

**Operational Genebank Manual for the UK Vegetable Genebank  
(Warwick Genetic Resources Unit)**

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## 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).*

The UK Vegetable Genebank (also known as Warwick Genetic Resources Unit) has a remit to collect, document and conserve, long term, the genetic variation extant within small-seeded vegetables and their wild relatives. Our largest collections are of crops such as brassicas, alliums, lettuce, carrot and radish; however we maintain smaller collections of many other vegetable crops. In total there are 117 genera represented in our collections from many areas of the world.

Our work is funded by a partnership agreement between the University of Warwick and UK government through Defra (the Department for the Environment, Food and Rural Affairs) from whom we receive our mandate as a contribution to meeting the UK’s obligations under international treaties concerning genetic resources.

Functionally we are part of the University of Warwick; UKVGB staff are employees of the University and the University is responsible for providing the facilities necessary for us to carry out work in support of our mandate as well as additional in kind resources.

**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 genebanks fall under these agreements?*

We have an agreement with the Center for Genetic Resources, The Netherlands to conserve carrot germplasm

**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.*

UKVGB will accept material into our collections if it falls within our mandate of conservation of diversity in small-seeded vegetable crops, and providing the germplasm offered does not duplicate that already in the collection. As our collections represent global genetic diversity, we do not place geographic limits on the material we accept. All germplasm must be acquired in accordance with relevant national and international legislation.

**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.)?

We initially rely on the taxonomic assessment by the donor, but will update passport data if users report inaccuracies, or if taxonomic mistakes are noticed during regeneration. We will carry out tests such as flow cytometry or molecular marker tests on a case by case basis.

**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).*

Seed is visually inspected for purity and the presence of debris and obvious pests or diseases. Seed morphology can also be used to detect gross taxonomic misclassification at this stage. Seed are weighed and germination tested and must meet the operational thresholds of both of these parameters before being accessioned into the collection.

**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)*

All material from the UKVGB collection is distributed under the terms of the SMTA, including crops not currently in Annex 1 of the ITPGRFA. Requestors accept the SMTA when they order germplasm online (click-wrap), information on each request is stored within the UKVGB database (GRIN Global)

### **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).*

Germplasm collecting is carried out as required – there is currently no formal programme. Should UKVGB engage in collecting expeditions we would follow currently published guidelines for sampling, where necessary work with the collaboration of local partners, particularly if collection is carried out outside the UK.

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

N/A

## **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 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?)*

UKVGB collections are partially safety duplicated under a 'black box' arrangement with the Centre for Genetic Resources, the Netherlands (CGN) and at the Svalbard Global Seed Vault. A formal signed agreement exists

agreeing reciprocal storage of safety duplicates under similar conditions with CGN. UKVGB packages seed following regeneration and a subsample is sent to CGN and SGSV. UKVGB also provides 'black box' safety duplication facilities to other genebanks.

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

The standard practice employed by UKVGB is to send a subsample of freshly regenerated seed, packaged appropriately, to CGN and SGSV where seed quantities permit. We record which of our accessions are duplicated in this manner. Not all accessions currently have safety duplicates, however this is being progressively addressed through the regeneration process.

### **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).

The UK is not prone to many natural disasters such as earthquakes or highly destructive storms. No special design features are necessary.

**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).*

UKVGB operates from dedicated facilities maintained by the University of Warwick. All external doors are kept locked and entry is gained either by card access or a key. An intruder alarm is active in the building outside of normal working hours. A full fire detection system is in operation, with both smoke/heat detectors and manual activation points. The fire system is under continual remote monitoring and is tested frequently.

Generator power is available should the main electricity supply fail; this automatically cuts in as required. External power points have been fitted to allow temporary refrigeration facilities to be used if necessary.

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

The base and active collections are currently housed in separate cold stores within the building.

### **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).*

Each of the two -20°C cold stores are chilled by two separate refrigeration units. Each unit is capable of maintaining the required temperature individually, and they are set up in such a way that the second system becomes active should the first unit fail. There is an automatic change over between units on a weekly basis to ensure an even workload and also to verify both units are functioning. The refrigeration systems are maintained by an external company under contract to the University, with regular planned and preventative maintenance.

