

Kingdom of Morocco



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National Plant Genetic Resources Conservation

Morocco Genebank
at INRA Settat

Overview



Located along the Atlantic ocean and the Mediterranean Sea, with the Rif Mountains in the North, the Atlas Mountains running north to south, and the Sahara on east and south of the Atlas Mountains, Morocco shelters a unique array of agroecosystems.

These contrasting environments, coupled with the rich history of the country, are the treasure house of an exceptionally rich biological diversity.

There are over 4500 species of higher plants (with 135 plant families, 940 genera and over 600 plant taxa as endemic), of which about 200 species are considered as rare or threatened.

Following the agreement by Morocco of the FAO Plant Genetic Resources Undertaking and the adoption of the Global Plan of Action on Plant Genetic Resources, INRA has developed a national genebank at its Settat Regional Center for medium and long-term conservation and utilization of plant genetic resources.

Objectives

A genebank committed to meet the following challenges



- ▶ Collection, conservation, characterization, and enrichment of plant genetic resources of cultivated, pastoral, aromatic and medicinal plant species, and their wild relatives.
- ▶ Multiplication, rejuvenation and evaluation of collected and conserved germplasm.
- ▶ Rational utilization of local and introduced plant genetic resources by the scientific community.
- ▶ Documentation of genebank collections by developing a centrally managed information system.
- ▶ Application of genetic markers technique to identify, characterize, evaluate and assess the genebank collections.
- ▶ Contribute to curb genetic erosion and increase public awareness.
- ▶ Conduct research in germplasm conservation, multiplication and adaptation.

Documentation and Management System



- ▶ The Documentation and Management System (DMS) is a powerful tool for scientists and decision makers. It helps in:
 - ➔ Providing information about genebank collections for both managers and users;
 - ➔ understanding ecosystem structure and function;
 - ➔ monitoring changes in flora; and
 - ➔ developing conservation strategies and action plans.
- ▶ MGB, in collaboration with ICARDA, has developed a database which is based on a model of genebank used at genetic resources unit of ICARDA.
- ▶ The system contains three types of data:
 - ▶ passport data that provide the identity of the accession;
 - ▶ evaluation and characterization data that describe the phenotype of the accession; and
 - ▶ management data that identify the storage location within cold rooms, the amount and quantity of seeds.
- ▶ The system also allows users to create tables, query all fields in the database, and create labels for storage and distribution.

