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COLLECTION AND CONSERVATION OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE IN ESTONIA

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The Estonian government has responded to the global efforts for conservation and sustainable use of biological diversity ratifying international agreements and initiating the National Programme on Plant Genetic Resources for Food and Agriculture. Collection, identification and conservation of plant genetic material of Estonian origin as well establishing the network were the essential activities of the National Programme. Since plant genetic resources form the core of initial material for plant breeders and scientists systematic investigations to improve utilisation of plant genetic resources are conducted. An overview of activities on preservation of plant genetic resources for food and agriculture in Estonia is presented.

Keywords: plant genetic resources, conservation, gene bank, accessions, plant breeding.

INTRODUCTION

Plant genetic resources for food and agriculture mean any genetic material of plant origin of actual or potential value for food and agriculture. They include commercial plant varieties (both currently available and those developed in the past) as well as traditional local plant varieties, landraces, wild material and breeding lines. Preservation of plant genetic resources is an essential tool for securing them for diverse utilisation in the future.

According to the international commitment arising from the ratification of the Convention on Biological Diversity (The Convention on ..., 1992), each country is responsible for conservation and sustainable use of plant genetic diversity as a local cultural and historical heritage to enhance the expediency of crop cultivation and ensure sustainable development of society.

Systematic approach towards the *ex situ* preservation of plant genetic resources for food and agriculture in Estonia was undertaken in the frame of collaborative Nordic-Baltic project in 1994–1999. This conceptual model was initiated by the Nordic Gene Bank (Nordic Genetic Resource Center). The Nordic-Baltic initiatives created the prerequisites for establishment of a well-structured 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.

Overview of 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.

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.

Milestones

- 1994–2002 Nordic-Baltic collaboration projects on plant genetic resources.
- 1994 Ratification of Convention on Biological Diversity.
- 1997 Estonian National Council on Plant Genetic Resources for Food and Agriculture.

- 1997 Memorandum of Understanding “Conservation of the safety duplicates of the Estonian *ex situ* genebank at the Nordic Gene Bank” was signed.
- 1998 Estonia became a full member of the European Cooperative Programme for Plant Genetic Resources (ECPGR).
- 1999 Foundation of the Genebank at the Jõgeva Plant Breeding Institute.
- 2002 Estonian Government approved the National Programme „Collection and conservation of Plant Genetic Resources for Food and Agriculture 2002–2006“.
- 2002 Memorandum of Understanding on cooperation of the Nordic Gene Bank, Estonian, Latvian and Lithuanian genebanks and N.I. Vavilov Research Institute of Plant Industry.
- 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 Ministry of Agriculture approved follow up National Programme “Conservation and Utilization of Plant Genetic Resources for Food and Agriculture 2007–2013“.
- 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, Estonian Committee on Plant Genetic Resources for Food and Agriculture, Latvian Genetic Resource Centre, Lithuanian Plant Genebank and the Nordic Genetic Resource Centre.
- 2009 Estonia signed the Memorandum of Understanding for the establishment of a European Genebank Integrated System (AEGIS).

Estonian National Plant Genetic Resources Programme

To realise the main goals for collecting and conservation of plant genetic resources for food and agriculture as defined in Convention on Biological Diversity, the Estonian Government approved the National Programme for Plant Genetic Resources

for Food and Agriculture in 2002. The mandate of the programme is collection, conservation, evaluation, characterization and documentation of plant genetic material of agricultural crops of Estonian origin, thus providing a basis for the future use of the genetic variation by plant breeders and researchers (Annamaa, Kukk, 2005).

The International Treaty on Plant Genetic Resources for Food and Agriculture (International Treaty ..., 2004) recognizes that the conservation, exploration, collection, characterization, evaluation and documentation of plant genetic resources are essential in meeting the goals for sustainable agricultural development for this and future generations. The Estonian Government, by approving the International Treaty, has acknowledged the responsibilities and applied relevant finances for the second phase of the National Programme in the years of 2007–2013. During this period the main goal is to proceed with characterization, evaluation and documentation of maintained accessions. In the first place it is planned to focus on further investigation of crops the regeneration of which is most urgent (Annamaa *et al.*, 2008). Ministry of Agriculture is responsible for overall programme coordination.