UKVGB is supported by an external generator in the case of failure of the main electrical supply, and this is tested regularly.

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

Temperature and humidity are monitored electronically and readouts of current conditions are displayed on the relevant control panels. In addition, conditions are monitored automatically; calls or emails are sent should either temperature or humidity vary beyond preset boundaries, or if the refrigeration plant fails. In addition, audible alarms will sound in the UKVGB building to alert staff of temperature/humidity deviations. Temperature and humidity data are logged and are available if required.

### **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;*
- b) *do you have direct access to the “mother” organization that provides the budget?;*
- c) *internal “security” of accessing these funds;*
- d) *long-term security and stability of funding (compensation of inflation rates, avoiding variation in years)*
- e) *any other observations that are relevant in this context).*

The UKVGB is supported by Defra via a partnership agreement between Defra and the University of Warwick, underpinned by a legally binding Memorandum of Agreement covering defined project periods of four years.

Monies are transferred regularly between Defra and the University of Warwick and are made available as needed. An allowance for inflation is factored into to project costs at the beginning of each project. UKVGB can make direct contact with the relevant personnel at Defra if required.

**IPS2** – Describe how you secure adequate staffing of your genebank.

All UKVGB technical and research staff are funded directly by the support project. Temporary workers are brought in as needed to cover the peak harvest season.

**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.

The UKVGB is included in contingency and emergency plans of the University of Warwick. The local fire service have visited the buildings and are aware of the seed collections and their locations.

**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.

UKVGB staff are kept up to date in terms of training in appropriate responses to fire and other emergencies through the training schedule provided by the University of Warwick. Fire detection and alarm systems are tested regularly.

In addition, strict protocols are operated concerning entry to the cold store; these are kept locked and only authorized staff may enter after ensuring that other UKVGB staff are aware they are working in the -20°C store. Personnel alarms are fitted to the controlled environment rooms so that help can be summoned in an emergency. Appropriate Personal Protective Equipment is provided where needed.

All staff are made aware of other hazards, and training is kept up to date together with appropriate risk assessments and standard operating procedures. Records of staff training are maintained for health and safety audit if required.

### **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.

### 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.).

Cultivation practice varies from crop to crop, but for outbreeding crops plants are grown in purpose-built isolation cages, monitored and treated for pest and diseases. Blowflies are used to pollinate all crops. Seeds are harvested at an appropriate maturity stage and immediately placed in a drying room (15°C, 15% RH) prior to threshing. Seed are cleaned thoroughly of all debris, and poor quality seed are removed where possible, usually by aspiration. Seed are returned to the drying room until they reach a moisture content of 5% by weight when they are packaged. Regeneration protocols for individual crops are available for reference.

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

Dormancy is treated generally by pre-chill methods. Where dormancy is suspected to cause low germination test results under ISTA conditions, the test is repeated under glasshouse conditions which permit softening of hard seed coats and the removal of inhibiting compounds.

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

We place emphasis on obtaining a high quality of seed rather than high quantities; for example we will not usually harvest from late developing inflorescences as these are known to produce smaller seed with reduced viability and vigor.

### **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).*
- f)

Germination tests are carried out prior to entry into long term storage (for new donations or regenerated seed), then every 10 years after that. Seed from each accession is sampled from the active collection. We carry out germination tests on two batches of 50 seeds. Crop-specific methods are followed, apart from for wild species, where germination tests are carried out over a longer timeframe in compost. Accessions are marked as unavailable and considered for regeneration when they fall below 50% germination.

**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.

The monitoring of viability is carried out according to the timings described above – no species/accession specific decisions are made.

**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.*

As described above, a threshold of 50% viability is set for all accessions. Once germination levels fall below this threshold the accession is removed from the list of accessions available for distribution until such time as it can be regenerated. In general, a lower limit of 5g seed is set as the threshold to trigger regeneration due to low seed stock levels. This limit is the base collection sample. Large seeded crops such as radish have a sample of 10g in the base collection, and this is the seed weight threshold which triggers regeneration.