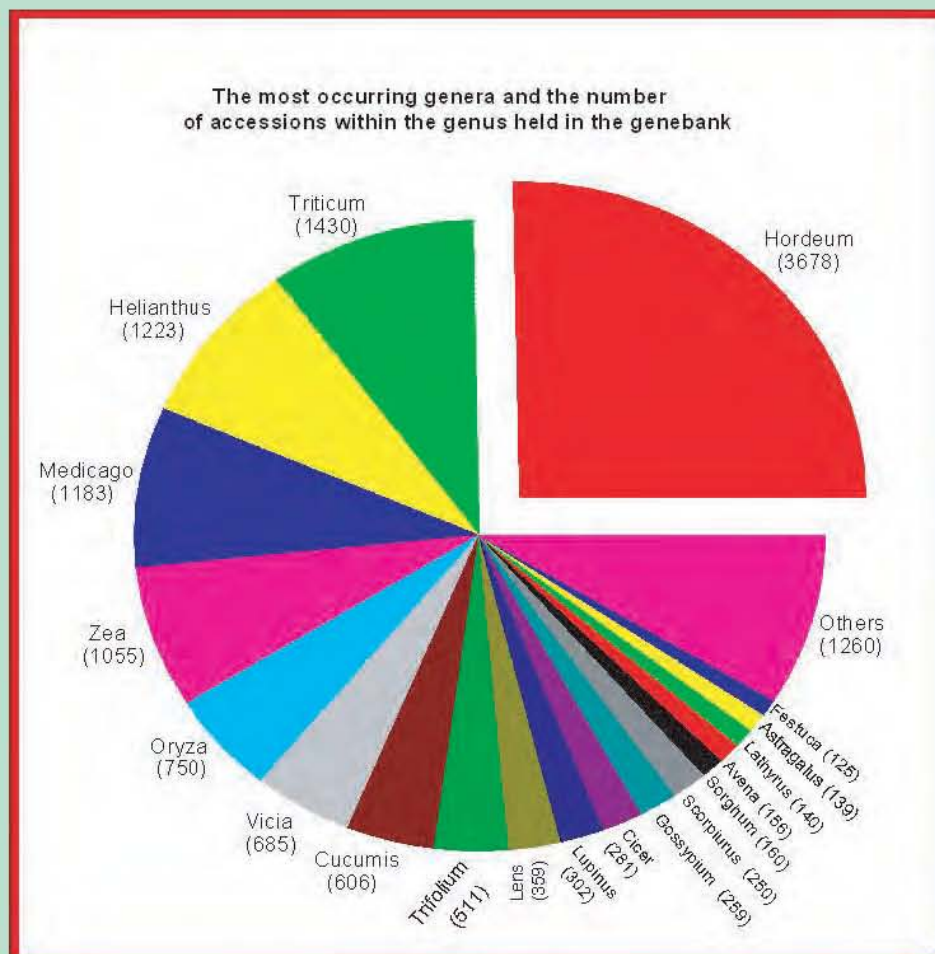
Documentation and Management System



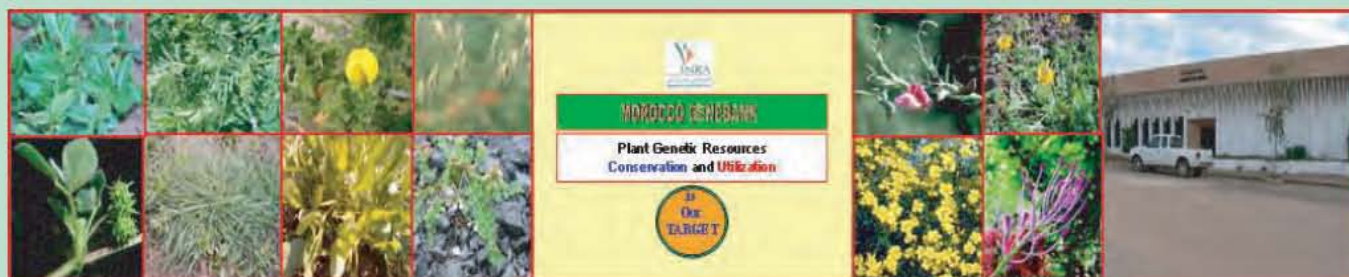
- The other system was developed by IPGRI in collaboration with INRA, and modified according to the needs of the Morocco genebank. This system is less data dependent and more integrated for managing genetic resources.
- ▶ The Genetic Resources Information System (GRIS) is subdivided into 9 major windows to provide information on:
 - ➔ Site;
 - ➔ Taxonomy;
 - ➔ Eco-geographic surveys;
 - ➔ Collected samples;
 - ➔ Germplasm management;
 - ➔ Germplasm import data;
 - ➔ Germplasm export data;
 - ➔ System properties; and
 - ➔ Design manager.
 - ▶ Most importantly, and in order to maximize both operation and data management efficiency, a barcode technology was incorporated into the system along with a remote and mobile technology to make use of PDA palm unit for digital survey forms.
 - ▶ A small program was created (Database Importer) to transfer data from ICARDA to IPGRI model.

Accessions Held in the Genebank

- ▶ The Settat genebank holds more than 14,552 accessions of different species (256), including cereals, forages, food legumes, cotton, melon etc. and their wild relatives.
- ▶ These accessions were transferred from different INRA research units or repatriated from International Institutions and Universities from all around the world.
- ▶ Eight genera held in the gene bank represent about 73% of the total accessions, namely, *Hordeum*, *Triticum*, *Helianthus*, *Medicago*, *Zea*, *Oryza*, *Vicia*, and *Cucumis*.
- ▶ The genus *Hordeum* accounts for more than 25% of total accessions available in the cold stores.