Following institutions are responsible for the preservation of plant genetic resources for food and agriculture in Estonia:

Genebank of the Jõgeva Plant Breeding Institute – Long-term seed preservation of cereals, vegetables, forage grasses and legumes.

Estonian Research Institute of Agriculture Department of Plant Biotechnology EVIKA – *In vitro* preservation of agricultural and horticultural crops.

Estonian University of Life Sciences Polli Horticultural Research Centre – Preservation of fruit trees and berry plants.

The Botanical Garden of the University of Tartu – Preservation of medicinal and aromatic plant species and ornamentals in *ex situ* field collection. Coordination of activities of private collectors and breeders of ornamentals.

Tallinn University of Technology Department of Gene Technology – 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 (The Second Report ..., 2012).

About 4500 accessions, mainly of Estonian origin, have been collected and maintained by the relevant stakeholders. All accessions are documented in accordance with the internationally agreed passport descriptors (FAO/IPGRI Multi-Crop ..., 2001).

***Ex situ* preservation in the Genebank**

Genebanks are dedicated to conserve the plant genetic resources, which guarantee their utilization in the future (Maxted *et al.*, 1997).

The Genebank of the Jõgeva Plant Breeding Institute was founded in 1999. Minister of agriculture has appointed the Genebank as a coordinator of long-term *ex situ* preservation in Estonia.

Nordic-Baltic plant genetic resources project had a considerable impact on establishment of the Genebank allocating the financial support of the Nordic Council of Ministers for purchase of specific equipment for the Genebank.

The mandate of the Genebank is collection, conservation, evaluation, characterisation and documentation of plant genetic material of agricultural crops of an Estonian origin. The Genebank holds the long-term seed collection of cereals, forage grasses and legumes, pulses, oil and fibre crops and vegetables.

The Genebank has all the essential equipment for management of the collection: seed-processing laboratory, drying facilities, seed moisture content analyzer, germination cabinet and deep freezers. 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 -18°C . Viability of conserved seeds is regularly controlled by germination tests in the Genebank.

Genebank accessions

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 are conserved in the Genebank.

Nearly 2500 seed accessions of 60 species of advanced cultivars, breeding lines and accessions collected during expeditions are preserved in the Genebank in 2012. Approximately half of accessions are of Estonian origin. Cereals and pulses take the largest share of collection (40 %), followed by oil and fibre crops (17 %).

The oldest accessions of Estonian origin stored at the Genebank are local barley samples from 1908 and 1912, garden bean 'Liplapi uba' (1920), winter rye 'Sangaste' (1926) and meadow fescue 'Jõgeva 47' (1928).

According to the agreement between the Jõgeva Plant Breeding Institute and the Nordic Gene Bank in 1997, safety duplicates of the most valuable accessions of Estonian origin are preserved by the Nordic Genetic Resource Centre.

Collecting missions

Sixteen collecting missions to natural and semi-natural grasslands of the western, northern and northern-eastern part of Estonia have been carried out since 2002 within the framework of the Nordic-Baltic project and a National Programme. Five of the missions have been jointly conducted together with Latvian and Lithuanian colleagues. Estonian forage crop breeders were involved in joint collecting mission organised in Latvia in 2004. Several accessions were collected from the unique plant communities, which have formed on the areas of previous Soviet military bases closed for civilians for more than 60 years. (Aavola, Annamaa, 2005). As a result 296 seed samples of forage grasses (18 species) and 163 samples of forage legumes (7 species) were collected in 150 natural habitats.

Collecting missions to natural habitats of Estonia, Latvia and Lithuania are planned to continue. The possibilities for joint missions with N.I. Vavilov Research Institute of Plant Industry to northwest region of Russia are under discussion.

