

intensive. To overcome this, core (10% of entire collection) and mini core collections (10% of core, and 1% of entire collection), representing the genetic diversity of cultivated crop species, were developed by ICRISAT scientists for most of the mandate crops and small millets. These collections have been extensively used by researchers to identify trait-specific germplasm for use in breeding programs.

Svalbard Global Seed Vault

Safety duplication ensures that a genetically identical duplicate accession is stored outside the country as a base collection for safety reasons. In an agreement with the Nordic Gene Bank (in partnership with Global Crop Diversity Trust), ICRISAT is in the process of depositing 110,000 of its accessions at the Global Seed Vault, Svalbard, Norway, over five years. The seed vault is located in a remote location within a mountain under the permafrost (-6°C) and cooled to approximately -18°C. The Global Crop Diversity Trust will be providing financial support for the packaging and shipping of samples. The first installment of 20,000 seed samples representing seven crops were deposited at the vault on 29 September 2008.

Germplasm adoption

In its efforts to conserve germplasm for posterity, ICRISAT has introduced a system of germplasm adoption by individuals to generate funds that will finance the huge operational costs of the ICRISAT genebank. As part of this program, individuals can 'adopt' germplasm accessions at a particular cost and contribute towards sustaining the genebank operations.

Conclusion

One of the long-term objectives of ICRISAT is to serve as the world repository for the germplasm of its mandate crops, including wild relatives, to reduce poverty, hunger and environmental degradation in the semi-arid tropics. The ICRISAT genebank has played a key role in restoring germplasm to national research programs in several countries to replace their lost collections. It has also promoted testing and release of several of its accessions directly as superior cultivars in different countries. Approximately 94,390 germplasm accessions were shared with cooperators in 144 countries. Out of this, NARS partners have released 609 varieties in 77 countries utilizing germplasm and breeding lines from ICRISAT.

Genetic resources

Conserving more than 119,000 crop accessions for posterity



About ICRISAT



The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that does innovative agricultural research and capacity building for sustainable development with a wide array of partners across the globe. ICRISAT's mission is to help empower 644 million poor people to overcome hunger, poverty and a degraded environment in the dry tropics through better agriculture. ICRISAT belongs to the Alliance of Centers of the Consultative Group on International Agricultural Research (CGIAR).

Company Information

ICRISAT-Patancheru (Headquarters)
Patancheru 502 324
Andhra Pradesh, India
Tel +91 40 30713071
Fax +91 40 30713074
icrisat@cgiar.org

ICRISAT-Liaison Office
CG Centers Block
NASC Complex
Dev Prakash Shastri Marg
New Delhi 110 012, India
Tel +91 11 32472306 to 08
Fax +91 11 25841294

ICRISAT-Nairobi (Regional hub ESA)
PO Box 39063, Nairobi, Kenya
Tel +254 20 7224550
Fax +254 20 7224001
icrisat-nairobi@cgiar.org

ICRISAT-Niamey (Regional hub WCA)
BP 12404, Niamey, Niger (Via Paris)
Tel +227 20722529, 20722725
Fax +227 20734329
icrisatnsc@cgiar.org

ICRISAT-Bamako
BP 320
Bamako, Mali
Tel +223 20 223375
Fax +223 20 228683
icrisat-w-mali@cgiar.org

ICRISAT-Bulawayo
Matopos Research Station
PO Box 776,
Bulawayo, Zimbabwe
Tel +263 83 8311 to 15
Fax +263 83 8253/8307
icrisatzw@cgiar.org

ICRISAT-Lilongwe
Chitedze Agricultural Research Station
PO Box 1096
Lilongwe, Malawi
Tel +265 1 707297/071/067/057
Fax +265 1 707298
icrisat-malawi@cgiar.org

ICRISAT-Maputo
c/o IIAM, Av. das FPLM No 2698
Caixa Postal 1906
Maputo, Mozambique
Tel +258 21 461657
Fax +258 21 461581
icrisatmoz@panintra.com

www.icrisat.org



INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS
Science with a human face

Introduction

Plant genetic resources are the foundation for crop improvement. Crop diversity in important food crops is being rapidly eroded mainly because traditional landraces are being destroyed or replaced by modern, high yielding cultivars; natural catastrophes (droughts, floods, fire hazards, etc), as well as large-scale destruction and modification of natural habitats harboring wild species. But genetic variation in traditional landraces and wild species is essential for crop improvement, especially to combat pests and diseases, and to produce cultivars better adapted to constantly changing environments. This is where genetic conservation plays a saving role.

Large-scale efforts were made across the globe to collect, assemble and conserve landraces, obsolete cultivars, genetic stocks and wild species important for crop improvement. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) responded to this need by establishing a Genetic Resources Unit in 1979.

