NordGen

Operational Genebank Manual

Nordic Genetic Resource Center

Contact:
NordGen
Växthusvägen 12
234 56 Alnarp
Sweden
Phone: +46 40 536 640
e-mail: info@nordgen.org

http://www.nordgen.org
https://www.facebook.com/nordgen
https://www.instagram.com/nordgen

0 Date of compilation

Day/month/year: 08/05/2024

The Quality Policy and Quality Management System of NordGen

NordGen's Quality Policy

The Management Group is setting the quality policy which is then approved by the Director.

NordGen's quality policy is:

- To ensure that the organisation has the capability to reach the overall aim of securing conservation and sustainable use of genetic resources in the Nordic countries.
- To ensure that all staff has the necessary competence and resources (equipment, software etc.) to be able to fulfil their respective tasks within the overall strategy of NordGen.
- To strive for being known for our knowledge and service regarding genetic resources for the Nordic countries.
- To strive to always act as a professional project partner.
- To make sure our activities are documented in order to be traceable.
- To ensure that the equipment is calibrated and/or verified at regular intervals and works properly.
- To take care of seed requests as well as other questions or requests from external sources as fast as possible
- To always strive for quality in the daily work and to encourage all staff to be creative, solution minded and work for continuous improvements.

NordGen's Quality Management System

NordGen has a functioning Quality Management System (QMS).

The QMS of NordGen is based primarily on AQUAS, ISTA and ISO9001 standards.
NordGen is a member of AEGIS and AQUAS is the quality system of AEGIS that all members should follow.

The main parts of the ISO9001 standard have been implemented in NordGen's QMS but currently there are no plans to get ISO-certified.

The basis of quality assurance that is central in both AQUAS and ISO9001 is the PDCA-cycle (Plan-Do-Check-Act).

The aim of NordGen's QMS

The aim of NordGen's Quality Management System is to ensure that the organization works according to well-defined procedures to get correct and reproducible results. With documented procedures it is easier to transfer knowledge to new staff members and to make sure everyone performs a certain task in the same way. Stakeholders, collaborative partners, and customers shall feel trust in the work of NordGen.

The structure of NordGen's QMS

The QMS of NordGen consists of:

- The overall Quality manual (QM).
- Procedures (P) with policies and principles for the quality work as well as for communication, acquisition of material, collection of wild material, regeneration, seed requests, monitoring seed viability, taxonomy, and naming in GENBIS.
- Working instructions (WI) with more detailed step by step instructions on how to perform a work task.
- Forms for the documentation of monitoring of equipment, calibrations, examinations etc.

The documents in the QMS are controlled in terms of how to prepare, approve, save, and distribute them as well as how to keep track of changes and make sure everyone uses the latest version.

Responsibilities

The Director of NordGen has the overall management and leadership of NordGen, including the responsibility of the economy, legal provisions, and staff. The Director can delegate responsibilities to others. The Director also has the overall responsibility for the QMS management and for assuring that the QMS is given the necessary resources.

The Extended Management Group of NordGen is responsible for setting the strategic direction for NordGen and the responsibility of the effectiveness of the QMS, for approving and communicating the quality policy.

The Quality Manager (responsible staff member) is responsible for keeping documents in the QMS up to date, for handling non-conformities, for assuring that internal audits are planned and performed and for reporting the quality work at least yearly to Director/Extended Management (at the Management review).

All staff at NordGen are responsible for working according to the QMS: to create and follow the procedures and working instructions in their respective field and update them if needed, to report and act on non-conformities, to know the quality policy and work in line with that.

1 Germplasm Acquisition and Accessioning

Genebanks can obtain the germplasm they want to conserve through a number of different ways. Conducting collecting missions is possibly the best way of acquiring germplasm material in the most reliable manner. Germplasm exchange with other genebanks is a third route to add genetic diversity to the collection. Obtaining and storing germplasm from researchers and plant breeders is another route to acquire genetic material. Such acquisitions should be guided by a formal mandate that the genebank concludes with its host organization or government and that provides the basis for a genebank acquisition policy. The actual accessioning of acquired germplasm samples, i.e. formally including it into the collection with its unique accession number, is a complex process during which the curator has to check a number of aspects such as the verification of the identity of the material, the health status, the availability of pertinent information, etc. It is further understood that also legal aspects form part of this activity, e.g. was the material collected/obtained in legal manner, are there any restrictions on its use, etc.

Box 1.1 Germplasm Acquisition and Accessioning

GA1 - Briefly describe any formal mandate that your genebank might have concluded with or received from your "mother organization" (e.g. institute, governmental body).
(*This description should include details on:*

a) *which species you conserve and make available;*
b) *who decides on what your mandate is and, if different,*
c) *from whom do you received the mandate;*
d) *the main aspects of the mandate; and*
e) *legal considerations on PGR as foreseen in national legislation).*

NordGen is a research institute under the Nordic Council of Ministers and are given their mandate through statutes signed by the five Nordic Governments (Denmark, Finland, Iceland, Norway, and Sweden). NordGen includes three sections, each dedicated to different types of genetic resources: Forests, Farm animals and Plants. The gene bank is part of the latter.

The mandate of the plant gene bank includes genetic resources for food and agriculture as well as ornamental plants. All material must be of Nordic origin or of Nordic relevance. The responsibility for conserving genetic resources in

the Nordic countries is divided between NordGen and the national programmes for genetic resources (or equivalent) in each country and is described in detail in the document "Responsibilities and tasks of NordGen and the Nordic national programs for plant genetic resources. A clarification document". NordGen is responsible for seed propagated plants and potatoes, while each individual country is responsible for clonally propagated plants.

Material included in NordGen's active collection is made available to users in the Nordic region, as well as internationally, under the Standard Material Transfer Agreement (SMTA) of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). The Nordic countries have signed the Kalmar declaration agreeing that "all accessions of the Nordic Gene bank[1], except for security collections held by NGB[1] for other gene banks, are under common Nordic management and in the public domain".

GA2 – Specific agreements. Does your genebank have any specific formal agreements with other genebanks regarding the conservation of specified germplasm?
(*This should include:*

a) *whether or not your genebank has any international agreements to conserve specified germplasm on behalf of other countries,*
b) *a specific region, and/or*
c) *the world*), and
d) *which crops or genepools fall under these agreements?)*

NordGen conserves safety-duplicates of accessions from other gene banks under specific black-box agreements (see Agreement for safety duplicates at NordGen-ver2). Currently we have agreements with organisations in Estonia, Finland, Israel, Latvia, Lithuania, Myanmar, Netherlands, Norway, Spain and Sweden.

GA3 - In case your genebank has a germplasm acquisition policy, what does the policy entail?

a) please specify which crops or which geographic area, if applicable.

NordGen has a procedure document on acquisition within its quality assurance system (see P.03.01), which describes the principles regarding acquisition, the type of material that can be accepted into the collection and the requirements regarding the material and associated documentation. NordGen accepts cultivars, landraces, Crop Wild Relatives (CWR), and research and breeding material and all material should be of Nordic origin or Nordic relevance.