### **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.

Drying rooms: 15°C and 15% RH  
Long term store (base and active): -20°C

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

Seeds are stored in a tri-layer foil laminate pouch of appropriate size. Heat sealers are used to ensure a hermetic seal against the ingress of moisture. Seeds are packaged by weight – our normal packets for distribution at 0.5g, however other pack sizes are used to increase the efficiency of packing and storage. Seeds with sharp spines or awns are either packed with a layer of card to protect the foil or are bulk packaged in glass jars with a rubber gasket seal. Base collection samples are packaged in plastic “clip lock” boxes with gaskets alongside silica gel sachets to minimize risk of seed rehydration in store. All seed packets are labelled with accession number, taxonomic information and accession name, along with a unique barcode to enable tracking of each seed packet. These labels are waterproof and robust.

**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?

Seed is packaged when it reaches 5% moisture by weight; this applies to all species.

**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.

Two -20°C stores are available giving a total of 90m<sup>2</sup> storage area. This area is fitted with mobile shelving and is currently at approximately 70% capacity.

**SC4** – 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).

The need for servicing, repair and replacement of the refrigeration and dehumidification equipment is accounted for when funding is renewed, and through direct funding by the University of Warwick.

### 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 and 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)?

Initial seed weights are recorded. The thousand seed weight can be used to convert this into numbers of seeds if required.

**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.

Seeds are packaged in foil laminate pouches as described previously. Seed are distributed in 0.5g quantities (with the exception of larger-seeded crops such as radish where 1g packets are distributed). The remainder of the active collection is packed into 5g or 10g pouches, with further larger pouches being used if necessary. The base collection is a single 5g or 10g pouch, which is packaged inside a plastic box with silica gel sachets.

**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

We use 5g as a minimum threshold for all species, with the exception of larger seeded species such as beet or radish where 10g is the minimum threshold.

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

N/A

### **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.)*

Outcrossing species are isolated from one another using purpose-built isolation cages in dedicated glasshouses. To increase efficiency, two non-compatible crops are placed in each cage. Pollination is carried out via blowflies which are introduced at the start of the flowering period. Specific protocols exist for different crops; for some, plants are harvested individually and then seed is recombined in equal proportions to form the regenerated seed lot. Some crops are regenerated in coldframes, and in these cases temporary pollination cages are set up over the plants prior to flowering to prevent access by natural pollinators prior to the introduction of blowflies. In the case of wind pollinated crops, specialized pollen-proof tents are used to limit unintentional pollen transfers between accessions.

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

N/A

### **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).*

The UKVGB is located in a temperate environment and most of the crops we regenerate are temperate crops. All material is regenerated under the same conditions (glasshouse or sheltered coldframe as required). For some crops such as short day crops, we collaborate with other organisations where our

environmental conditions are unsuitable, or use specialized glasshouse facilities on site to adequately control temperature and photoperiod.

**RE2** – Please include any other relevant points on regeneration environment. We are investigating the impact of different wavelength of LED supplementary light on flowering behaviour to aid the efficiency of regeneration.

#### **Box 3.2.4.A Seed Processing Procedures**

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

Seeds are threshed and cleaned according to crop-specific protocols developed over many years at the UKVGB. All material harvested is identified with the relevant accession number and great care is taken to ensure no accidental mixing of seeds occurs. Seed threshing and cleaning takes place in a dedicated facility with local exhaust ventilation. Due to the small quantities of seed involved, all material is cleaned and processed by hand. Equipment is cleaned of stray seed and debris between accessions.

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

Seeds are dried using the drying room facilities (15°C and 15% RH) for several weeks prior to packaging. Moisture content is verified using a hand held hygrometer to ensure seed moisture content has equilibrated with the drying room environment.

**SPP3** – Please describe how you keep the time between harvesting and the actual (long-term) storage of seeds as short as possible.

Seeds are threshed and cleaned as soon as possible (generally within 12 weeks of harvest) and all regenerated material is packaged and placed in the long term store as soon as germination testing, moisture content analysis and packaging is complete.