The germplasm in the ICRISAT genebank at its headquarters in Patancheru, India, was assembled from 144 countries through donations from various institutes and by launching germplasm collection missions in areas of origin and diversity of the mandate crops, jointly with national agricultural research systems (NARS), universities and international institutes.

The genebank is engaged in assembly, conservation, maintenance, characterization, evaluation, documentation and distribution of germplasm of the mandate crops – sorghum (*Sorghum bicolor* (L.)



The ICRISAT genebank in Niamey, Niger.

Moench), pearl millet (*Pennisetum glaucum* L. R. Br.), chickpea (*Cicer arietinum* L.), pigeonpea (*Cajanus cajan* (L.) Millisp.) and groundnut (*Arachis hypogaea* L.) and their wild relatives; and six small millets – finger millet (*Eleusine coracana* (L.) Gaertn.), foxtail millet (*Setaria italica* L.), barnyard millet (*Echinochloa crus-galli* (L.) Beauv.), kodo millet (*Paspalum scrobiculatum* L.), little millet (*Panicum sumatrense* Roch. ex Roem. & Schult) and proso millet (*Panicum miliaceum* L.).

The ICRISAT genebank is one of the world's largest repositories for the genetic resources of its mandate crops, and at present conserves 119,074 accessions from 144 countries. All incoming germplasm samples are examined by the Indian Plant Quarantine Services with the assistance of the National Bureau of Plant Genetic Resources (NBPGR), India for exotic pests and diseases.

Facilities for conservation

The seeds of ICRISAT mandate crops and small millets can withstand desiccation to low moisture content. Therefore, seed storage is the principle method of conservation of their genetic resources. Seeds are stored in a controlled environment in the genebank to prolong seed viability. This process minimizes the frequency of regeneration, which is expensive and involves the risk of losing genetic integrity of accessions. The collections are stored in medium-term storage rooms maintained at 4°C and 20-30% Relative Humidity (RH) for distribution and internal utilization. The base collection is stored in the long-term conservation facilities at -20°C since 1991. Wild species of groundnut and chickpea, which do not produce adequate quantities of seeds, are maintained as live plants either in the special facility created, or in a greenhouse; and wild species of pigeonpea, sorghum and pearl millet, which do not produce



Seeds of ICRISAT mandate crops are the precious possessions of the genebank.



Testing germination of seeds between moist towels.

or produce very little seed, are maintained in the field genebank at ICRISAT, Patancheru.

To meet the demand for germplasm of mandate crops from African countries and to facilitate easy access to the germplasm collections, ICRISAT also established medium-term cold stores run at 4°C and 20-30% RH at Nairobi, Kenya; Bulawayo, Zimbabwe and Niamey, Niger to hold working collections, core and mini core collections and reference sets of composite collections.

Genebank operations

The initial step in *ex situ* conservation of germplasm resources is the assembly of germplasm. Germplasm collection and conservation are expensive. Hence, collections are undertaken only after a critical assessment of the need, and assembly is made only of unique landrace germplasm that is not already represented in the collection.

Conserved germplasm accessions are maintained by monitoring for seed viability and quantity at regular intervals. Accessions showing critical seed viability (<85%) and quantity in medium-term store (<50 g for cereals and <100 g for legumes) are regenerated as the situation warrants.

Characterization and evaluation of the assembled germplasm is done using a set of internationally accepted descriptors for stable botanical characters and a few environmentally influenced agronomic and quality traits. Characterization and evaluation of data facilitate preliminary selection of germplasm by users, while information on country of origin, location of collection and other passport data permits the selection of germplasm on geographic basis and identification of gaps in the collection for further exploration.

The Convention on Biological Diversity (CBD), which came into force on 29 December 1993 and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) of 29 June 2004, provide the framework for acquisition and utilization of germplasm. Consistent with Article 15 of the CBD, which recognizes the sovereign rights of nations over their biodiversity, collection and acquisition of germplasm are undertaken with prior informed consent, using Material Transfer Agreements (MTA) on mutually agreed terms.

Following the ITPGRFA, ICRISAT supplies germplasm to bonafide users free of cost. Germplasm samples are distributed under the Standard Material Transfer Agreement (SMTA), which prevents the recipients from claiming intellectual property rights.

Documentation is essential for good genebank management to allow efficient and effective use of germplasm. The data are maintained using relational database management systems (Genebank Information Management System-GIMS), which facilitate sharing and easy retrieval of information. ICRISAT also ensures access to the passport and characterization data by participating in the CGIAR's System-Wide Information Network for Genetic Resources (SINGER).

Core and mini core collections

Although there was an increase in the collections, there was no corresponding increase in their use by scientists, indicating that the collections were not being used to their full potential. The main reasons for this inadequate use are: large size of the collection, and the varied traits of breeders' interests, which require exhaustive and multi-locational evaluations that are both cost and time



Seed consignment ready to be shipped to the Svalbard vault.