GA4 – How do you verify the identity of the germplasm material received (e.g. relying on the donor's information, comparing material with other accessions, involving (taxonomic) expertise, etc.)?

[1] The Nordic Gene Bank, abbreviated NBG, has from its inauguration in 1979 worked to conserve plant genetic resources. Since 2008 it is part of NordGen, which has a mandate to conserve not only plant genetic resources but also the genetic resources of farm animals and forestry.

The seed purity and taxon are checked by the staff at the seed laboratory when processing the incoming seeds (see WI.300.02.00). If the seed laboratory identifies any taxonomic uncertainties, a sample of the seeds are sown and, if the relevant taxonomic expertise is not available at NordGen, a taxonomist is invited. The taxon is also checked during regeneration. For other information about the accessions, we rely on information from the donor.

GA5 – Describe if and how you conduct an assessment of the various quality aspects of the seeds, tissue culture or plant material received.
(*This description includes:*

a) *quality aspects related to the correct identification of a given accession, but also*
b) *health*
c) *purity aspects of the sample/accession*), and
d) *use of a quality control system (e.g. ISO).*

The new material always follows any phytosanitary regulation applicable to it. In the seed lab, technicians ensure that the seeds are of the correct species and that the sample is pure seeds. A visual inspection of the seeds is made to identify problems such as insects, fungi, or diseases. During regeneration, all accessions are monitored.

Potato accessions introduced into the *in vitro* collection are always tested for the presence of diseases and, if necessary, undergo a virus elimination process. Potato accessions are also identified by their morphological characteristics and by DNA-fingerprinting.

GA6 – Describe whether and how the SMTA is being implemented.

a) Extent of materials covered by SMTA (crops, numbers of accessions)
b) Ways of SMTA implementation and documentation of transfers of PGR
c) *Other aspects (e.g. monitoring, supervision)*

NordGen uses the SMTA of the International Treaty for Plant Genetic Resources for Food and Agriculture (TPGRFA) for all accessions in the collection, both for species included and not included in Annex 1 of the ITPGRFA. All transactions are registered in our gene bank information system, GENBIS, and accessions of Annex 1 taxa are reported to the ITPGRFA secretariat.

A subset of the collection is made available each year to hobby growers also with the SMTA, and in addition they receive an information letter that in layman terms describes the restrictions and obligations for the use of the seeds.

Box 1.2 Germplasm Collecting

GC1 – Describe here the details of the strategy that you follow in implementing germplasm collecting missions.
(*This description should include:*

a) *general aspects of planning and implementing a collecting mission,*
b) *the criteria you use for priority setting;*
c) *the actual strategy followed in sampling material from farmers' fields, from nature, etc.; and*
d) *how your germplasm acquisition policy underpins the mission*).

Planning and implementation of collection missions takes place in cooperation with Nordic experts and stakeholders (see WI.350.01.00), either within projects or as part of the activities within NordGen's working groups[2]. The working groups, in cooperation with the plant experts at NordGen, play a central role in evaluating what material is missing from the collection and prioritizing collection activities.

Guidelines for seed collection missions is given in NordGen's QA documents, where also minimum standards for collection in wild populations are defined (see WI.350.02.00). For example, sampling should not endanger the health and survival of the natural population, appropriate permissions should be acquired, sampling should be done from at least minimum number of plants and adequate documentation should be collected.

SE2 – Provide any additional information on the germplasm collecting activities of your genebank, including the collaboration with others.

The most recent collection missions have taken place within a Nordic project on Crop Wild Relatives (CWR). The project includes experts from all the Nordic countries and common efforts have been made regarding prioritization of CWR taxa and identification of gaps. Seeds have been collected by local experts in each country (Denmark, Finland, Iceland, Norway, and Sweden).

2 Ensuring Security

This chapter refers to the security of the genebank structure itself (i.e. its physical security), the safety of its germplasm (i.e. the maintenance of viability) as well as the institutional and personnel security, aspects which together will ensure the long-term conservation of the entire collection.

2.1 Physical Security

To ensure the physical security of the collections, the following aspects are regarded as essential elements for achieving the objective:

Box 2.1.1 Safety Duplication (of long-term conserved germplasm)

SD1 - Please describe how your genebank implements the safety duplication

[2] NordGen has eight working groups focused on different crop groups. Each working group has one or two experts from each Nordic country, and they meet two times each year, one online and one in person.

of your germplasm material.
This description should include the following aspects:

a) The type of safety duplication (e.g. black-box; no specific arrangement; other);
b) The location(s) where you store your safety duplicates (country; genebank);
c) Whether or not you are using a formal agreement with the genebank(s) that store your duplicates?
d) Whether the safety duplicates are stored under conditions comparable to your own? Please provide details;
e) *Do you maintain safety duplicates from other genebanks at your genebank? If so, do you know any details of that material?*)

NordGen's seed accessions are stored in three locations: Active storage in Alnarp in Sweden, First Duplicate storage in Flakkebjerg in Denmark and Safe storage in Svalbard Global Seed Vault (SGSV). All Active Core* accessions should be stored this way (see WI.410.05.03).

NordGen has a formal agreement for storing safety duplicates with AU Flakkebjerg, a part of Aarhus University in Denmark. NordGen is responsible for the samples, which are not stored as black boxes. The samples are kept at the same temperature and in the same type of aluminium-plastic composite bag as in the Active storage, but they are packed using a vacuum sealer, which is not done for any other storage type.

SD2 – Do have a safety duplication policy? If so, please provide essential details.

All Active* accessions should be safety duplicated. Accessions that are part of the Active core collection should be duplicated at Flakkebjerg and Svalbard (see WI.410.05.01).

** The accession status determines how an accession is maintained at NordGen: how it is stored, whether it is distributed, germination tested, and regenerated. Accession status is given for each accession in GENBIS and can be as follows:*
***Active Core** – Accession accepted for long-term conservation and maintained under optimal conditions.*
***Active** – Accession accepted and maintained under optimal conditions, but only until the seeds lose germination ability (no regeneration).*
***Inactive (Historical)** – This status applies to accessions that do not fulfil the requirements for Active status.*
***Material in transition (MIT)** – This status applies to accessions temporarily stored at NordGen under a specific agreement (MIT contract). Distribution of the material, or certain data, is not allowed during this period.*
***Incoming** – Awaiting decision. Given when it is not clear if an accession should be accepted into the collection and what status it should have.*
***Pending (PEN)** – Replaced by Incoming. This status is not used any longer.*

Box 2.1.2 Structure

SS1 - Please provide details on how your genebank building has been designed to resist natural disasters (e.g. earthquakes; flood; storm).

NordGen is located within a geologically and climatically stable region. Earthquakes in this region are exceedingly rare and of low magnitude. The gene bank's building is situated about 1.5 km from the coastline, 9 m above sea level, so it is not threatened by floods. The gene bank building is new, designed specifically for this purpose and meets all the official building code requirements for the area in which it is located.

SS2 - Please describe the security arrangements that you have in place to protect your genebank against burglars, fire and others.
(*Please include details on the following arrangements, as applicable:*

a) *Fences;*
b) *Security doors;*
c) *Alarm system;*
d) *Fire detectors;*
e) *Standby generator;*
f) *Others (please specify*).

