being renewed and new accessions are added. To prevent erosion during regeneration the inventories of the accessions are conducted periodically, accessions are propagated by means of cuttings mostly, and the field collections are being renewed by replanting with new young plants.

The disease and pest damage in field collections has been evaluated mostly on the basis of visual symptoms. The sanitary status of the accessions, especially in respect of virus diseases needs much more attention and a systematic approach. Depositing duplicate accessions in other collections is problematic as there is a threat of spreading diseases due to exchange of infected material. In some cases disease pressure can even threaten the survival of the collections



(e.g. fire blight in *rosacea*). In blackcurrant collections for example there is a potential threat of introduction of reversion virus with new material if it has not been virus indexed as the disease has been spreading rapidly in many collections recently.

The major constraints are related to insufficient funding, which hinders exploitation of specific laboratory equipment. The main options to overcome these limitations are in acquiring of research fund of the European Union. Limited number of qualified staff is becoming a serious issue as well.

There is evident need for training of staff on conservation methodology and in the field of genotyping.

2.5 Documentation and characterization

Documentation system for the national inventory of all institutions contributing to the accomplishment of National Programme was created in 1999. MS Access software was used for database management. Development of the electronic database was continued in the frames of the EPGRIS project.

Specialists of different Estonian institutions dealing with preservation of plant genetic resources have been participating in training courses on the management of genebank documentation system organised by the Nordic Genetic Resources Center.

The documentation system SESTO created and administered by the Nordic Genetic Resources Center is used as the Estonian on-line documentation system for passport data of *ex situ* plant genetic resources since 2009¹.

Regular updates to EURISCO databases are carried out via SESTO.

To improve the documentation system following actions shall be taken:

- Inserting passport data of medicinal and aromatic plants and ornamentals to SESTO (Botanical Garden of University of Tartu).
- Developing new modules for hosting of characterisation and evaluation data in SESTO.
- Inclusion of characterization and evaluation data into SESTO.

2.6 Roles of botanical gardens

There are two botanic gardens in Estonia: the Tallinn Botanic Garden and the Botanical Garden of the University of Tartu. The main aim for botanic gardens is to find out, collect and conserve local cultivars and species of ornamental, medical and aromatic plants, also scientific research.

Botanical gardens of Estonia are involved in *ex situ* management of local cultivars of ornamentals and medicinal and aromatic plants growing and exposing them to students and all visitors.

Ornamental plant collections in the botanical gardens have safety duplications in botanical gardens and in private collections.

The only source to get local cultivars of ornamental plants and medicinal plant species is to cooperate with private gardeners.

Botanical gardens cooperate within the country, also in a network of botanical gardens of Baltic countries and a network of botanical gardens of the Baltic Sea region.

The Tallinn Botanic Garden was the main ornamental plant breeding institution in 1960-1980. Many local cultivars and new seedlings were selected during about 20 years of work. The main cultures were *Dianthus*, *Begonia x tuberhybrida*, *Gladiolus*, *Lilium*, *Rosa* and *Primula*. Today many famous cultivars were bred by private gardeners. On account of it botanical gardens try to keep communication with them. In present time big collections of *Clematis*, *Rosa*, *Syringa*, *Lilium*, *Hemerocallis*, *Anemone* and decorative trees are growing in the private gardens.

The botanical gardens of Estonia have 221 cultivars growing in outside collections: 54 in the Tallinn Botanic Garden and 189 in the Botanical Garden of the University of Tartu. The biggest of them are *Clematis* (60 taxa), *Rosa* (30 taxa), *Hemerocallis* (18 taxa), *Syringa* (13 taxa), *Sempervivum* (10 taxa), *Anemone* (10 taxa) and *Primula* (6 taxa).

In the frames of the National PGR Programme the Botanical Garden of the University of Tartu enriched their collections with 166 local cultivars from private gardens and commercial plant nurseries. Since 2002, passport data of 433 ornamental plants (cultivars) and 50 medical and aromatic plants were entered into the database.

¹ <http://nordgen.org/sesto/index.php?scp=est&thm=sesto>

Priority activities for the next years are evaluation of new cultivars of *Syringa* and conservation in collections as well as establishment of the Garden of Medicinal and Aromatic Plants in Botanical Garden of the University of Tartu.

In addition to the collections in botanical gardens in Tartu and Tallinn, there are smaller collections of different crops all over the country. Government of Estonia approved the list of plantations with the value on plant breeding, research or cultural heritage in 1998 in which 77 public or private gardens, fruit gardens or arboretums from different parts of Estonia are listed.

2.7 An assessment of major *ex situ* needs

The main priority of *ex situ* genebanks is continuation of characterisation and evaluation of accessions. Results obtained from tests will provide adequate data for further improvement of plant breeding efficiency. Consequently this information will lead us to better utilisation of *ex situ* plant genetic resources. Investigations shall be focused on determination of traits important from the ecological aspect – disease resistance, quality, stability to different ecological conditions. The major outcome lays in increased food security.

Currently no cryopreservation facilities are available in Estonia for use with plant material but it would be important to research the possibilities of using this method in maintaining genetic resources collections, especially because of constant expose of field collections to diseases and pests that in some cases may become critical to survival of the accessions. Cryopreservation (especially cryopreservation of dormant buds and cuttings) could become an alternative to duplicate field collections of accessions.

To increase the efficiency of preservation following research activities shall be undertaken:

- Investigation of influence of different *in vitro* conservation methods for the viability of the accessions, morphological and economical characters of accessions;
- Implementation of cryopreservation methods on different species;
- Estimation of effectiveness of long-term *in vitro* conservation and cryopreservation and comparison with methods;
- Genotyping of the preserved material with different methods, comparison of the methods.

Completing safety duplication of fruit trees and berries is an urgent issue. Duplication of the collection of medicinal and aromatic plants will be solved with the establishment of the Garden of Medicinal and Aromatic Plants at the Botanical Garden of Tartu University.

Implementation of the online documentation system SESTO is a remarkable development in data management of Estonian PGR collection. Further training for users and development of SESTO for characterization and evaluation data is essential.