Characterization and evaluation

Characterization and evaluation of the accessions, as well as regeneration and multiplication

are carried out in cooperation with the breeding departments of the Jxgeva Plant Breeding Institute.

Descriptors for evaluation were selected from the descriptor lists developed by the working groups of the European Cooperative Programme for Plant Genetic Resources and the Bioversity International.

Characterization and evaluation of some crops such as wheat, barley and forages was started during the first period of the National Programme. For the description of tomato, oats and field pea the field trials were conducted 2007–2011.

Genebank took part in the project co-funded by the European Commission: Avena genetic resources for quality in human consumption (AVEQ). During 2007–2011 evaluation, characterisation and documentation of oat genetic resources was carried out by 15 project partners from nine European countries.

The project focused on traits relevant for the quality of oats in human consumption and on cold tolerance, which is important for oat in several regions in Europe. Traits important for the quality of oats in human consumption, like protein, fat, minerals, dietary fibre (especially β -glucan), antioxidants and phenolic compounds, and resistance to *Fusarium* infection and mycotoxin contamination of more than 600 genebank accessions representing 12 *Avena* species were evaluated in field and laboratory experiments. These traits are considered important for breeding high quality oat cultivars, in order to meet the increasing demand for healthy food in Europe.

Documentation of collections

Information on plant genetic resources is maintained in common on-line database SESTO, which is supported by the Nordic Genetic Resource Center. 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.

Essential international activities are participation in the European Cooperative Programme for Plant Genetic Resources (ECPGR) and in implementation of An European Genebank Integrated System (AEGIS). Estonian plant genetic resources

network has been remarkably improved because of effective cooperation with the ECPGR.

Further participation in international cooperation is highly prioritized activity to ensure consistent enhancement of genebanks and versatile development of local networks. More specific interaction with N.I. Vavilov Research Institute of Plant Industry and the Nordic Genetic Resource Center on preservation, pre-breeding and organisation of collecting missions shall be undertaken.

CONCLUSIONS

Conservation of national heritage, the plant genetic resources for food and agriculture, is a mandate of every stakeholder determined by international agreements. Genebank of the Jõgeva Plant Breeding Institute, Department of Plant Biotechnology EVIKA (Estonian Research Institute of Agriculture), Polli Horticultural Research Centre (Estonian University of Life Sciences), The Botanical Garden of the University of Tartu, Department of Gene Technology (Tallinn University of Technology), have formed the core of the Estonian plant genetic resources network under coordination of the National Plant Genetic Resources Committee to implement the plant genetic resources programmes for 2002–2006 and 2007–2013.

Estonian institutions dealing with preservation of plant genetic resources have fulfilled their obligations in accordance with the International Treaty and main goals of the European Cooperative Programme for Plant Genetic Resources.

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СБОР И СОХРАНЕНИЕ ГЕНЕТИЧЕСКИХ РЕСУРСОВ РАСТЕНИЙ ДЛЯ ПРОДОВОЛЬСТВИЯ И СЕЛЬСКОГО ХОЗЯЙСТВА ЭСТОНИИ

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Эстонское правительство отреагировало на глобальные усилия по сохранению и устойчивому использованию биологического разнообразия ратификацией международных соглашений и положило начало Национальной программе по генетическим ресурсам растений для производства продовольствия и сельского хозяйства. Сбор, выявление и сохранение генетического материалов эстонского происхождения, а также создание сети генбанков были основными мероприятиями Национальной программы. Так как генетические ресурсы растений составляют основу исходных материалов для селекционеров и ученых, проводятся систематические исследования для улучшения использования генетических ресурсов растений. Освещается деятельность по сохранению генетических ресурсов растений для продовольствия и сельского хозяйства в Эстонии.

Ключевые слова: генетические ресурсы растений, сохранение, генофонд, образцы, селекция растений.