NordGen has implemented all measures to ensure the maximum security of the gene bank, including those listed above. For security reasons, we do not provide details of these measures.

SS3 – Please provide information on any other structural security aspects that you might have in place.

None

Box 2.1.3 Security Equipment

SE1 - Provide details on the kind of emergency (back-up) equipment or arrangements that you have in place to ensure permanent electricity and cooling.
(*Aspects to consider are:*

a) *"back-up" compressors for your cold rooms;*
b) *generator;*
c) *regular maintenance and trial runs;*
d) *other*).

NordGen has an emergency generator and backup system for cooling.

SE2 – Describe how you monitor temperature and relative humidity in your cold stores and drying room?

Temperature loggers in all temperature-critical rooms and freezers, which are

connected to a centralized database. This monitoring system allows for continuous tracking of temperature conditions in these areas.
Additionally, in the drying room, NordGen logs not only temperature but also relative humidity. By monitoring both temperature and relative humidity, NordGen ensures precise control and management of the drying process to achieve the desired moisture content in the seeds.

The temperature loggers utilized by NordGen provide valuable data that is not only collected but also stored for further analysis and tracking over time. To ensure efficient data management, NordGen hosts its database in the cloud using Microsoft SQL Server. By leveraging cloud-based infrastructure, NordGen benefits from virtually limitless storage capacity, allowing for the accumulation and retention of extensive data.

Box 2.1.4 Institutional and Personnel Security

IPS1 – Provide details on the "institutional security", in particular with respect to the provision of financial means to operate the genebank
Aspects to consider are:

a) *timely transfer of funds from the "mother" organization to the genebank;*

NordGen receives base grants from the Nordic Council of Ministers 4 times a year (quarterly)

b) *do you have direct access to the "mother" organization that provides the budget?*

No

c) *internal "security" of accessing these funds;*

Payment of the grants is followed up by a check of payment date. The funds are distributed per month.

d) *long-term security and stability of funding (compensation of inflation rates, avoiding variation in years)*

NordGen's continued operations and development need additional external project funds to carry out activities connected to the backlog, among other things. The Swedish inflation has affected NordGen strongly as the local currency is very weak.

e) *any other observations that are relevant in this context*.

IPS2 – Describe how you secure adequate staffing of your genebank is?

The staff is highly qualified in key areas for the operation of the gene bank. The majority of employees that are specialists in gene banking are employed on permanent contracts and the administrative staff are employed on Nordic

contracts for 8 years.

Box 2.1.5 Contingency Plans:

CP1 - Describe the kind of emergency or contingency plan that your genebank has in place to cope with disaster situations.

NordGen is actively working to improve the working environment and has routines in place for emergencies. NordGen has set up a Working Environment Group. The group works to ensure that the laws and requirements regarding the working environment at NordGen are followed. The group works for a good working environment and contributes with information in this area. The group updates governing documents and arrange training in Cardiopulmonary resuscitation, defibrillators and first aid. NordGen has a Working Environment Policy and Working Environment Manual (see WI.941.01.01, WI.941.01.02, WI.941.01.03).

NordGen also has a Crisis Management Group. The group works to develop routines in case of disasters and crisis events. (See NordGens policy – Crisis management and first aid)

CP2 - Provide information on the kind of training, security drills and other activities that your genebank gives to its staff to deal with emergency situations, if any.

Every year a fire drill is held together with the Fire Service.

3 Germplasm Maintenance

This chapter deals with key aspects of managing germplasm in a genebank, i.e. the maintenance of the viability, the genetic integrity, the availability of the conserved germplasm as well as the management of the corresponding information. Given the fact we are covering seed, in vitro cultures, and entire plants it might well be that not all aspects are covered by one and the same genebank. In those cases it is suggested that only the applicable sections are completed. Accordingly, at the beginning of each section of this chapter you will find a “navigation box” (highlighted in yellow) that will help you as user of the template to complete the correct section(s).

3.1 Maintenance of Viability

This section refers to the maintenance of the longevity of the seeds or of tissue cultures or living plants in storage. A high initial viability is the most important pre-condition for achieving the longest lifespan of seed accessions in storage, hence maximum efforts need to be taken to ensure that seeds to be stored have the highest possible viability. Optimum growing conditions when multiplying/regenerating the accessions, efficient management of the preparatory steps before storing the germplasm, adequate storage conditions as well as proper monitoring of the viability are critically important.

A. Seed Collections

Box 3.1.1.A Initial seed viability

IV1 - Describe the procedures or practices that you have in place to ensure the highest possible initial viability of your seed, in particular during regeneration and post-harvest (e.g. cultivation practices, pollination aspects, use of specific equipment as shelters, storage of harvested seeds, cleaning, etc.).

Regeneration is done to ensure high quality and high viability of the harvested seeds. All important tasks during regeneration are documented in GENBIS. It is important to always aim for optimum growing conditions during cultivation. The regenerated accessions are therefore visually inspected on a regular basis throughout the whole regeneration period, to ensure good vigour and health. Parameters include watering, binding, fertilization, control of pests and diseases and correct harvest time. Knowledge about appropriate pollinators for different crops/species is also crucial, as well as flexibility regarding the needs of specific crops/species, for example rain cover during the seeds' ripening period.

During intermediate harvest and post-harvest before threshing, the harvested material is stored in a drying room, in room temperature and in relative air humidity of 30%.

IV2 – Describe procedures how you deal with a) dormancy and b) hard seeds?

Dormancy in seeds is broken using various methods depending on the specific taxa. NordGen stores the information on how to pre-treat seeds in GENBIS. This resource provides guidance on the appropriate techniques to overcome seed dormancy and problems with hard seeds for different accessions.

Some of the common methods used to break seed dormancy and deal with hard seeds include:

- Scarification: This involves chipping or nicking the seed coat to allow moisture to penetrate and promote germination.
- Gibberellic acid treatment: Gibberellic acid is applied to seeds to stimulate germination by breaking dormancy.
- KNO3 treatment: Potassium nitrate (KNO3) is used as a chemical treatment to overcome seed dormancy in certain taxa.
- Stratification: Seeds are subjected to a period of cold and moist conditions to simulate winter conditions, which helps to break dormancy and promote germination.

By referencing the Inventory Viability Rule in the GENBIS data table, NordGen can determine the appropriate pre-treatment methods for specific accessions, ensuring the successful germination and propagation of seeds with dormant characteristics.

IV3 – Please provide any other information on procedures that you follow to ensure highest possible initial viability.

By documenting and storing the viability methods in GENBIS, NordGen maintains an up-to-date resource that outlines the appropriate procedures for conducting viability tests. The viability methods describe the specific techniques, protocols, and criteria to be used when evaluating the viability of seeds for each taxon.