THE STATE OF USE

3.1 The importance of utilization

The value and utilization efficiency of accessions is determined by the available information on their genetic variability.

Benefits from a use of plant genetic resources for food and agriculture depend on a quality of preserved accessions, level of knowledge on their major traits and on information distribution efficiency to the public.

Beside the main task preservation of accessions the genebanks shall pay special attention to development of knowledge on their gene pool by more consistent and purposeful study programmes. Characterisation, evaluation and description of the material should be focussed on desired morphological, biological and agronomical traits that would increase applicability of information stored in databases.

Special attention shall be directed towards investigations on topics in which are being interested plant breeders and scientists, the main customers of genebanks.

Several versatile measures shall be applied to increase public awareness on preservation of plant genetic resources. An active dissemination of information in media, public appearances, development of user-friendly information exchange systems, these are the most relevant and useful activities.

There is a broad scope of activities in regard to improvement of utilisation of plant genetic resources. Equally well justified measures are improvement of quality of seed storage documentation system SESTO, arrangement of specialised training courses for scientists and technical staff as well as production and dissemination of publications.

3.2 Utilization of conserved plant genetic resources and major constraints to their use

Consistent conservation activities on plant genetic resources have taken place in Estonia during the last ten years.

Variable number of requests for seed material and potato tubers has been received by genebanks annually. The material is requested for research, breeding, establishment of demonstration fields and for preservation in collections of other countries. However, due to the development of information systems and public awareness measures the number of requests is steadily increasing.

The requests for the germplasm from breeders, genebanks, scientists, museums, and hobby growers are recorded in separate folder. The amount of material distributed is indicated in the database of genebank. There is no dedicated computerised software applied for that purpose at present.

However, utilization of database SESTO originated by the NordGen will allow Estonian genebanks to improve handling of seed requests and to implement an effective data recording system of germplasm collections.

3.3 Utilization activities

3.3.1 Characterization and evaluation

A major task of the first National Programme "Collection and Conservation of Plant Genetic Resources for Food and Agriculture in 2002-2006" was establishment of computerised database system. The efforts were mainly directed towards compilation of multi-crop passport data in descriptors format, as develop by IPGRI and FAO.

An adequate characterization and evaluation of accessions is the priority of the second phase of the Estonian National PGR Programme.



The level of characterization and evaluation vary between collections to large extent. Most of the long-term preserved varieties of Estonian origin are characterised by the tests for distinctiveness, uniformity and stability (DUS test) during official procedures for registration of crop varieties. There is comprehensive information on morphological, agronomical and biochemical traits available.

Even though, it is reasonable to conduct further characterisation and evaluation tests of these accessions to compare them with accessions of foreign origin in similar conditions.

For the priority crops the procedures for description and time schedule agreed in ECPGR working groups are followed. Dedicated trials for characterisation and evaluation of tomato and oats' accessions of Estonian origin were established in 2008.

Information on wheat breeding lines stored in the genebank is obtained during the breeding process and records are maintained electronically by breeders. Although due to different prioritisation and non-sufficient resources special characterization test have not been conducted until now. Mapping with molecular markers were done on some wheat accessions.

Almost half of the *in vitro* preserved accessions are thoroughly characterized and evaluated. The appropriate field trials are carried out annually. Hence, number of these tests is limited by a high labour force demand and large quantities of new accessions are being deposited by the genebank annually.

For the majority of accessions of fruit and berry crops phenological studies have been conducted and the relevant information is available. Study of biochemical content of fruits and genotyping of accessions using molecular markers are the topics of coming research programme.

Since 2007 the inventory and detailed characterisation of Estonian and introduced cultivars of *Ribes* collection has been carried out in the frames of project "RIBESCO - Core collection of Northern European gene pool of *Ribes*" (2007-2011).

Collections of medicinal and aromatic plants are characterized and evaluated for morphological traits.

The core of information system SESTO for characterization and evaluation is currently under the development, therefore the relevant data about collections are not yet available electronically.

Further increase in quality of information system will be tightly related to opportunities of further molecular data analysis. Collaboration on national and regional level will have important implications in achievement of results.

3.3.2 Promotion of local varieties

Demand for the accessions of Estonian origin has been increased since last few years. Obsolete varieties and landraces have been requested by hobby growers, museums, schools and agricultural parks to establish field collections for exhibition and propagation of local varieties.

There are several varieties of forage grasses (*Koeleria macrantha*, *Festuca ovina*, *Festuca rubra*) and legumes (*Medicago*, *Lupinus*) developed recently from the material collected from natural habitats during the collecting missions in Estonia.

Collecting missions of *Phalaris arundinacea* and relevant field experiments are initiated in the frames of project: "Usability of reed canary grass for bioenergy production".

Some older varieties of field peas, which are characterised by high leaf mass, are being used as a green manure in organic farming.

The Rural Development Programme 2007-2013 to support utilisation of local varieties has been effectively implemented from 2009. The objective of this programme is to ensure the preservation of the local rye variety "Sangaste", which was bred in 1880-s, as a valuable cultural heritage and source of genetic diversity. The "Sangaste" rye is the oldest known cereal variety currently cultivated in Europe. In comparison with modern rye varieties "Sangaste" has a longer straw and thus has been also used for bioenergy purposes.

3.3.3 Plant breeding and research

In Estonia plant breeding of agricultural and horticultural crops is mostly conducted by public organisations. The plant breeding activities have been formalised by the several dedicated national programmes.

The state programme "Plant breeding programme 2009-2019" was approved in 2009.

The aim of the programme is to ensure plant breeding of agricultural crops for food, feed and technical use. Developed varieties shall be characterised by high yielding potential, disease resistance and grain quality.

Estonian farmers benefit from the usage of local varieties due to better adaptation of these varieties to variable and unique agro-ecological conditions.

