Standards and best practices for genebank management

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Outline

• Introduction
• Historical context
• Revision of genebank standards
• Best practices
• Summary
State of *ex situ* conversation of plant genetic resources

- Over 1750 genebanks exist worldwide.
- About 7.4 million germplasm accessions conserved in *ex situ* collections,
- More than 70% of the genetic diversity of some 200-300 crops is already conserved in genebanks (SBSTTA, 2010)
- Establishment of the Svalbard Global Seed Vault, a last resort safety back-up repository of genetic resources to safeguard humanity.
- Geographic distribution of genebanks with holdings of >10,000 accessions
  - Source: WIEWS 2009; Country Reports; USDA-GRIN 2009, SOW2
Brief historical context of genebank standards

• Panel of Experts on Plant Exploration and Introduction (1975)
  • preferred and acceptable standard

• IBPGR Advisory Committee on Seed Storage (1985)
  • integrity of plant genetic resources collections but also the safety of staff working in genebanks

• FAO/IBPGR Experts Consultation Group on Genebank Standards (1992)
  • FAO/IPGRI Genebank Standards 1994
Process for revision of Genebank Standards 1

- The CGRFA at its 12th session agreed on the need for revising the *Genebank Standards* and requested FAO in cooperation with the ITPGRFA, CGIAR and other international institutions, to undertake this review.
- Bioversity and FAO prepared a first draft version together with GCDT, ITPGRFA and IPPC.
- Inputs sought from genebank experts.
- Revision of first draft and production of ‘draft revised Genebank Standards’.
Process for revision of Genebank Standards 2

- Further inputs sought and received from National Focal Points for CGRFA, ITPGRFA and ECPGR
- Draft submitted for information to the 4th Governing Body of the ITPGRFA in Bali March 2011
- Same draft to be considered by ITWG-PGRFA of the commission in April
- Final draft will be considered at 13th session of CGRFA in July 2011 for endorsement
Structure of draft revised Genebank Standard

- Preamble
- Introduction
- Underlying principles
- Standards for
  - Acquisition
  - Viability monitoring
  - Storage conditions
  - Regeneration
  - Characterization
  - Documentation
  - Distribution
  - Safety duplication
  - Security/personnel
- Annexes
Underlying principles

- Identity of accessions
- Maintenance of viability and genetic integrity
- Maintenance of seed health
- Physical security of collections
- Availability and use of germplasm
- Availability of information
- Proactive management of genebanks
What’s new and/or has changed?

1994 standards  Draft Revised standards

Definition of ‘standard’

Acceptable standards – in many cases minimal but adequate

Preferred standards – a higher and thus safer standard

One standard –
The lowest level of performance of a routine genebank operation below which there is a high risk of losing genetic integrity

(e.g. a probability of 5% or more of losing an allele in an accession over the storage period)
New standards for acquisition

• All seed samples are acquired legally with technical documentation in line with Treaty

• Have a minimum of associated data (FAO/IPGRI multi-crop passport descriptors)

• Period between seed collecting and transfer is as short as possible.

• Minimum size of a seed sample must capture 95 percent of alleles in the sampled population.
New standards for characterization

• Around 95 percent of accessions are characterized within five years of acquisition or the first regeneration cycle.

• Characterization should be based on standardized internationally agreed descriptor lists and made publicly available.
Drying conditions

Drying at 10-25 °C and 10-15 % RH

Drying at 5-20 °C and 15-25 % RH

• At a critical moisture level (CML), max longevity is attained and drying below this level does not increase seed longevity further

• Studies have shown that lowering storage temperature increases the critical moisture level, which suggest dangers of overdrying seeds if we dry at lower RH

• Various RH-temperature combinations for a given species. Important for genebank curators to clearly understand relationship to decide on best drying conditions.

• Still uncertainty among scientific community about lowest CML – more scientific studies required
Storage conditions

• Acceptable: Sub-zero temperatures (<0°C) with 3-7% seed moisture content (depending upon species).
• Preferred: -18°C or cooler with 3-7% seed moisture content (depending upon species).
• Use of any type of sealed moisture-proof containers

• Long-term conditions: -18 ± 3°C (MOS & safety duplicates)
• Medium-term conditions: under refrigeration at 5-10°C.
• All seed samples sealed in a suitable air-tight container in storage environment RH 15±3%.
Viability monitoring

- Carried out at (or soon after) receipt and subsequently at intervals during storage.

- Initial germination test should be carried out on a minimum of 200 seeds drawn at random from the accession.

- Germination should exceed 85% for most cereals & 75% some vegetables and lower for some wild or forest species.

- Conducted after cleaning and drying the accession or at the latest within 12 months after receipt of the sample at the genebank.

- Viability monitoring test set at 1/3 of time predicted for viability to fall to 85% of initial viability.

- Germination should exceed 85% for most cereals & 75% some vegetables and lower for some wild or forest species.
Regeneration

- Viability falls to 85% of the initial value.
- It is desirable to use 100 plants or more for regeneration to avoid the probability of large losses of alleles.
- Seeds used to plant material for regeneration should be as close as possible genetically to the original germplasm.
- Viability drops below 85% of the initial viability. The most-original-sample should be used to regenerate those accessions.
- The sample size of the accession to-be-regenerated contains a minimum number of plants which capture at least 95 percent of alleles with a minimum frequency of 0.05.
- Regenerated material should contain less than 1 percent of contamination.
- 50 seeds of MOS is archived in long term storage.
Other standards in brief

• **Documentation:**
  • Passport data of 100 percent of the accessions are documented, maintained in suitably designed databases and duplicate set maintained outside genebank

• **Distribution:**
  • in compliance with national laws and relevant international treaties and conventions; at least 95% of seeds and information are made available

• **Safety duplication:**
  • geographically distant area, under the same or better conditions than those in the original genebank

• **Security and personnel:**
  • risk management strategy in place; follow local Occupational Safety and Health protocols.
Best Practices on genebank management 1

- Required for effective genebank management and are necessary to achieve the genebank standards
- Should be harmonized among genebanks
- Yet they are not easily available
- Need for crop specific best practices

- These were the reasons for the development of the

http://cropgenebank.sgrp.cgiar.org
Best Practices on genebank management 2

- Nine crop specific best practices
- Regeneration guidelines for 21 crops
- General procedures for genebank management
- Strategies (e.g. genetic diversity, risk management, STOGS etc.)
- Learning resources - extensive selection of publications, guidebooks, training manuals, photos, videos
- Used as a training material for courses on genebank management
Best Practices on genebank management 3

- CGKB developed within World Bank funded project, coordinated by SGRP
- Collaborative effort with contributions from national and international genebanks and more than 100 individuals

Some further developments:
- New crop best practices (radish)
- Updated plant collecting guidelines
- Genebank documentation
- Core collection procedures

Number of visits to the crop genebank knowledge base
March 2010 - March 2011
Summary

- There has been a great increase in the number of genebanks worldwide.
- Genebank standards are needed to ensure that genetic resources are maintained in the most effective and efficient manner across collections.
- Genebank standards need to be based on sound scientific findings.
- For many standards there is still lack of evidence – more research required.
- Genebank standards also needed for other *ex situ* collections (Field GB, *in vitro*, cryo and DNA banks).
Best practices are needed to ensure that genebank standards are met.

http://cropgenebank.sgrp.cgiar.org

THANK YOU FOR YOUR ATTENTION