Box 3.1.2.A Seed Viability Monitoring

VM1 - Describe the routine seed viability monitoring system that you use.
(*The monitoring system should include the following aspects:*

a) *frequency of testing;*
b) *sampling method applied;*
c) *any thresholds that you use;*
d) *whether you apply different procedures for crops/species with erratic initial viability or irregular viability lifespan;*
e) *etc*).

a) All new seed lots undergo testing to assess their quality and viability. After the initial testing, a regular testing schedule is implemented. In most cases, the frequency of testing is every 10 years, ensuring that the viability and quality of the stored seeds are periodically evaluated. However for Accession of taxa; *Triticum aestivum* subsp. *aestivum*, *Hordeum vulgare* subsp. *vulgare*, *Hordeum vulgare* subsp. *spontaneum*, *Avena sativa*, *Pisum sativum* subsp. *sativum*, *Pisum sativum* var. *arvense*, the testing frequency is extended to every 25 years if the last test results indicated a viability of 85% or higher. This adjusted testing schedule takes into account the relatively higher stability and longevity of these species' seeds, allowing for longer intervals between viability assessments (see P.03.11).
b) 50 seeds are used for viability testing. If the result is below the minimum accepted percentage, a new test is performed using an additional 50 seeds.
a) NordGen follows the viability directives set by the European Union (EU) for crops covered under the directive. These directives outline the minimum viability requirements for specific crops. However, for species that are not covered by EU's directive, a minimum viability of 85% is generally used as a standard. Exceptions to the 85% viability threshold can be made in cases where the accession is known to have difficult germination characteristics. In such instances, the person responsible for the accession may consider a lower viability percentage acceptable based on the specific requirements and challenges associated with that accession.
To ensure accurate documentation, the minimum viability percentage per accession is stored in GENBIS. This database serves as a comprehensive record including relevant viability information, enabling efficient management and retrieval of data related to seed viability (see

P.03.04).
b) Yes, see point C.

VM2 - Please describe the information "system" that you might have in place that allows you to make more species or even accession-specific decisions when the next monitoring should take place.

NordGen utilizes GRIN-Global as the foundation for recording and managing its seed collection. GRIN-Global is a comprehensive system that facilitates the organization and retrieval of information, including seed-related data. Within GRIN-Global, NordGen can record and access various details about the seed lots, including viability test results and protocols. The system provides functionality for managing seed-lot decisions, allowing NordGen to make informed choices regarding the storage, utilization, and distribution of seed lots based on their viability and quality assessments.

VM3 - Please provide information on non-specific thresholds that you might use for viability of seeds (i.e. percentage of germination) and for the amount of seeds left of an accession to initiate regeneration? *In case you differentiate between self- and outbreeding species, please answer for each category separately.*

NordGen does not have non-specific thresholds for viability tests. Accessions are regenerated if the germination percentage falls below the minimum. The minimum accepted germination percentage is set per accession, and the percentage is defined in the inventory maintenance policy. The default value for the germination percentage is 85. An accession is multiplied if the total seed amount is less than 9 sowings (minimum regeneration amount) and one distribution bag (see P.03.04, WI.420.02.02). Typically, this amount is 2500 seeds.

Self- and outbreeding species will often have different minimum seed amount for regeneration, and therefore they have different thresholds.

Box 3.1.3.A Seed Storage Conditions (for the different types of collections, i.e. short/medium- or long-term storage)

SC1 - Please provide details on temperature and relative humidity conditions of your storage and drying rooms. In case they vary from room to room, please provide details for each.

All seeds undergo a drying process in the drying room at a relative humidity of 15% at a temperature of 15 degrees Celsius. Once the seeds have equilibrated with the room conditions or when their water content drops below 7%, they are ready for storage.
The seeds are then stored at approximately -18 degrees Celsius to maintain their quality and viability. In the active store, standalone freezers are utilized to provide the required low temperature. For the base storage, which includes

the first duplication, all samples are stored in a freezer room specifically designed for long-term seed preservation.

SC2 – Provide details on the type of containers and the packaging procedures (and the corresponding equipment, if any) that you use.

To ensure optimal storage conditions, the seeds are packed in three-layer aluminium bags and then heat-sealed. This packaging method helps to provide a barrier against moisture, light, and oxygen, protecting the seeds from external factors that could potentially affect their viability and longevity.

For the base storage, an additional step is taken to enhance the preservation of seeds. The bags used for base storage are vacuum-sealed. This process removes air from the bags, further minimizing the exposure of the seeds to oxygen, which can contribute to seed deterioration over time. The vacuum-sealed bags create a more controlled and stable environment for long-term storage, maintaining the quality and viability of the seeds.

SC3 - What is the range of seed moisture contents (smc) of your stored seeds of different species; what measures do you apply to keep and/or monitor the (low) moisture level? Do you treat different species differently?

The water content of the seeds in the collection exhibits a known range between 2.4% and 6.9%. This variation in water content is a result of the drying process applied to all taxa. The seeds are dried to reach equilibrium at a relative humidity of 15% under controlled conditions of 15 degrees Celsius.

SC4 - Provide data on the total storage capacity (number of containers, number of accessions) and an estimated percentage to which extent this capacity has been filled.

The total storage capacity of the facility is approximately 91,000 accessions. Currently, around 40% of the storage capacity is utilized. This means that a significant portion of the available space is still available for storing additional accessions.

SC5 – Please include any other aspects regarding storage conditions at your genebank that you regard as important (e.g. anticipated lifespan of freezing and drying equipment and related prudent financial management).

None

B. In vitro Culture Collections

Box 3.1.1.B Initial viability

IV1 - Describe the procedures or practices that you have in place to ensure the highest possible initial viability of your plant material, in particular during culture of donor plants (e.g. cultivation practices [field, greenhouse], phytosanitary pre-treatments, like use of pesticides).

Two NordGen's employees are trained in how to maintain the in vitro cultures. One of the employees performs the lab work on regular basis, and the other one is a back-up person if necessary.

Donor material must be visibly healthy. Potatoes are donated to the gene bank as tubers or in vitro plants. In vitro plants that come from breeding institutes, seed potato producers or other gene banks usually have known and confirmed health status. Healthy in vitro plants are transferred to fresh medium and after 3 weeks of quarantine are included in the collection.

Tubers are tested for quarantine bacteria, planted in pots, and obtained plants are tested for viruses. If viruses are present in plants the material is placed in thermotherapy. After thermotherapy meristems are excised and introduced to in vitro. The obtained plants are screened for viruses again. If one or more viruses are present, the thermotherapy is repeated (See WI.450.01.01 and WI.450.03.03).

The thermotherapy, testing and introduction to in vitro of new accessions donated to the gene bank as tubers is outsourced at another institution.

IV2 – Describe procedures of explant isolation (organ source in the plant, manipulations) and sterilization (chemical and handling) of the explants.

This process is outsourced. After thermotherapy plant tips, size ca. 1 cm. are cut, transferred to sodium hypochlorite 5% solution with Tween20 for 30 sec, then 2x washed with distilled water for 30 sec, meristems are taken from sterilized tips and transferred to Murashige & Skoog medium.

IV3 – Please provide any other information on procedures that you follow to ensure highest possible initial viability.