The following institutions are involved in the state programme on plant breeding in Estonia:

- **Jõgeva Plant Breeding Institute:** plant breeding and maintenance breeding of cereals, forages, oil crops, potatoes and vegetables;
- **Estonian Research Institute of Agriculture:** plant breeding and maintenance breeding of forages (*Melilotus*, *Galega*), meristem propagation of potato and horticultural crops;
- **Polli Horticultural Research Centre of Estonian University of Life Sciences:** plant breeding and maintenance breeding of fruit trees and berries;
- **Department of Gene Technology of Tallinn University of Technology:** pre-breeding of cereals, utilization of biotechnology methods.

3.3.3.1 Jõgeva Plant Breeding Institute

Jõgeva Plant Breeding Institute an autonomous state research and development institute under the jurisdiction of the Ministry of Agriculture of Estonia.

There are 283 varieties of agricultural crops have been bred at the Jõgeva Plant Breeding Institute 70 varieties are listed in 2009 in Estonia or other countries.

Genetic background of new cultivars of cereals, oil crops and potatoes is mostly inherited from external sources. Initial material for the breeding programmes of forage grasses and legumes is mostly based on accessions collected from native origin during collecting expeditions.

Very positive impact on activities of genebank has a fruitful cooperation with plant breeders. Characterisation, evaluation and regeneration of accessions are often conducted by relevant breeding departments. Breeding material and collections not used in breeding programme are stored at the genebank. Plant breeders are responsible for the maintenance of field collections with 4-5 thousand accessions annually.

Cereals

Breeding of barley (for feed and food, malting), spring wheat, winter wheat, oats and winter rye is carried out. To a large extent breeders use the adapted material or varieties from Northern and Western Europe, Baltic countries and germplasm from genebanks (CIMMYT, Vavilov Institute). Sometimes more "exotic" germplasm is included in screening for disease resistance or quality traits (collaboration material with Tallinn University of Technology).

Forage grasses and legumes

There is breeding programme 5 species of forage grasses and 7 legumes conducted, maintenance breeding of 27 forage species is carried out.

30 varieties of Estonian origin of 17 species were included to the official variety list of Estonia in 2008. The species *Festuca*, *Lolium*, *Phleum*, *Trifolium* and *Medicago* are widely used. The aim of current work is to breed productive forage crop and decorative lawn varieties for various cultivation purposes by improving their productivity or aesthetic value, herbage or turf quality, winter and disease resistance.

Breeders take advantage of initial material collected from the natural and semi-natural grasslands for the production of synthetic varieties.

New species used in breeding programme in Estonia are *Festuca ovina* (initial material was collected during the collecting missions in the frames of the National Programme), *Festuca rubra* of tussock type and *Trifolium incarnatum*.

Potatoes

The main goal of potato breeding is to breed high-yielding table and industrial varieties which are medium late to late, have good resistance to diseases, pests and mechanical damages and have high quality. There are breeding programmes of potato late blight and potato cyst nematode been developed to increase the resistance to pests and diseases. The initial material is mostly obtained from genebanks or plant breeders. Wild germplasm has not been used in potato breeding.

Oil crops

Estonia is the most Northern country where purposeful breeding of winter turnip rape is currently carried out. The initial material was obtained from Svalöf Weibull AS in the frames of cooperative programme. The most promising breeding lines are in comparative field trials in Finland, Norway and Canada.



Vegetables

Breeding programmes of tomato and garden pea are based on frequent use of gene bank own collections, collection of Vavilov Institute and our own stocks of adapted material from Baltic countries, Northern and Western Europe. Wild species have been used in tomato breeding. Maintenance breeding of garden bean, onion, cabbage and radish of Estonian varieties has been carried out during the last decade. As a part of research activities old tomato varieties of Estonian origin are tested to investigate their suitability for organic farming.

3.3.3.2 Polli Horticultural Research Centre of Estonian University of Life Sciences

Breeding of fruits and berries

Over the years, 93 fruit and berry cultivars have been bred at Polli. Most of them have been registered in Estonia, some cultivars are registered in Latvia. Six apple cultivars are in evaluation trials for commercial growers in Italy and the Netherlands. Four new blackcurrant cultivars are being tested in trials conducted in Germany, Finland, Poland and Lithuania.

The main target in fruit and berry breeding is to develop high yielding cultivars, which are well adapted to local climatic conditions and have attractive appearance, good taste and flavour. Depending on the species, the aim is to breed cultivars resistant to specific diseases as this is important from ecological and environmental aspects of cultivation. In apples for instance breeding for scab resistant cultivars has been going on for 10 years already. Specific target in blackcurrants and raspberry is to obtain cultivars berries rich in antioxidants.

The amount of breeding material: 2 700 seedlings of apple, 319 of pears, 215 of sweet cherry, 1 940 of blackcurrant and 136 of raspberry.

3.3.3.3 Department of Gene Technology of Tallinn University of Technology

Quantitative powdery mildew resistance has been introgressed into hexaploid wheat using *timopheevii* group wheat as a donor. Three loci involved in resistance have been mapped, and the main locus on chromosome 4A is now the target in a BAC cloning cooperative project (with Institute of Experimental Botany, Czech Republic).

Molecular analysis of accessions

1. In addition to varieties listed in Estonia, a set of common wheat accessions has been genotyped, mainly DH introgression lines.
2. Potato breeding material, local old varieties and cultured in Estonia varieties are being genotyped with SSR markers

3.3.3.4 Crop improvement programmes and food security

The main collaboration research areas of the Jõgeva Plant Breeding Institute and Tallinn University of Technology are related to investigations on spring and winter wheat.

Within the collaboration with the Department of Gene Technology the following topics are covered at present: genetic analyses of powdery mildew resistance, the use of microsatellite markers in fingerprinting of varieties and comparison of genetic and morphological analyses to estimate genetic diversity, identification and verification the varieties and breeding lines. In previous year's biochemical fingerprinting method of HMW glutenin subunits by SDS – PAGE electrophoresis was used to predict baking quality of the wheat material. To increase adaptive potential and disease resistance wheat wild relatives of *Triticum timopheevi* and *Triticum militinae* were used. The obtained hybrid line 8/1 is currently used as a valuable source of powdery mildew resistance in breeding. More intensive use of doubled haploid method and marker-assisted selection is foreseen to increase effectiveness of plant breeding.

