The Millennium Seed Bank Partnership (MSBP) Seed Conservation Standards for 'MSBP Collections'

Table of Contents

Introduction

To be recognised as a global resource and to satisfy the needs of anticipated users of collections and associated data, MSBP seed collections must be of the highest quality. The standards provide a framework to recognise **Millennium Seed Bank Partnership Collections** ('MSBP Collections'), including material not duplicated at Kew's Millennium Seed Bank. The standards assure users of the utility of the collections and provide a basis for technology transfer amongst partners and capacity development within the MSBP network.

Setting standards for seed conservation of wild plant species is particularly difficult. In comparison with most crop species, populations of wild plants tend to be heterogeneous, with widely spread flowering and fruiting times. This may affect initial seed viability and vigour and, consequently, seed longevity. Seed dormancy is frequently encountered, creating difficulties for germination testing. Many *ex situ* conservation programmes focus on collecting seeds from small populations of rare and threatened species, meaning that desired seed numbers are difficult to obtain.

The standards represent current best practice for long-term conservation of orthodox seeds. They draw on and reference various existing protocols and guidelines (see Annex). Such protocols may have been developed for a particular activity (e.g. seed testing), a particular set of species (e.g. sampling guidelines for rare and endangered plants), or to meet the needs of regional networks.

The twenty standards (1.1-7.1) cover all stages (1 - 7) of the *ex situ* conservation process and indicators are proposed for each with the exception of those marked*. Partners meeting the MSBP

Seed Conservation Standards may share accession data via the MSBP Data Warehouse following the MSBP Seed data resources and glossary (document available from the MSBP website).

The Seed Conservation Standards

1_Collections

Seed, herbarium vouchers and data are collected to recognised protocols or guidelines:

1.1. Genetic materials, including traditional knowledge, are legally collected and conserved
1.2. Collection names are verified (ideally by reference to a herbarium voucher specimen)
1.3. Genetic diversity of sampled population is adequately represented
1.4. Essential field data is recorded
1.5. Survival of source population is not compromised

Indicators:

- Copies of agreements and permits showing that genetic materials have been collected in accordance with all applicable laws, including consent from government and landowners
- Herbarium voucher material collected from same population as seeds (or field verification made)
- Agreement with appropriate herbarium to verify herbarium voucher
- Data records for: verifier, date of verification, name and authority used
- No more than 20% of the available, ripe, seeds are collected
- Field data records

2_Processing

Seed collections are accessioned, dried and processed according to recognised protocols or guidelines:

2.1. Unique accession reference number is assigned to all incoming material
2.2. Collections are placed in a dry environment of 15% relative humidity (RH) ± 3%, 15°C ± 3°C, within 4 weeks of collection. Immature seeds are ripened before drying; short-lived and/or microscopic seeds (e.g. *Salix*, *Populus*, orchids) are dried within 1 week of collection.
2.3. Collections are cleaned to remove empty, poorly-developed and insect-infested seeds and debris
2.4. Purity is assessed by X-ray and/or cut test

Indicators:

- Data records for seed maturity, drying, cleaning, X-ray/cut test

3_Storage and Duplication

Seed collections are stored and duplicated according to recognised protocols or guidelines:

3.1. Seed collections are banked as soon as possible after drying to equilibrium with 15% RH ± 3%, 15°C ± 3°C, and within 6 months of collection. Short-lived and/or microscopic seeds (e.g. *Salix*, *Populus*, orchids) are banked within 2 weeks of drying
3.2. Collections are held in air-tight (hermetic) containers
3.3. Collections are stored at -20°C ± 3°C
3.4. Collection size is monitored to ensure that sufficient potentially viable seeds are available for effective management and distribution to users
3.5. Collections are duplicated at -20°C ± 3°C after drying to equilibrium with 15% RH ± 3%, 15°C ± 3°C at a second, geographically-separate, facility or reason for non-duplication recorded (reasons include: low seed number, accession being regenerated and/or on priority list for recollection)

Indicators:

- Records of container testing
- Functioning cold storage facilities (freezers, cold room)
- Agreement in place with second seed bank
- Notification of Transfer (NOTs) records
- List of non-duplicated materials, with justification
- Collection size (i.e. seed number) data

4_Viability Monitoring

Seed viability is monitored according to recognised protocols or guidelines:

4.1. Initial viability is tested, preferably by germination test, and monitored at least every 10 years
4.2. Management decisions (including to regenerate or re-collect) are implemented if initial viability is below 85% and if/when collection quality drops to 85% of initial viability*

Indicators:

- Data records for date of receipt and date of viability testing
- Germination test results (including data on fresh, un-germinated seeds and empty/incompetent seeds if applicable)
- Regeneration/re-collection lists

5_Data Management

5.1. A data management system, using recognised seed bank data standards, is in use and capable of export in standard format

Indicators:

- Database records with mandatory fields completed

6_Distribution

6.1. Collections are available for use (under an appropriate Material Supply Agreement), at least in country where banked
6.2. A distribution policy, with appropriate risk management for pests, diseases and potentially invasive species, is in place and applied

Indicators:

- Distribution policy available
- Distribution data available

7_Seed Bank Management

7.1. Risks to collections are accurately assessed and appropriate mitigation procedures are in place for significant risks.

Indicator:

- Risk assessment strategy in place against major threats e.g. power cut, fire, flooding, earthquake

Annex

Relevant protocols, guidelines and references:

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ISTA (2021) *International Rules for Seed Testing, Edition 2013*. ISTA, Switzerland. URL: https://www.seedtest.org/en/international-rules-for-seed-testing-_content---1--1083.html

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Seeds of Success (2018) *Bureau of Land Management Technical Protocol for the collection, study, and conservation of seeds from native plant species for Seeds of Success*. URL: https://www.blm.gov/sites/blm.gov/files/uploads/SOS%20Protocol%206.20.18.pdf