All new potato accessions in NordGen's in vitro collection are screened for the following pathogens when an in vitro culture is initiated:

- ELISA assav: PLRV, PVA, PVM, PVS, PVX, PVY, TSWV, TRV, PMTV
- Petrobacterium atrosepticum (syn. Erwinia carotovora subs. atroseptica)
- Pectobacterium carotovorum subs. carotovorum (syn. Erwinia carotovora subs. carotovora), Dickeya spp. (syn. Erwinia chrysanthemi)
- RT-PCR assay: PSTVd
- PCR assav: Clavibacter michiganensis ssp. Sepedonicus, Ralstonia solanacearum

This is outsourced at other institutions.

Box 3.1.2 .B Viability Monitoring

VM1 - Describe the routine in vitro viability monitoring system that you use.
(*The monitoring system should include the following aspects:*

a) *regular control of contamination events,*
b) *control of hyper-hydricity,*
c) *control of health state (if different from a above),*
d) *etc*).

a) In vitro viability monitoring is done during every regeneration/subculture onto new media. During culture in incubators samples are visually checked every second week, especially for occurrence of bacterial and fungal contaminations.
b) Hyperhydricity is not a problem under our conditions.

VM2 - Describe the information "system" (i.e. an "expert system") that you might have in place that allows you to make more species or even accession-specific decisions when the next monitoring should take place.

No specific system for timing of monitoring is implemented. The in vitro collection includes 95 accessions and can be monitored without implementing an IT system. Practical experience and skills of the technical staff are crucial for specific decisions.

VM3 - Please provide information on non-specific thresholds that you might use for vigour of in vitro cultures (i. e. multiplication rates, loss by weak growth) and for the amount of culture vessels (tubes, jars) left of an accession to initiate additional multiplication measures?

Culture conditions correspond to the purpose of the performed multiplication. Application of specific culture conditions results from personal experience of responsible staff. There are no standardized procedures in the laboratory.

Box 3.1.3.B Storage Conditions (for the different types of collections i.e. short/medium- or long-term storage)

SC1 - Please provide details on light, temperature and relative humidity conditions of your culture and storage rooms, as applicable. In case they vary from room to room, please provide details for each.

NordGen uses a growing room with several incubators in it. Air supply to the room occurs via HEPA filter and there is a slight overpressure in the room. Temperature and light intensity can be regulated individually for each incubator. The in vitro cultures are stored in incubators in following conditions: +15°C (+20°C the first week after subculturing), 16h light. The humidity in the room is not controlled.

SC2 – Provide details on the type of cultivation vessels (tubes, jars plastic vessels etc.) and the transfer procedures (including the corresponding equipment, if any) that you use.

Cultivation vessels: glass tubes (inner diameter 2,5cm, length 15cm), polypropylene caps; scissors, forceps, scalpel, heat sterilizer (270°C), Bunsen burner, sterile plastic Petri dishes, LAF-bench, ethanol.

SC3 – Please include any other aspects regarding in vitro culture and storage conditions at your genebank that you regard as important.

None

C. Cryopreserved Collections

NordGen does not have cryopreserved collections.

D. Field Genebank Collections

NordGen does not have field genebank collections.

3.2 Maintaining Genetic Integrity

Maintaining the genetic integrity of an accession can be achieved by minimizing genetic drift which may occur predominantly during the process of regeneration, due to too small numbers of individuals being planted, sub-optimal pollination and/or the introgression of alleles from other accessions or commercial crops or crop wild relatives. The following aspects are important for achieving the objectives of maintaining genetic integrity and should be briefly described. Please note that a distinction should be made between seed numbers for an accession and seed numbers for sub-samples per accession. The latter only applies if the seeds of a given accession are being stored and distributed as sub-samples. As genetically modified materials get more widely distributed and as it might have specific (legal, technical, administrative) requirements a separate box on this type of material is included.

For in vitro cultured and cryopreserved material, which are normally maintained as clones, genetic stability is as important as genetic integrity of the seed-stored material.

A. Seed Collections

Box 3.2.1.A Seed Containers and Sample Size

SCSS1 – Do you document the initial number of seeds of individual accessions (either as received from collecting missions or through exchange)?

Yes, the seed weight is recorded in the information system GENBIS and seed number is estimated based on the weight and the hundred grain weight. This information is stored in the database for future reference.

SCSS2 – Please describe what kind of containers (and equipment) you use,

the procedure you follow with respect to sub-sampling, seed numbers per container, etc.

To ensure proper storage and preservation, all sub-samples are placed in three-layered aluminium bags and sealed using heat sealers (for first duplication, vacuum packing is used). Once sealed, the bags create a hermetic environment, effectively protecting the seeds. For the first and second duplications, the seed amount is three times the amount required for one sowing. In active storage, the seed amount is up to three times the sum of the amount needed for one sowing and 80 times the amount required for distribution.

All sub-samples are stored at approximately -18 degrees Celsius to maintain their viability. In the active storage, standalone freezers are utilized, while in the base storage, a freezing room is available.

To calculate the needed seed per location, a scale and seed counter are used to count and weigh 500 seeds. This count is used to approximate the Hundred Seed Weight (HSW) except for certain taxa where the seed counter is not reliable. For those taxa, 250 seeds are counted by hand to determine the necessary quantity (see WI.410.05.05).

SCSS3 - What is the number of seeds that you use as the minimum threshold per accession? Are these seed numbers of a given accession based on genetic parameters (such as reproduction biology; heterogeneous samples)? Please provide URL of your protocols if these are on-line available.

The standard for packing seeds to our main collections: three sowings conserved in the Svalbard global seed vault, three sowings to base storage in Denmark and three sowings and up to the amount needed for 80 distributions in active storage in Sweden (see WI.410.05.03). The seeds in the active store are also used for viability monitoring. The exact amount in a sowing- and in the distribution bags are determined based on the species and type of material and varies among accessions (see WI.300.02.13). The standard for both is 250 seeds.

SCSS4 – Please provide details on other aspects that are important in this context.

Box 3.2.2.A Pollination Control

PC1 - Please describe the regeneration procedures that you follow for self- and outbreeding species.
(*Please include in your description the following aspects:*

a. *Any control measures to minimize or avoid cross pollination between accessions;*
b. *The use of pollination cages for insect pollinated species;*
c. *The use of specific pollinators for insect pollinated species;*
d. *Strategies to ensure that males and females participate equally in the*

reproduction).

e. *Strategies to avoid any genetic drift (minimum number of plants, minimum number of plants at flowering stage before pollinators introduction, similar quantity of seeds harvested from each plant, etc.*

Efforts are made to avoid cross pollination in all cross-pollinated species. The exact approach varies among crops/species. Many of the insect pollinated crops are isolated in pollination cages while wind pollinated crops are isolated by distance, often in combination with hedges that break the wind flow (see WI.440.06.01). If insect cages are used, pollinators are placed in the cage. The pollinators used in the cages are bumble bee drones, bumble beehives or flies. Which pollinator that is selected depend on the species/crop. For some species, cultivation manuals have been made to document the regeneration procedures, these also cover pollination strategies to some extent (see Manuals). Species with intricate regeneration requirements or those that are prone to failure are prioritized for documented procedures. This ensures the knowledge for their continued existence is preserved and readily available. In contrast, species that reproduce easily or have well-established cultivation practices may not require such detailed manuals. Regarding dioecious species, like asparagus, a larger number of seeds are sown, to make sure that the accession consists of a minimum number of both females and males.