Collaboration with the Department of Analytical Chemistry of Tallinn University of Technology was started in 2008 to study wheat phenol compounds by HPLC-MS method and oxidation products of free polyunsaturated fatty acids of some wheat varieties. Adaptation of wheat varieties to different environmental and cultivation conditions will be investigated.

The most useful germplasm characterised by disease resistance and short-strawed lines of winter rye were obtained from the cooperative programme with the N. I. Vavilov Institute for Plant Industry to broaden gene pool of the breeding programme at Jõgeva Plant Breeding Institute. Winter hardiness of varieties is important for crop improvement programme aimed at increase of food security.

In accordance with the Commission Directive 2008/62/EC appropriate conservation varieties or landraces shall be designated in Estonia.

There are future cooperative pre-breeding activities planned between the Genebank of Jõgeva Plant Breeding Institute and Latvian Genetic Resource Centre. Study visit of participant of the Estonian National Programme to the Latvian Genetic Resource Centre is planned for autumn 2009. The purpose of the visit is to get acquainted with the genotyping systems already successfully utilised in Latvia. Investigation of collaboration opportunities on fingerprinting of the germplasm of Estonian origin are planned in the nearest future.

The doubled haploid method shall become the essential routine of every plant breeding programme.

It is expected that the use of plant genetic resources in breeding programme of forage and amenity grasses will increase in next decade.

Further improvement of use of plant genetic resources requires more detailed information on accessions, enhancement of availability and accessibility of information and integrated activities of all counterparts coordinated by the National Committee.

Increasing importance of pre-breeding in improvement of usage of plant genetic resources assumes revision of funding policies, which shall be turned into favour of such long term activities on characterisation and evaluation of plant genetic resources for food and agriculture.

THE STATE OF NATIONAL PROGRAMMES, TRAINING AND LEGISLATION



4.1 Networks

Estonia has developed a network of institutions involved into preservation of plant genetic resources. The network members are: Genebank of the Jõgeva Plant Breeding Institute (*ex situ* preservation of cereals, forage grasses, legumes, forage legumes, vegetables, winter turnip rape); Department of Plant Biotechnology EVIKA at the Estonian Research Institute of Agriculture (*in vitro* preservation of agricultural and horticultural crops); Polli Horticultural Research Centre of Estonian University of Life Sciences (fruit crops and berry plants); Botanical Garden of Tartu University (medicinal and aromatic plant species); Institute of Gene Technology of Tallinn University of Technology (wild relatives of wheat, molecular genetics techniques).

The network members are responsible for collection, preservation and evaluation of all plant genetic resources for food and agriculture common in Estonia. All institutions are actively involved into utilisation of plant genetic resources. The network members are supported by the Estonian Government through financial support for joint activities, organisation of network meetings and other relevant activities.

Cooperation between partners of network has had an important impact on utilisation of plant genetic resources. Collaboration between Jõgeva Plant Breeding Institute, Estonian University of Life Sciences and Estonian Research Institute for Agriculture has brought a positive outcome in further characterisation and evaluation of plant genetic resources.

Through network activities major tasks foreseen by a National Programme have been completed. Main benefits of networking are: adequate assessment of needs, sharing of responsibilities, exchange of information and technical expertise, increased awareness and improved access of PGRFA, joint characterization and evaluation of germplasm.

4.2 National programmes for plant genetic resources

Preparatory activities for compilation of a national programme were initiated by network institutions in 1999. During three preparatory years limited finances for activities on plant genetic resources were allocated for management of collections and participation in international activities.

Estonian Government approved the First National Programme on preservation of plant genetic resources in 2002.

Implementation of National Programme is mostly conducted by the institutions governed by the Ministry of Agriculture and the Ministry of Education and Research. The Ministry of Environment is involved into specific activities like on-farm conservation. The electronic database of accessions of ornamental plants maintained by hobby gardeners and private breeders is held by Tartu Botanical Garden of Tartu University. Safety duplicates of some accessions of these collections are preserved by the botanical garden.

4.2.1 Estonian National Programme “Collection and Conservation of Plant Genetic Resources for Food and Agriculture in 2002-2006”

The main body responsible for coordination and implementation of the National Programme is the National Committee on PGRFA established by the Ministry of Agriculture in 1997.

The Committee consists of ten members representing all organisations involved into implementation of a National Programme as well as representatives of the Ministry of Agriculture and the Ministry Environment. The meetings of the Committee are held regularly, 2-4 times a year.

Objectives of the programme

- Survey and inventory of the collections
- Repatriation of the material of Estonian origin
- Development of the national PGR network
- Creation and management of electronic database at the Jõgeva PBI
- Collection of accessions (expeditions to natural and semi-natural grasslands)
- Sustainable conservation and utilization of PGR of varieties, advanced breeding lines and native ecotypes adapted to local edaphic and climatic conditions of Estonian origin to ensure implementation of the Convention on Biological Diversity
- Assurance of safety duplication of accessions of Estonian origin
- Evaluation and characterization of the accessions and methodological investigations
- Exploration and utilization of collections
- Relevant activities necessary for the public awareness raising
- Cooperation with N.I. Vavilov Research Institute of Plant Industry, Russia the Nordic Genebank and the genebanks of Baltic countries
- Participation in projects coordinated by FAO and Bioversity International

The following institutions were involved to the National programme in 2002-2006:

Genebank of the Jõgeva Plant Breeding Institute

Long-term *ex situ* conservation of cereals, forage grasses, legumes, forage legumes and vegetables.

Plant Biotechnological Research Centre EVIKA of Estonian Agricultural University

In vitro preservation of agricultural and horticultural crops.

Polli Horticultural Institute (Estonian Agricultural University)

Preservation of fruit trees and berry plants.

Institute of Experimental Biology (Estonian Agricultural University)

Preservation of wild relatives of wheat and disease resistant hybrid wheat lines. Monosomic aneuploid analysis and molecular-genetics techniques in characterization of preserved disease resistant wheat genotypes.

