



Accessibility and exchange of plant germplasm by Embrapa

Patrícia Goulart Bustamante^{1*} and Francisco Ricardo Ferreira¹

Received 3 March 2011

Accepted 27 June 2011

ABSTRACT - This paper presents information about the organizational structure of Embrapa's banks and collections of plant germplasm and lists the 14 projects that comprise the Plant Genetic Resources Network which houses about 200 000 access and correspond to a collection of 300 genera, 787 species (90 % exotic). The main goal of the Plant Genetic Resources Network is being a source of variability for breeders of nationally and internationally research institutions. The paper also presents the different ways of knowing and accessing the collection of plant genetic resources maintained at Embrapa. Special emphasis is given to the way of the researchers can import and export plant germplasm, including presentation of a series of accessions exchanged in the last 35 years by Embrapa Genetic Resources and Biotechnology. The paper also provides the necessary documents and specifies the step-by-step to exchange and quarantine of germplasm held by Embrapa Genetic Resources and Biotechnology.

Key words: plant genetic resources, germplasm banks, exchange and quarantine of plant germplasm.

INTRODUCTION

The integrated focus on genetic resources research began in the country with the creation of the National Center for Genetic Resources (Cenargen), now known as Embrapa Genetic Resources and Biotechnology. Since its creation in 1976, it has integrated activities of its research units, national and international universities and research institutions in the collection, conservation, characterization and exchange of germplasm throughout the country.

The result of this effort of over 30 years is reflected in collection and conservation of some two hundred thousand accesses. Half of this is in the long-term collection in Cenargen (-20 °C), designed to act as a back-up collection, with duplicates of each access stored in the Active Germplasm Banks preserving 107,000 accesses (in the field, cold chambers, and *in vitro*), corresponding to a collection of 300 genera, 787 species (90 % exotic). This

heritage is relevant to food safety in Brazil, with its main objective being to be a source of variability for breeders.

In January 2009, the genetic resources activities at Embrapa were organized within the National Platform for Genetic Resources. Plant genetic resources formed a project called Plant Genetic Resources Network (Plant Network). This network project is structured into 14 projects, and activities are carried out by 30 decentralized Embrapa units, in close cooperation with some 100 partners, grouping over 300 researchers. The Network's leadership is carried out by a committee made up of 14 researchers from nine Embrapa units, leaders of the projects comprising the Plant Network. Each of the projects is also managed by a committee formed by those responsible for Plans of Action, that in many cases coincide with the Trustees of the Active Germplasm Banks. Thus, the network structure allows a large exchange of information. Progress is tracked through biannual reports and meetings.

¹ Embrapa Recursos Genéticos e Biotecnologia, C.P. 2372, 70.770-900, Brasília, DF, Brazil. *E-mail: pgoulart@cenargen.embrapa.br

In the plant genetic resources network at Embrapa, besides management, there are three other transversal projects, under the responsibility of Cenargen: taxonomic collection and studies; in situ/on farm conservation and medium and long term conservation, including the Colbase, an in vitro collection and cryopreservation. In the network structure, the germplasm banks are organized according to the use of the species or according to related species: cereals and pseudo-cereals (under the leadership of Embrapa Wheat, RS), oilseeds, pulses and fiber (under the leadership of Embrapa Cotton, PB); vegetables and condiments (under the leadership of Embrapa Horticulture, DF), forages (under the leadership of Embrapa Beefcattle, MT), fruits (leadership of Embrapa Cassava and Fruitculture, BA), medicinal, aromatic plants and condiments (leadership of Embrapa Eastern Amazon), ornamental (leadership of Tropical Agro-industry, CE), forest species and palms (leadership of Embrapa Western Amazonia, PA); industrial species (leadership of Embrapa Genetic Resources and Biotechnology, DF) and roots and tubers (leadership of Embrapa Cassava and Fruits, BA). Each collection is under the responsibility of a trustee appointed by the president of Embrapa.