A recommended number and minimum number of plants is defined for different types of species/crops (see WI.420.08.01). The aim is to reduce the loss of diversity through genetic drift and ensure adequate seed production during regeneration. In many cases the recommended number for cross pollinators is 100 plants and the minimum 30 plants.

PC2 – Provide any other relevant information on procedures that you apply to control pollination of your germplasm.

Box 3.2.3.A Regeneration Environment and Procedures

RE1 – Describe the regeneration environment and conditions that you apply. If applicable, you might want to distinguish between different types of germplasm (e.g. wild relatives, landraces, modern varieties, breeding material, genetic stocks, etc.).
(*Consider the following aspects:*

a) *In how far are the environmental conditions of the current regeneration of individual germplasm accessions comparable to the environmental conditions that existed at the original collecting or breeding site?;*
b) *Do you use controlled environments?;*
c) *Do you collaborate with other genebanks in Europe?;*
d) *others*).

Regeneration is conducted by NordGen staff in Alnarp, southern Sweden and in cooperation with partners in other locations in Denmark, Finland, Norway, and Sweden. This has been done both to increase the regeneration capacity

and to be able to cultivate accessions in an environment closer to their original location. Cooperation partners include plant breeding companies, other companies, research institutes and universities. Currently we are not cooperating with other European gene banks regarding regeneration. Some regeneration is done in greenhouses where the environment can be at least partially controlled. Regarding the regeneration done at Alnarp, some efforts are made to regenerate wild material in a similar plant habitat as in the wild, at least when it comes to soil types. Although, an exception is the cereal wild relatives, that are often regenerated in the greenhouse due to better control of the cultivation and harvesting method.

RE2 – Please include any other relevant points on regeneration environment.

None

Box 3.2.4.A Seed Processing Procedures

SPP1 – Describe the protocol(s) that you use for threshing and seed cleaning.

Regenerated samples:
The inventory label follows the sample through all steps of the regeneration process, starting from the packing of the sample in the seed laboratory before sowing. The label remains with the sample during sowing, harvesting, threshing, cleaning, purity assessment, and drying in the seed laboratory. This ensures proper tracking and documentation of the sample's progress and allows for accurate inventory management throughout the regeneration process.

The threshing protocol varies depending on the taxa being processed. For cereal crops, a threshing machine is used to separate the seeds from the plant material. In the case of many wild, ornamental, and vegetable taxa, a brushing machine is employed for threshing. For taxa where machines cannot be utilized, threshing is done manually.

After the threshing process, seed cleaning is performed using a winnower. The winnower helps separate any remaining debris from the seeds, ensuring a cleaner and higher-quality seed product.

New incoming accessions:
Depending on the state of the samples, certain steps like threshing may not be necessary. However, cleaning and purity assessment are always performed. Throughout the process, the inventory label remains with the samples, ensuring proper identification and tracking.

The process is described in NordGen's quality management system (see WI.310.11.01, WI.310.11.02, WI.310.11.03, WI.310.11.04).

SPP2 – Describe the protocol(s) that you use for seed drying, including whether you use different drying procedures for different types of species.

All species undergo a drying process at a temperature of 15 degrees Celsius and a relative humidity of 15%. This controlled drying environment ensures proper moisture removal from the samples, promoting their longevity and maintaining their quality during storage. Additionally, after a period of two months, random samples are tested for water content to verify that the drying process was successful and that the samples are within the desired moisture range.

SPP3 – Please describe how you keep the time between harvesting and the actual (long-term) storage of seeds as short as possible.
Random samples from the drying room are taken for water content measurement approximately 2 months after being stored. These random samples are divided across taxa and further categorized by types within the taxa to ensure representative sampling. If the initial water content test of the samples exceeds the desired threshold, a new test will be performed after some time. This additional test helps ensure accurate water content measurement and confirms that the samples have reached the target moisture level. Once the total water content reaches 7% or lower, indicating the desired moisture level has been achieved, the samples are packed for storage.

SPP4 – Please describe how and where you store (in a temporary manner) newly harvested seeds.
(Please provide details on the temperature and relative humidity of the storage room/space; what type of containers do you use, if any).

Seeds are stored in paper bags in an intermediate storage room. The storage room is maintained at a relative humidity of 30% and ambient room temperature. This storage condition helps maintain the quality and viability of the seeds during the intermediate storage period. The use of paper bags prevents moisture build-up.

SPP5 – Describe the criteria you use to decide on seed quantity per accession for the long-term storage.

The number of seeds needed per accession is calculated based on two factors: the number of seeds needed for one sowing and the number of seeds used for distribution. No extra seeds are stored for viability monitoring; they are taken from the seeds stored for distribution.

Depending on the total number of seeds available, the accession will be stored in up to three locations. If there are enough seeds, the storage locations will be as follows: safe, base, and active.

No sample will be sent to safe storage if the viability test does not meet the threshold value (see WI.410.05.03).

Box 3.2.5.A Genetically Modified Material

GMM1 – In case you treat GMO material differently from "normal germplasm", please provide here the details for each of the deviating procedures (and equipment).
NordGen has no GMOs in the collection.

GMM2 – Describe the policy and procedures (if any) in your genebank, related to ensuring that distributed samples are not containing GMOs.

B. In vitro Culture Collections

Box 3.2.1.B In vitro Culture Vessels and Sample Size

SCSS1 – Indicate if you document the initial number of explants of individual accessions when culture is initiated (from one or from more clonal donor plants)?

Each step of the working procedure is documented in a logbook, including the number of plants, used medium content and conditions.

SCSS2 – Please describe in general terms the type of culture vessels (as far not already done in section SC2 in Box 3.1.3.B), media and phytohormones you use as well as the procedures you follow with respect to cutting technique, callus exclusion, etc.

The type of culture vessels is mentioned in section SC2 in Box 3.1.3.B.

For long-term potato storage MS medium with vitamins is used, supplemented with sucrose (30 g/l). We do not use phytohormones as a standard in our medium. But an exception can be done for a weak in vitro culture and IBA can be added to stimulate root development (see WI.450.03.06).

SCSS3 – Please indicate whether or not you use a minimum number of in vitro plantlets per accession?

Minimum number of in vitro plantlets per accession is 6 (see WI.450.03.02).

The whole collection is backed up in Finland, also 6 plantlets per accession.

SCSS4 – Please provide details on other aspects that are important in this context.

None

Box 3.2.2.B In vitro Culture Procedures

SPP1 – Describe the numbers of sub-clones you may cultivate per accession (assuming that this is not crop specific)
We may cultivate 6 to 10 plants per accession. Each new potato accession introduced to in vitro collection consist of 5 clonal lines originating from 5 different meristems. Then each clonal line is multiplied to 2 plants to obtain 10 plants (5x2) per accession in total.

SPP2 – Describe the sub-culture duration (if not crop specific)

Subculture of long-term maintained in vitro potato plants under our conditions is done 3-4 times per year.