Botanical Garden (University of Tartu)

Preservation of natural habitats of grasses. Preservation of decorative species and varieties. Coordination of activities of private collectors of decorative species.

Department of Pharmacy (University of Tartu)

Preservation of medicinal and aromatic plants in field collection.

The Second National Programme "Conservation and Utilization of Plant Genetic Resources for Food and Agriculture 2007-2013" was approved by the Minister of Agriculture in 2007.

Considering the positive results of the first national programme in 2000-2006 and fulfilment of specific tasks (survey and inventory of the collections, repatriation of the material of Estonian origin and development of the national PGR Network), the main scope for the second national programme has altered.

The Second National Programme has modified main tasks considering the objectives defined by a Global Plan of Actions and the International Treaty on Plant Genetic Resources for Food and Agriculture for conservation and sustainable use of plant genetic resources for food and agriculture.

The main objectives of the National Programme are characterisation and evaluation of accessions, utilisation of new conservation methods, capacity building activities, National Legislation and policy framework, information management and dissemination and further development of networks for plant genetic resources.

4.2.2 Estonian National Programme “Conservation and Utilization of Plant Genetic Resources for Food and Agriculture 2007-2013”

Programme management

- Ministry of Agriculture is responsible for overall programme coordination.
- PGRFA Committee for guidance and planning of the programme was established in 2007. Committee consists of responsible persons from four institutions involved into a utilisation of the National Programme, representatives from the departments of Research and Development and Plant Health of the Ministry of Agriculture, representative from the Ministry of Environment, in total 10 persons. National PGRFA Programme and the Committee are governed by the Department of Research and Development of the Ministry of Agriculture.
- In relation to the EU Commission Directive 2008/62/EC on the marketing of “conservation varieties” PGRFA Committee is obliged to make the decisions on the acceptance of conservation varieties in 2009. A new member of the Committee will be appointed to represent Estonian Plant Production Inspectorate in this matter.

Objectives of the programme

- Collection, conservation and sustainable use of plant genetic resources of Estonian origin
- Description, evaluation and documentation of accessions
- Development of the online searchable database (cooperation with the Nordic Genebank)
- Participation in international cooperation

Sharing the responsibilities

(Detailed introduction of the institutions in Chapter 3):

Genebank of the Jõgeva Plant Breeding Institute

<http://www.jpbi.ee>

Long-term seed preservation of cereals, vegetables, forage grasses and legumes.

Department of Plant Biotechnology EVIKA (Estonian Research Institute of Agriculture)

<http://www.evika.org>

In vitro preservation of agricultural and horticultural crops.

Estonian University of Life Sciences Polli Horticultural Research Centre

<http://www.polli.ee>

Preservation of fruit trees and berry plants.

The Botanical Garden of the University of Tartu

<http://www.ut.ee/botaed>

Preservation of medicinal and aromatic plant species and ornamentals in *ex situ* field collection. Coordination of activities of private collectors and breeders.

Tallinn University of Technology Department of Gene Technology

<http://geen.ttu.ee/>

Preservation of wild relatives of wheat and disease resistant hybrid wheat lines. Monosomic aneuploid analysis and molecular-genetic techniques in characterization of preserved disease resistant wheat genotypes.

In general, the level of financial support to the National Programme has been sufficient for fulfilment of general activities. However, due to the variation of priorities and circumstances some adequate alterations shall be considered in financing schemes during coming phases of the Programme.

There are several measures foreseen to strengthen the National Programme and to increase capability of organisations. Pre-breeding activities are among the most challenging issue for genebank and shall be a mainstay in coming years. To achieve positive outcome more finances and manpower shall be applied.

Further devolvement of national network will focus on establishment of wider public awareness aimed at attraction of private breeders' and hobby farmers into preservation activities.



4.3 Training

During the last decade, staff of the institutes involved into fulfilment of a national programme has been participating on a number of training courses and workshops covering several important aspects of genebank management. Some examples: Cryopreservation of plant genetic resources, (Italy, 1998), Workshop on GM-technology & Nordic genetic resources: (Nordic Gene Bank 2006), Workshop on IT management in genebanks and the documentation system of the Nordic Gene Bank (SESTO) (Nordic Gene Bank, 2007).

However, training opportunities have not been planned and elaborated consistently. More detailed planning of training opportunities in regard to further needs is strongly recommended.

Highly important is to continue development of international relations to create additional opportunities for multilateral cooperation on characterisation and evaluation. The actions that foster broad range training opportunities for genebank specialists shall be elaborated more consistently.

A more appropriate financial support shall be considered for training on several topics - genetic analyses, conservation methods, public awareness and documentation.

4.4 National legislation

Estonian nature conservation system is well developed at administrative and legal level, but it still needs improvement of management aspects. The main regulations in nature conservation are stated in Nature Conservation Act. Significant nature conservation related documents are also Forest Act, Heritage Conservation Act, Environmental Monitoring Act and Water Act.

Seed certification, quality requirements, seed marketing, Plant breeders' rights, supervision and sanctions are regulated by the Plant Propagation and Plant Variety Rights Act in Estonia (2006). Plant Production Inspectorate (Agricultural Board from 1 January 2010) is the designated Authority for granting plant breeders rights, listing of varieties entitled for certification and marketing.

The Government of Estonia deposited its instrument of ratification of the 1991 Act of the International Convention for the Protection of New Varieties of Plants on September 24, 2000.

As a consequence of the Estonian membership in the European Union (2004), Estonian legislation is in conformity with EU legislation. The European Community Plant Variety Rights are valid in Estonia since 2004.

The European Community legislation governing the marketing of seed of agricultural plants, namely Council Directives 66/401/EEC, 66/402/EEC, 2002/53/EC, 2002/54/EC, 2002/56/EC, 2002/57/EC and vegetable seeds (2002/55/ EC) have possibility to establish specific conditions for marketing of seed and seed potatoes of agricultural landraces and varieties which are naturally adapted to the local and regional conditions and threatened by genetic erosion.