Accessibility to the plant genetic resources maintained by Embrapa

Interested users must visit the Plant Network site on the internet (<http://plataformarg.cenargen.embrapa.br/pnrg/rede-vegetal>) or contact the leadership of the Plant Network (redevegetal@cenargen.embrapa.br) or the Trustee's Supervision of Embrapa (curadoria@cenargen.embrapa.br).

If the user is interested in accessing the materials preserved by Embrapa in Germplasm Banks, the site Cenargen (<http://www.cenargen.embrapa.br/recgen/intercambio/organizacao.html>) can be accessed and requests can be sent to the germplasm exchange sector.

After receiving the request, the germplasm bank curators and product managers (employed by Cenargen) will process the request in compliance with the law and internal Embrapa rules.

According to Ferreira and Carlos (2009), one of the main activities of Embrapa Genetic Resources and Biotechnology is to carry out plant germplasm exchange and quarantine to meet the needs of the National Agricultural Research (SNPA). In this study, mainly the processes of importation and exportation of plant germplasm will be analyzed.

Germplasm exchange

Germplasm importation begins by filling out the request form for import of material for scientific research, available on the homepage www.cenargen.embrapa.br. The completed form is forwarded to the Sector of Germplasm Exchange at Embrapa Genetic Resources and Biotechnology, where the process is registered, receiving a sequential number followed by the year. This process is referred to the Curator of Genetic Resources for technical evaluation on the import requested. This is followed by a correspondence signed by the Head of Embrapa Genetic Resources and Biotechnology and registered with the Ministry of Agriculture, Livestock and Supply (MAPA) requesting permission to import. Once the import permit issued by MAPA is accepted, the Sector of Germplasm Exchange issues a letter along with the green-yellow label (Import Permit label) to the germplasm supplier abroad.

The material, which may come in the form of seed, cutting, in vitro or any other type of propagule is sent by the supplier and received in Brasilia, where customs clearance is carried out at the Internal Revenue Service and MAPA. A MAPA inspector prescribes quarantine and the material is sent to the Level 1 Quarantine Station of Embrapa Genetic Resources and Biotechnology.

Upon arrival at the Sector of Germplasm Exchange of Embrapa Genetic Resources and Biotechnology, the material is checked and registered in the genetic resources database and analyzed by several laboratories for mites, insects, weeds, fungi, nematodes, bacteria and viruses. After analysis, a phytosanitary report is issued and sent to be examined by a MAPA inspector who signs a quarantine release term. At this point, the material is ready to be sent to Quarantine Station of Embrapa Genetic Resources and Biotechnology.

Germplasm exportation is simpler than importation, since as a rule, there is no quarantine, with the process initiating by filling out a request form for export of scientific research material, available on the homepage www.cenargen.embrapa.br. The filled form is forwarded to the Sector of Germplasm Exchange of Embrapa Genetic Resources and Biotechnology, along with the material (seeds, cuttings, in vitro, etc), the import permit of the requesting country and the certificate of origin. The process is approved and given a sequential number followed by the year.

Upon its arrival at the Sector of Germplasm Exchange of Embrapa Genetic Resources and Biotechnology, the

material is checked and registered at the genetic resources database and then submitted to phosphine treatment (seed) or sanitary treatment with pesticide spray (vegetative propagation material). A sanitary report is issued specifying the product used, dosage and exposure time. This report with the material, the import permit and the certificate of origin are referred to the MAPA, which issues a plant phytosanitary certificate. With this document the material can be sent to the interest party abroad.

Both Import and export processes comply with current international and national legislation, mainly related to material property. For species listed in the International Treaty on Plant Genetic Resources for Food and Agriculture (TIRFAA), an SMTA (standard agreement for material transfer) must be signed. CGEN/IBAMA rules must be followed for species native to Brazil and Embrapa rules must be followed for exotic species.

Table 1 shows that during the past 3.5 decades almost 460,000 plant germplasm accessions were imported and 63,000 were exported. The internal transit between Embrapa Genetic Resources and Biotechnology and other Embrapa units, as well as other institutions, mainly from SPNA, has exchanged about 90 thousand accessions. Therefore, a total of almost 611,000 accessions have been exchanged during this period, totaling an annual mean around 17,000 accessions, with the vast majority being imports.