SPP3 – Describe the criteria you use to decide on in vitro plant quality (if not crop specific).

Potato plants with well-developed leaves, rooted, without visual signs of bacterial and fungal contaminations.

Box 3.2.3.B Genetically Modified Material

GMM1 – In case you treat GMO material differently from "normal germplasm", please provide here the details for each of the deviating procedures (and equipment).

No GMO material is conserved at NordGen.

C. Cryopreserved Collections
NordGen does not have cryopreserved collections.

E. Field Genebank Collections
NordGen does not have field genebank collections.

3.3 Ensuring Availability

An important objective of conservation efforts is to facilitate the effective utilization of germplasm accessions by researchers, breeders, and farmers. Thus, ensuring the ready availability of stored germplasm is an important principle. It refers to the ability of genebanks to supply and distribute the stored germplasm, together with any associated information, in an adequate way to users. Aspects that can affect the availability include: (a) policies, (b) seed stock, (c) health status of accessions, and (d) distribution quantity. Although most of the questions are not relevant in the ECPGR/AEGIS context, it was decided to keep the questions and to allow for a comprehensive genebank manual that can be used "globally".

A. Seed Collections

Box 3.3.1.A Ensuring Availability of Germplasm – Policy Aspects

AGP1 – Describe the germplasm distribution policy that you follow at your genebank.
(*You might want to consider in your response the following aspects:*
a) *crop/species specificity;*
b) *whether or not sufficient seed stock is available; who the requestor is;*
c) *what the purpose of the germplasm request is;*
d) *any restrictive conditions and/or*
e) *the total amount of accessions sent per request for distribution of germplasm;*
f) *use of a formal agreement to distribute the germplasm*).

The distribution policy is available on the GENBIS website GRIN-Global (nordic-baltic-genebanks.org). Any seed user can request seeds via our website without any charges, if it is for scientific or educational purposes. The seed requesters should accept the SMTA terms and conditions before submitting the requests (we have adopted Shrink-wrap as a method to accept the SMTA).

There is no limit on the number of accessions per request, but for large requests (>100 accessions/request) we contact the requester to get more information about the project.

AGP2 - Do you have as part of your service rendering policy aspects such as a "maximum time" between receiving a germplasm request and distribution of the germplasm?

NordGen strives to handle orders as fast as possible; however, during holidays, peak seasons and for large orders it may take 10 working days or more to handle an order.

AGP3 – Describe how you treat "related information" about the requested accessions that you make available to the requestor, i.e. provide details on the typical information you send out with the germplasm.

All information about the accessions is available on the website GENBIS. However, we do include the SMTA with a link to the website and a list of the material that includes accession number, accession name, species, and the germination rate.

Box 3.3.2.A Ensuring Availability of Germplasm – Seed/Germplasm Stock Aspects

AGSS1 - Please provide details on the minimum/maximum amount of seed, plant, in vitro samples that you distribute (where relevant, differentiated by species groups, i.e. self-pollinating, cross-pollinating and/or whether an

accession is homo- or heterogeneous).

The normal amount for distribution is 250 seeds per accession. The seed amount for breeding and research material of cereals is 10 seeds. For large seeded species like peas and beans the amount is 25 seeds per accession and for some specific vegetables, the seed amount is also reduced to 10-25 seeds. Further deviations exist (see WI.300.02.13, WI.300.02.13_Appendix2).

AGSS2 – Describe how you store the seeds/etc. of a given accession with respect to the use of single or multiple bags or containers per accession.

In general, one distribution bag is kept at -18°C along with the bulk bag for each accession. If there is no pre-packed distribution bag, then a new one will be packed upon request. Seeds for viability monitoring are sampled from the bulk bag.

AGSS3 – Describe how you manage the availability of adequate seed/etc. stock per accession, including the use of an absolute lower minimum of seeds per accession as the threshold to decide to regenerate.

If the seed number of an accession is below the minimum level, the accession is added to the regeneration list. See Box 3.1.2.A “Seed Viability Monitoring VM3” above and P.03.04.

AGSS4 – Provide here information on any other aspects that are relevant to manage seed/etc. Stocks.

None

Box 3.3.3.A Ensuring Availability of Germplasm – Health Aspects

AGHA1 – Describe how you store seed/other germplasm with respect to germplasm health considerations, including whether you have a “policy” of storing only “disease free” (as far as you can see or determine) accessions, at least for the quarantine pests and diseases.

The requirements from the national authorities are followed.

All accessions are monitored by gene bank staff during the regeneration process for the presence of pests and diseases, then a visual inspection of the harvested seeds is performed by our seed laboratory. New accessions are also inspected visually in the seed laboratory before being processed.

AGHA2 – Describe how you follow plant quarantine rules and regulations when exporting germplasm abroad (especially to countries at another continent).

Outside of the EU, a phytosanitary certificate and/or import permit is often required and this sometimes depends on the crop of requested accessions.

AGHA3 – Describe if and how you distribute germplasm accompanied by a phytosanitary certificate or a "plant passport".

When a phytosanitary certificate is required, we send the material accompanied by a phytosanitary certificate issued by the Swedish Board of Agriculture.

A plant passport is issued for seeds of species that require it when they are ordered on-line and sent by post to end users.

AGHA4 – Provide any other relevant information on procedures that you follow with respect to germplasm health aspects.

None.

Box 3.3.4.A Germplasm Supply

GS1 – Describe the policy of your genebank with respect to the sample size that you use for distribution purposes, including whether you differentiate between germplasm from self- or outbreeding species, heterogeneous accessions, and possibly other aspects.

See 3.3.2 A, AGSS1.

GS2 – As GS1 above, but in case your germplasm samples do not possess the minimum viability, would you increase the number of seeds?

That depends on the seed availability. For Active Core accessions with a distribution size of 50 seeds or higher, the viability must be 40% or higher. For Active Core accessions with a distribution size of less than 50 seeds, the viability must be 50% or higher.

For Active non-core accessions, the same rules apply. However, if an accession has no viability, it is set for distribution, and the requester is informed accordingly (see P.03.09).

GS3 – Please provide information on any other aspects related to seed supply.

None.

B. In vitro Culture Collections

Box 3.3.1.B Ensuring Availability of Germplasm – Policy Aspects

AGP1 – Describe the germplasm distribution policy that you follow at your genebank.
(*You might want to consider in your response the following aspects: is the*

user informed about the option to get provided with in vitro cultures and whether they are available all the time of the year, are in vitro samples an option or the only way to get material; who the requestor is; what the purpose of the germplasm request is; any restrictive conditions and/or the total amount of accessions sent per request for distribution of germplasm; use of a formal agreement to distribute the germplasm)

We distribute potato accessions as in vitro plantlets and mini tubers. Distribution for research and educational purposes is prioritized, and there are more restrictive conditions for distribution to private users. In vitro plantlets are produced and distributed on request only for research and educational purposes. Mini tubers are distributed to private users as well as for research and educational purposes. Every year we produce mini tubers of 12-13 accessions from our collection.

AGP2 – Indicate if you have as part of your service rendering policy aspects such as a "regular or a maximum time" between receiving a germplasm request and distribution of the germplasm?