Commission Directive 2008/62/EC of 20 June 2008 providing for certain derogations for acceptance of agricultural landraces and varieties which are naturally adapted to the local and regional conditions and threatened by genetic erosion and for marketing of seed and seed potatoes of those landraces and varieties shall bring into force by 30 June 2009. Plant Propagation and Plant Variety Rights Act is currently under proceeding for amendments in the Parliament of Estonia for transposition of abovementioned directive.

Seed trade with third countries and notification to the Commission of areas and yields has been regulated by Council Regulation (EC) No 1234/2007 of 22 October 2007, establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products (Single CMO Regulation).

To support the regionally balanced development of rural areas through the European Union, Common Agricultural Policy measures, Estonian Government approved "Estonian Rural Development Plan 2007-2013" in 2009.

The role of State Programme "Plant breeding programme 2009-2019" is to ensure plant breeding of agricultural and horticultural crops.

The development plan for the years 2007-2013 for promoting the use of biomass and bioenergy.

Directives for establishment of National Council on Plant Genetic Resources for Food and Agriculture (1997), Estonian National Programme "Conservation and Utilization of Plant Genetic Resources for Food and Agriculture 2007-2013" and PGRFA Committee for guidance and planning of the National Programme (2007) are issued by the Minister of Agriculture.

Preparation and enforcement of the directives on marketing of the genetic resources of hobby and conservation varieties of vegetables, also on marketing seed mixtures are expected from the European Commission in the near future.

4.5 Public awareness

Public awareness activities are coordinated by a National Council and accomplished by institutions involved into a national programme in their field of activities. Public awareness measures are well defined in general.

Different opportunities have been used to increase public awareness. Relevant information has been published in specialised newspapers, magazines and dedicated publications (“Plant varieties as environmentally valuable material and biodiversity”; “Estonian Fruit and Berry Cultivars 2006”). Compilation about the results of the first National Programme “Collection and Conservation of Plant Genetic Resources for Food and Agriculture 2002-2006” (2006).

Specialists have presented reports and overviews on local and international conferences, workshops and seminars. Several public appearances on television and radio (Bionina, Maahommik) have been taken place.

Dedicated lectures have been conducted by genebank specialists during specialised exhibitions. Among them the most attractive were “Diversity of different crops” (presentation of approximately 200 potato varieties) and an exhibition “Diversity for food” organised by Tallinn Botanical garden.

Internet homepages of all institutions serve effectively for dissemination of information on special topics (e.g. Global Seed Vault in Svalbard).

Important role in public awareness activities have organised visits of schools to *ex situ* genebanks, botanical gardens and plant breeding institutions.

Estonian botanical gardens have special departments – (e.g. clematis garden) also other local cultivars are exposed within other collections of botanical garden.

There is a dedicated network of botanical gardens for dissemination of relevant information

established in Estonia. In autumn of 2009 a brochure on plant genetic resources for food and agriculture is planned to be

published, relevant finances have been allocated.

Thus, more consistent approach by initiation of national public awareness programme has to be elaborated in regard to dissemination of information and attraction of wider audience into preservation of plant genetic resources for food and agriculture.



THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

5.1 Regional networks

Long-term purposeful activities on plant genetic resources conservation were initiated in Estonia in the framework of Nordic-Baltic cooperative programme in the middle of 1990's. The overall goal of the programme was to establish *ex situ* genebank to secure conservation of existing collections of agricultural and horticultural crops of Estonian origin. The other objectives were description and documentation of available germplasm, repatriation of missing accessions from collections of other genebanks in Europe and to conduct collection missions in natural habitats.

The Nordic-Baltic programme promoted regional collaboration on conservation and sustainable use of plant genetic resources and assisted in sharing of information and technology. Crop specific networks of cereals, forages, medicinal and aromatic plants, vegetables and fruits and berries were established involving representatives, mostly plant breeders, of relevant institutions from Estonia, Latvia, Lithuania and the Nordic Gene Bank.

Annual meetings of all above listed crops were conducted regularly in Baltic countries. There were established field trials with accessions from all countries. Joint Baltic-Nordic collecting missions of forages were organised in Estonia and Latvia in 2002-2004.

Since 2005, the number of crop-specific workgroup meetings has decreased. However, participation in international programmes has effectively combined activities in Baltics with other international undertakings. Participation in joint projects, establishment of mutual comparative field trials and common research projects have strengthened regional cooperation of Baltic countries on the network level.

Regional cooperation has assisted in fulfilment of the mandate of every Baltic genebank to preserve and utilise their original germplasm.

Nordic –Baltic meetings on overall plant genetic resources issues have been regularly conducted in one of three Baltic countries or at the Nordic Genetic Resource Centre already since 1999.

Participation on meetings has been self-funded by genebanks since 2004.

Discussions of the representatives of the Baltic germplasm holders and the Nordic Genetic Resource Center have covered the following subjects during the last meetings in 2008 and 2009:

- Status on work on plant genetic resources in all countries.
- Progress in SESTO documentation system utilized by the NordGen and Baltic genebanks.
- Back up of safety duplicates in Global Seed Vault in Svalbard.
- Implementation of the Standard Material Transfer Agreement.
- EC Directive on Conservation Varieties.
- Funding of collaboration – project ideas for the Nordic-Baltic collaboration programmes (pre-breeding, clonal material data access).
- Progress on AEGIS project.

Collaboration with Nordic countries has played a significant role in increasing the awareness of plant genetic resources in Estonia.

Below are listed major achievements of Nordic-Baltic collaboration during the last decade:

- Setting up infrastructure for Estonia for long-term *ex situ* storage.
- Courses and education about practical aspects of gene bank operations, documentations, etc;
- Collaboration in establishment of national programme of preserving of plant genetic resources.
- Development of computerized databases, documentation and information management.
- Safety duplications of the most valuable genotypes of agricultural crops of Estonian origin at the Nordic Genetic Resource Center.