Genera Held in the Genebank



Genus		Genus		Genus		Genus	
Name	Number	Name	Number	Name	Number	Name	Number
Aegilops	83	Dactylis	120	Lens	359	Poa	4
Agropyron	2	Dasypyrum	1	Lepidium	4	Retama	1
Agrostis	3	Elytrigia	3	Linum	51	Sagisorba	3
Allium	1	Eragrostis	5	Lolium	46	Scorpiurus	250
Alyssum	3	Erucastrum	5	Lotus	63	Setaria	1
Anthyllis	36	Erysimum	1	Lupinus	302	Sorghum	160
Arrhenatherum	1	Faba	4	Lycopersicon	8	Stipa	3
Astragalus	139	Festuca	125	Medicago	1183	Tetragonolobus	1
Avena	156	Foeniculum	1	Melica	5	Thlaspi	1
Biserrula	18	Glebionis	1	Melilotus	42	Torilis	1
Brachypodium	4	Gossypium	259	Onobrychis	8	Trifolium	513
Brassica	4	Hedysarum	12	Ononis	1	Trigonella	57
Briza	3	Helianthus	1223	Ornithopus	10	Triticum	1621
Bromus	5	Hibiscus	30	Oryza	710	Vicia	772
Calendula	5	Hippocrepis	65	Panicum	5	Vulpia	1
Carthamus	13	Holcus	1	Phalaris	68	Triticosecale	3
Cicer	281	Hordeum	3677	Phaseolus	5	Zea	1055
Coronilla	38	Koeleria	1	Phleum	1	Others	11
Crambe	9	Lathyrus	140	Piptatherum	25	Total	Accessions
Cucumis	609	Lavandula	2	Psium	69	78	14552

Ex situ Conservation



- ▶ Morocco GeneBank (MGB) is well equipped to meet international standards for long-term preservation of germplasm.
- ▶ Considering the complexity of genebank management, MGB has access to expertise in seed physiology, genetics, molecular biology, biometrics, plant pathology, and entomology, through a multidisciplinary team of scientists of INRA.
- ▶ Collections of MGB are stored and distributed as seeds. MGB has various facilities:
 - ➔ Seed cleaning room: Seeds for storage should be clean and free from weeds, pests, and pathogens;
 - ➔ Seed drying chamber:
 - ➔ Temperature: + 18°C (adjustable)
 - ➔ Relative humidity: 10 to 15% RH
 - ➔ Chamber space volume: 42 m³.
 - ➔ Viability and germination testing:
 - ➔ Viability and germination monitoring test is required to ensure that seeds stored do not fall below acceptable levels of viability.
 - ➔ Regeneration should be undertaken when viability falls to 80% of the initial value during storage.
 - ➔ Active collection chambers:
 - ➔ Number: 2
 - ➔ Temperature: + 5°C
 - ➔ Chamber space volume: 289 m³, each.
 - ➔ Base collection chamber:
 - ➔ Temperature: - 18°C
 - ➔ Chamber space volume: 142 m³.
- ➔ Documentation and management system

Repatriation of Moroccan accessions

Country	Organization		Genera	Species
	Code	Name	Number	
Australia	ATFCC	Australian Temperate Field Crops Collection	7	80
	CIIA	Crop Improvement Institute of Agriculture	1	229
Netherlands	CGN	Center for Genetic Resources	3	96
Mexico	CIMMYT	International Center for the Improvement of Maize and Wheat	1	52
Syria	ICARDA	International Center for Agricultural Research in the Dry Areas	25	4130
Germany	IPK	Institute of Plant Genetics and Crop Plant Research	1	31
Czech Republic	Ruzyne	Research Institute of Crop Production	9	63
USA	NSGC	National Small Grains Collection, Idaho	6	704
	RPISTA	Regional Introduction Station, Iowa	20	77
	USDA	USDA-ARS, Pullman, WA	142	1211
Total			215	6673

Challenges Ahead: Molecular Biology Tools

- ▶ Despite significant progress in conserving plant genetic resources, much remains to be accomplished by the Settat genebank.
- ▶ The genebank will continue to seek and to collect new germplasm, but in the near future its activities will shift from rescuing the endangered germplasm to the active use of collections.
- ▶ Without active use, potentially valuable germplasm remains unexploited, and genebank becomes a museum.
- ▶ Efficient germplasm use requires active interaction among a multidisciplinary team of scientists, including genebank curators, plant biologists, and breeders.
- ▶ Efficient evaluation of the collection is a prerequisite for the successful exploitation of conserved germplasm.
- ▶ Recent progress in molecular biology techniques applied to plant genetic resources offers a powerful tool to tackle the problem. The development and use of these techniques will complement agro-morphological characterization currently used in the gene bank.





- ▶ A further challenge ahead in the conservation of plant genetic resources in Settat genebank is the conservation of species that are sterile and that must be stored as clones, and species that are highly heterozygous.
- ▶ The conservation approach to address these problems is the field genebanks, but this method cannot provide secure, long-term conservation.
- ▶ The genebank will pursue one of its strategic objectives namely developing and applying tissue culture and cryopreservation protocols to germplasm collections for long-term preservation.
- ▶ This collection will serve as a back-up in the event the material maintained is destroyed in the field due to biotic or abiotic stresses, or removed due to maintenance costs.



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