Table 1. Germplasm accessions exchanged (between 1976 and 2010) by Embrapa Genetic Resources and Biotechnology

Years	Import	Export	Internal	Total
1976-1979	11,338	4,706	8,720	24,764
1980-1989	105,958	24,344	33,264	163,566
1990-1999	145,922	20,861	19,607	186,390
2000-2010	195,660	12,801	27,794	236,255
Total	458,878	62,712	89,385	610,975
Percentage	75%	10%	15%	100%

The plant species presenting greater germplasm flow in the last years were: rice and soybeans (imports) and rice and cassava (exports). The countries that donated

most germplasm to Brazil were the USA, Argentina, France and Mexico, while the countries that received the most germplasm from Brazil during this period were the USA, Haiti, Peru, Colombia and France.

It is important to remember that, although Brazil holds the greatest biodiversity in the planet (Marques and Marinho 2007), it is highly dependent on exotic plant germplasm for breeding programs and related research, considering that the vast majority of products of economic and social importance for the country, is not native to Brazil. As a result, Brazil imports more germplasm than it exports.

Because of this genetic material imported, Brazil has good germplasm banks of several important agricultural products, providing leverage to the breeding programs, and allowing the development of new improved and more competitive cultivars. This certainly contributes to the sustainability of this thriving Brazilian agribusiness.

It must be noted that the exchange of all this material was carried out very effectively and successfully, considering that there has never been any escape of quarantined pests during this period, despite the fact that some highly publicized exotic pests for domestic agriculture were intercepted and/or eliminated in the quarantine analyses. According to Marques and Marinho (2007), the exchange of plant germplasm carried out by Embrapa Genetic Resources and Biotechnology is an orderly activity which, for nearly three decades, has always excelled, with increasing levels of efficiency and safety, incorporating new concepts and improved methodologies. Therefore, the advantages gained from adding this large plant germplasm collection to the genetic heritage of the country are evident.

The flow of genetic resources involves many details regarding import and export of plant germplasm exchange. Several stages are needed from the moment requirement for import and/or export permission with MAPA is made until the material is released, obviously including the preparation of the documents required, and the quarantine, weeds, insects, mites, mycology, bacteriology, nematology and virology analyses.

Acessibilidade e intercâmbio de germoplasma na Embrapa

RESUMO - *Este trabalho apresenta informações sobre a estrutura organizacional e o acervo dos bancos de germoplasma vegetal do Sistema Embrapa. São apresentados os 14 projetos que compõem a Rede de Recursos Genéticos Vegetais que abriga cerca de 200 mil acessos e correspondem a um acervo de 300 gêneros, 787 espécies (90 % de exóticas) e tem como principal objetivo ser fonte de variabilidade para o trabalho de melhoristas de instituições de pesquisa nacionais e internacionais. Em seguida, são apresentadas as diferentes formas de conhecer o acervo e acessar os recursos genéticos vegetais mantidos na Embrapa. Destaque especial é apresentado à maneira como se dá os processos de importação e exportação de germoplasma vegetal, inclusive com apresentação de uma série histórica dos acessos intercambiados nos últimos 35 anos. O artigo também traz os documentos necessários bem como especifica o passo-a-passo do intercâmbio e quarentena de germoplasma realizado pela Embrapa Recursos Genéticos e Biotecnologia.*

Palavras-chave: *recursos genéticos vegetais, bancos de germoplasma, intercâmbio e quarentena.*

REFERENCES

- Ferreira FR and Carlos M (2009) Intercambio de germoplasma vegetal na Embrapa, Brasil. In **7º Simposio de recursos genéticos para América Latina y el Caribe**. INIA, Pucón, p. 573-574
- Marques ASA and Marinho VLA (2007) Movimentação de germoplasma vegetal no Brasil – intercâmbio e quarentena. In Nass LL (ed.) **Recursos genéticos vegetais**. Embrapa Recursos Genéticos e Biotecnologia, Brasília, p. 145-168.