- Joint collecting missions of Baltic representatives.
- Adaptation of documentation system SESTO to Baltic genebank information system;
- Exchange of germplasm.
- Joint crop specific working groups.
- Joint research activities, incl. characterization and evaluation of germplasm.
- Joint scientific meetings and research projects.
- Increased stakeholder participation.
- Access to financial resources through participation.
- Sharing of responsibilities for network activities.
- Exchange of technical expertise.
- Access to advanced research results.
- Increased public awareness on PGRFA.
- Rationalisation of activities.

There have been several positive results on Baltic-Nordic collaboration obtained recently.

All three Baltic countries participate in the common scientific research collaboration projects of barley since 2003 and a follow-up project “Mapping of QTLs for local adaptation in various spring barley genotypes with Nordic and Baltic origin” with national financing for 2008-2011 is ongoing.

Nordic Genetic Resource Center has submitted applications for new cooperative activities. Projects Neighbour Network Program – “Training on pre-breeding of barley” and “How to use SESTO” have been approved and appropriate finances were allocated.

The Nordic Council of Ministers has approved Nordic-Baltic Mobility programme to conduct workshop “Documentation and access to material and information of vegetatively propagated plants and forest resources” in Estonia in 2010.

Cooperation with the N. I. Vavilov Institute of Plant Industry

There has been mutually beneficial collaboration between Jõgeva Plant Breeding Institute in Estonia with the N. I. Vavilov Institute of Plant Industry (VIR) in St. Petersburg. The most valuable accessions of Estonian origin preserved by VIR were successfully repatriated. Some accessions of VIR were regenerated in Estonia. A winter rye plant breeding programme was carried out between Jõgeva PBI and VIR. The most useful germplasm characterised by disease resistance as well as short-strawed lines were applied to breeding programme at Jõgeva PBI.

Memorandum on cooperation between the Nordic Gene Bank, Estonian, Latvian and Lithuanian genebanks and Vavilov Institute on repatriation of accessions of Baltic and Nordic origin was signed in 2002. As a result of cooperation a number of accessions has been offered by VIR for repatriation.

The Memorandum of Understanding on Cooperation for Preservation and Utilisation of Plant Genetic Resources for Food and Agriculture between N.I. Vavilov Research Institute of Plant Industry (Russia), the Committee on Plant Genetic Resources for Food and Agriculture (Estonia), the Genetic Resource Centre (Latvia), the Plant Genebank (Lithuania) and the Nordic Genetic Resource Centre was signed in 2009.

5.2 International programmes and international crop-specific networks

Estonia participates as a full member in European Cooperative Programme on Plant Genetic Resources (ECPGR) since 1998. *Avena*, Barley, Wheat, Forages, Potato, *Malus/Pyrus*, *Prunus*, *Solanaceae* and Medicinal and Aromatic Plants are the prioritised working groups in which activities and meetings the nominated persons from Estonia participate.

Estonia has obtained the most valuable outcome from participation in crop-specific networks of ECPGR.

As highly efficient tool for practical implementation has recommended itself the European Central Crop Databases.

Several Estonian breeders are members of the European plant breeders’ association EUCARPIA, which supports their collaboration with other European breeders and scientists on crop-specific level.

European projects (*Ribes*, *Avena*) are important because of practical contribution to crop improvement processes in different countries.

Jõgeva Plant Breeding Institute has remarkably efficient cooperation on spring wheat breeding with Boreal Plant Breeding Ltd (Finland) and on winter turnip rape breeding with Svalöf Weibull AB (Sweden).

There are new cooperative varieties of both crops registered in Estonia, Finland, Sweden and Canada.



Evidently the highest positive outcome will be created by multilateral relations. Among priority activities shall be considered further integration of national policies and strategies with international regulations.

All relevant Estonian stakeholders shall apply for additional financial resources to assure constituent development of international relations.

5.3 International Agreements

- 2000: Memorandum of Understanding "Conservation of the safety duplicates of the Estonian *ex situ* genebank at the Nordic Genebank".
- 2002: Memorandum of Understanding regarding collaboration on the development of a European Plant Genetic Resources Search Catalogue (EURISCO).
- 2002: Memorandum on cooperation of the Nordic Gene Bank, Estonian, Latvian and Lithuanian genebanks and N.I. Vavilov Research Institute of Plant Industry (Russia).
- 2004: Accession of the International Treaty on Plant Genetic Resources for Food and Agriculture by Estonia.
- 2009: Follow-up Memorandum of Understanding on Cooperation for Preservation and Utilisation of Plant Genetic Resources for Food and Agriculture - N.I. Vavilov Research Institute of Plant Industry (Russia), the Committee on Plant Genetic Resources for Food and Agriculture (Estonia), the Genetic Resource Centre (Latvia), the Plant Genebank (Lithuania) and the Nordic Genetic Resource Centre.
- 2009: Estonia signed the Memorandum of Understanding for the implementation of An European Genebank Integrated System (AEGIS).

5.4 International Projects

During the last decade international cooperation has significantly improved public awareness and reasonably supported the conservation activities of plant genetic resources in Estonia.

The most positive impact on preservation of Estonian plant genetic resources has had the following projects:

- 1994-1999: Project of the Nordic Council of Ministers "Conservation of plant genetic resources in the Baltic States" – creation of the networks and working groups of the Baltic and Nordic countries, establishment of the Estonian genebank, training on genebank management.
- 1999-2002: Public and Private Partnership in Estonian Plant Breeding. Including training on genebank management at the Centre for Genetic Resources in the Netherlands (CGN).
- 2000-2002: Project of the Nordic Council of Ministers "Regional co-operation on plant genetic resources for mutual benefit" – Back up for safety duplicates, joint collecting missions, improvement of knowledge on plant genetic resources preservation.
- 2002-2006: Faba Bean Breeding for Sustainable Agriculture (EUFABA) - combining the application of marker-assisted selection and conventional breeding methods to develop enhanced faba bean genotypes with characteristics of importance to sustainable agriculture across Europe.
- 2003-2005: Strengthening of the Estonian Plant Health System in accordance with EU legislation with specific attention to plant propagation material.
- 2003-2006: Studies on the new Nordic populations of *Phytophthora infestans* to improve potato late blight forecasting and control.
- 2003-2004: Implementation of EU Regulations for Indexing Nuclear Stock Potato Plants for Quarantine Pathogens in the Baltic Countries and Poland.
- 2005-2008: Enhanced control of *Potato mop-top virus* in the Nordic and Baltic Sea region.