Time period is not fixed because of maintenance cycle requirements. Potato in vitro cultures are propagated for research purposes upon mutual agreement and as a priority; to private users mini tubers are distributed only in March-May.

AGP3 – Describe how you treat "related information" about the requested accessions that you make available to the requestor, i.e. provide details on the typical information you send out with the germplasm.

Accession number, accession name, meristem number, and date of production. More information can be obtained via GENBIS or on request from curator.

Box 3.3.2.B Ensuring Availability of Germplasm – Germplasm Stock Aspects

AGSS1 - Please provide details on the maximum amount of in vitro samples that you distribute.

The number of samples distributed depends on how many were ordered and according to agreement. Usually, 3 plants or 3 mini tubers per accession.

AGSS2 – Describe how you store the samples of a given accession with respect to the use of vessels for culture and vessels for distributions (glasses of plastic bags).

Commonly the plants are distributed in sealed glass tubes.

AGSS3 – Describe how you manage the availability of adequate plants per accession, including the use of an absolute lowest minimum of plants per

accession as the threshold to decide to regenerate.
Between 6 and 10 samples are always maintained. In case of an order, plants are propagated from these.

AGSS4 – Provide here information on any other aspects that are relevant to manage stocks (e.g. transfer of material through greenhouse transfer phases in case a user cannot handle in vitro cultures).

Box 3.3.3.B Ensuring Availability of Germplasm – Health Aspects

AGHA1 – Describe how you store germplasm with respect to germplasm health considerations, including whether you have a "policy" of storing only "disease free" (as far as you can see or determine) accessions, at least for the quarantine pests and diseases.

NordGen has a policy of storing only "disease-free" potato accessions. Virus elimination and testing for quarantine diseases is done when an in vitro culture is established (see WI.450.03.02).

AGHA2 – Describe how you follow plant quarantine rules and regulations when exporting germplasm abroad (especially to countries at another continent).

To users in Sweden and other EU countries potatoes are always sent with an EU Plant Passport that is issued by NordGen. For the export of the requested material outside the EU, germplasm is accompanied by a phytosanitary certificate issued by the Swedish Board of Agriculture (Jordbruksverket) (see WI.450.07.02).

AGHA3 – Describe if and how you distribute germplasm accompanied by a phytosanitary certificate or a "plant passport".

The instructions of the Phytosanitary authority are followed. The distributed germplasm is accompanied by a phytosanitary certificate or EU Plant Passport. Import permit is also required. See WI.450.07.02 and WI.430.03.01 for more information.

AGHA4 – Provide any other relevant information on procedures that you follow with respect to germplasm health aspects.

None

Box 3.3.4.B Germplasm Supply

GS1 – Describe the policy of your genebank with respect to the sample size that you use for distribution purposes.
Usually, 3 in vitro plants or 3 mini tubers per accession.

GS2 – Please provide details of your routine methodology of containers etc. that you use to distribute in vitro cultures.

Standard cultivation glass tube or a paper bag for mini tubers.

GS3 – Please provide information on any other aspects related to in vitro plant supply.

Not shipped in periods of frost, express delivery for remote countries, even within Europe, periods without light as short as possible.

C. Cryopreserved Collections

NordGen does not have cryopreserved collections.

D. Field Genebank Collections

NordGen does not have field genebank collections.

4 Providing Information

The lack of adequate information on a given accession may well decrease the value of that accession to the user. The information on individual accessions should be as complete as possible in order to facilitate the identification of duplicates and/or to select accessions with desirable characteristics. A genebank should have a documentation system in place that allows to optimize management of the collections as well as to provide access to information about the collection to users.

Box 4.1 Genebank Documentation System

GD1 - Please provide details on the technical aspects of the genebank information management system(s) that you use.

a) On which software is the system based (i.e. Oracle, Fox Pro, MS Access, MS excel, MS Word, other?).
b) In case you use a manual information management system, please provide details.
c) In case your “internal” database(s) is/are different from the publicly available database(s), please provide details on both,
d) Describe which activities of the genebank are covered by the system.

NordGen maintains the Nordic Baltic Genebanks Information System (GENBIS), which is used by NordGen and the national genebanks in Denmark, Estonia, Finland, Iceland, Latvia, Norway, and Sweden. It is built on the GRIN-Global information system, which is a MS SQL server with .net web server and .net application. This system is used both for internal and external purposes. Activities supported by GENBIS include documentation, germination testing, seed storage, regeneration, orders, and distribution.

GD2 - Provide details on which types of data you handle in your documentation system, e.g. passport data, characterization & evaluation data, cultivar data, material distribution etc.

GENBIS handles taxonomic information, passport data, information on seed storage, seed quality and quantity, regeneration, orders/distribution, and characterisation/evaluation.

GD3 - In case your internal database(s) is/are different from the publicly available database(s), please provide details on both.

The same database is used externally and internally, but only a subset of the information is displayed in the public version (https://nordic-baltic-genebanks.org/).

GD4 – Describe in which form you send accession specific data (e.g. as hard copy, electronically – if the latter, please specify (in plain text) which file format, i.e. Excel, Access, others is used).

Public data, such as taxonomic information, basic passport data and characterisation and evaluation data can be found on the public web pages (https://nordic-baltic-genebanks.org/). Characterisation and evaluation data can be downloaded in a .csv format and can be easily viewed in Excel or other programmes.

GD5 - Provide information on how technical support for development and maintenance of the documentation system is arranged.

The GRIN-Global database platform is updated and maintained by the USDA. GENBIS is maintained and updated by staff at NordGen, in some cases assisted by consultants. Technical support is provided by NordGen to users and to the other member gene banks using GENBIS.

GD6 – Describe your genebank policy with respect to backing-up of the database contents, including with which frequency?

The complete database is backed-up every day.

GD7 – Provide any other information on your information management system that is not covered in one of the above questions.

None

Box 4.2 Information Exchange

IE1 – Please describe how you make your passport data available to users (i.e. as hard copy; via the internet; other?).

Public passport data can be found on the GENBIS web pages and can be

partially downloaded in Excel format. More extensive passport data can be provided in Excel format (or similar formats) upon request.

IE2 - Please indicate if your data is available as machine-to-machine web-services. In case it is, describe.

a. what types of data (passport data, characterization & evaluation data etc)

   Passport data.

b. which web-service interfaces are available (i.e. GBIF IPT, BioCase, TapirLink).

   GBIF (BioCase) and BrAPI.

IE3 - Please indicate if your data is published to EURISCO. Describe which data is published to EURISCO and at which intervals.

MCPD and EURISCO descriptors are regularly uploaded to EURISCO.

IE4 – Please provide any other information on information exchange that is important for others to know.

IE5 - Describe the kind of information you distribute together with the germplasm to persons that request germplasm?
(*Please consider the following data types: Passport, Characterization; Evaluation, and/or Germplasm management data (e.g. viability percentage; protocols followed for routine operations; etc.*).

The following information is distributed with the seeds: accession number, accession name, taxon, and germination percentage. In addition, a link to the web page with additional public information is provided.