Ongoing international projects

- 2007-2011: EC AGRI GEN RES (870/2004): Project on oats genetic resources "Avena genetic resources for quality in human consumption – AVEQ". 15 partners from 8 countries - Jõgeva Plant Breeding Institute from Estonia. Project coordination: Julius Kühn-Institute Federal Research Centre for Cultivated Plants, Germany. The project focuses on traits relevant for the quality of oats in human consumption (contents of protein, fat, minerals, dietary fibre, antioxidants and phenolic compounds), resistance to *Fusarium* infection and mycotoxin contamination and on cold tolerance, which is important for oat in several regions in Europe.

- 2007-2011: EC AGRI GEN RES (870/2004): Project on *Ribes* (currants and gooseberry) genetic resources. "RIBESCO-Core collection of Northern European gene pool of *Ribes*". 11 partners from 10 countries - Polli Horticultural Research Centre from Estonia. Project coordination: MTT Agrifood Research, Finland.

The project has given us an opportunity to look into the collection we have in a more methodologically advanced way and has been a good way to share the experience of different countries in maintaining and managing plant genetic resources. Molecular markers approach has revealed some duplicates or very closely related accessions.

International collaboration has to be directed towards more active initiation of joint undertakings on evaluation of preserved germplasm in different conditions to secure utilisation of plant genetic resources for food and agriculture on the basis of equal sharing of responsibilities, tasks and benefits.



ACCESS TO PLANT GENETIC RESOURCES AND SHARING OF BENEFITS ARISING OUT OF THEIR USE, AND FARMERS' RIGHTS

The sustainable use and conservation of plant genetic resources is best ensured by an open access to plant genetic resources by plant breeders and farmers facilitated through a multilateral approach.

Global binding agreements are seen as essential preconditions for equitable sharing of the benefits from the utilisation of plant genetic resources. The internationally accepted rule of free access to protected varieties for the acts done privately and for non-commercial purposes, for experimental purposes and for the purpose of breeding other varieties is in place.

The right of farmers' to produce and use farm-saved seed and propagating material is widely recognised in Estonia. The distribution of seed of main agricultural species require, prior to the marketing, certifications granted through an official examination where the so-termed value for cultivation and use has been assessed and confirmed. Appropriate measures have made possible participation of farmers in plant breeding and relevant decision making processes which serve for increased sharing of benefits and in long-term will assure food security. Farmers' Rights establish a legal framework to ensure active participation of farmers in development, maintenance and utilisation of crop genetic resources.

There are two organisations representing agricultural producers - the Central Union of Estonian Farmers and the Estonian Agricultural Producers' Central Union.

The most relevant international agreements in regard to Farmers' Rights recognised in Estonia are: the International Treaty on Plant Genetic Resources for Food and Agriculture, the Convention on Biological Diversity (CBD) and the Convention of the Union for the Protection of New Varieties of Plants (UPOV).

Practical implementation of Farmers' Rights is based on following documents:

- Plant Propagation and Plant Variety Rights Act.
- European Council Regulation (EC) No 2100/94 on Community plant variety rights and Commission Regulation (EC) No 1768/95 of 24 July 1995 implementing rules on the agricultural exemption provided for in Article 14 (3) of Council Regulation (EC) No 2100/94 on Community plant variety rights and Plant Propagation and Plant Variety Rights Act.
- To promote the use of certified seed in Estonia plant breeding companies, variety representatives and seed growers have established the Estonian Seed Association in 2006.
- Implementation of plant breeders' rights by collecting royalties for farm saved seed was commenced by the Estonian Seed Association in 2008. Appropriate conditions and procedures were defined in consultation with the Central Union of Estonian Farmers and the Estonian Agricultural Producers' Central Union.

The concept of "farmers' exemption" has been introduced. In the case of certain species farmers are authorized to use for propagating purposes in the field, on their own holding the product of the harvest which they have obtained by planting, on their own holding, propagating material of a variety other than a hybrid or synthetic variety. The "farmers' exemption" is implemented for spring barley, spring wheat, oats, field peas, spring rape, potatoes, flax, winter wheat, winter barley, winter rye, winter triticale and winter rape varieties either protected by the European Union or the Estonian plant variety protection law.

The small farmers, who do not grow plants on an area bigger than the area which would be needed to produce 92 tonnes of cereals or 185 tonnes of potatoes in case of European Community plant variety rights and 10 ha agricultural species and up to 1 ha of potato in case of National Plant Breeders rights, are exempted for paying royalties to the holder. Other farmers shall pay an equitable remuneration to the holder, which shall be sensibly lower than the amount charged for the licensed production of propagating material of the same variety in the same area. The royalties are charged as follows: cereals and field peas 2,75 EUR per tonne, oil crops 5,75 EUR per tonne, potatoes 25,5 EUR per tonne.

THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT



7.1 Distribution of food from intervention stocks to the most deprived persons

Agricultural products in intervention storage or processed products made from them can be distributed to deprived persons free of charge or at a minimum price covering the distributing organisation's direct distribution costs via a volunteer programme implemented in the Member States since 1987. Charitable organisations carrying out the distribution of food play an important role in the scheme; they must meet certain conditions (e.g. checked accounting system, compliance storage facilities, sufficient manpower, readiness to involve volunteers, etc.).

Estonia decided to participate in the scheme for the distribution period 2006/2007. The distribution period lasts from 1 October till 31 December of the following year. The funds required for implementation of the plan, totalling EUR 324 813, were allocated in accordance with Commission Regulation (EC) No 1539/2006. Within the limits of this amount, Estonia can use 3 000 t of cereals and buy from the market EUR 5 190 worth of skimmed milk powder and EUR 300 worth of rice.