**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 temporarily in paper bags/envelopes in a drying room (15°C and 15% RH) after they have been cleaned and threshed to continue drying prior to packaging

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

Regeneration must produce enough seed to replenish the base collection, provide safety duplicate samples of 5g. No specific upper limit is set for

seed quantity in the active collection – in practice this can range from 2g – 2kg

#### **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).

We do not handle transgenic material at the UKVGB

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

We do not permit transgenic material in our facilities, however we do not routinely test for transgenic contamination in donated material. Donors are asked to verify material is not transgenic.

### **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 mandate of the UKVGB enables us to distribute seed to requestors from organizations involved in 'breeding, research, education and development'. If sufficient seed are available in the active collection to meet the request then the request will be fulfilled. We distribute 0.5g seed per accession, with the exception of large-seeded crops such as beet or radish where the standard distribution amount is 1g. If over 100 accessions are requested, we will discuss with the requestor whether all of the material is required. Seed is not generally sent to individuals for use in private gardens, however exceptions may be made if good quantities of seed are available. All requests are made under the terms of the sMTA. In the case of non-Annex 1 crops, the same agreement is used.

**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?

We aim to dispatch seed within 10 days of receiving the online request indicating agreement to the terms of the sMTA. Exceptions occur when the seed request is particularly large or phytosanitary certification is required.

**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.

A packing list is sent with all seed requests. In addition, the passport data and any further information such as characterization, evaluation or image data we hold is available to users via our online portal at [grin-global.warwick.ac.uk](http://grin-global.warwick.ac.uk). Data on our collections can also be found in aggregator databases such as EURISCO and Genesys PGR.

### **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).

We distribute 0.5g seed per accession, with the exception of large-seeded crops such as beet or radish where the standard distribution amount is 1g.

**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.

Seeds are packaged in foil laminate pouches as described previously. Seed are distributed in 0.5g quantities (with the exception of larger-seeded crops such as radish where 1g packets are distributed). The remainder of the active collection is packed into 5g or 10g pouches, with further larger pouches being used if necessary. The base collection is a single 5g or 10g pouch, which is stored inside a plastic box with rubber gasket along with silica gel pouches.



**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.

Seed stock levels are tracked in the UKVGB database and updated automatically via scanning of barcodes as material is removed. As described previously, accessions are not distributed when stock levels reach the level of the base sample – 5g seed in most cases, or 10g for larger-seeded crops such as radish and beet.

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

N/A

### **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.

Seed is visually inspected for pests and diseases before storage. All extraneous plant debris is removed. Material is not tested routinely however when tests are carried out, the results are kept in the UKVGB database and affected material is flagged as not available for distribution.

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

If required, seed is sent for inspection by the UK authorities to obtain phytosanitary certification prior to dispatch. The requirement for this is confirmed with the user and the UK authorities.

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

If required, seed is sent for inspection by the UK authorities to obtain phytosanitary certification prior to dispatch. Documentation is attached to the outside of each package where required.

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

We monitor plants during regeneration for symptoms of various seed transmitted diseases such as viruses and bacterial infections, however we do not carry out specific laboratory tests to confirm presence/absence. Plants

with such infections are generally destroyed and seed is not entered back into the collection.

#### **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.

We distribute 0.5g seed per accession, with the exception of large-seeded crops such as beet or radish where the standard distribution amount is 1g. Aspects of reproductive biology such as heterogeneity and auto/allogamy are not taken into account.

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

We would advise the requestor, and send more seed if appropriate

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

N/A

### **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)*

N/A

**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?

N/A

**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.

N/A

**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.

N/A

**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).

N/A

**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.

N/A

**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).

N/A

**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.

N/A

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

N/A

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

N/A

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

N/A

#### **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.

N/A

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

N/A

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

N/A

### **C. Cryopreserved Collections**

#### **Box 3.3.1.C Ensuring Availability of Germplasm – Policy Aspects**

**AGP1** – Describe the germplasm distribution policy that you follow at your genebank.

*(Cryopreserved material is for distribution in exclusive cases only – e.g. for special research, please describe your policy; 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).*

N/A

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

N/A

**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.

N/A

**Box 3.3.2.C Ensuring Availability of Germplasm – Germplasm Stock Aspects**

**AGSS1** - Please provide details on samples that you distribute (where relevant).

N/A

**AGSS2** – Describe how you store, for distribution, the cryopreserved material of a given accession with respect to the use special equipment such as dry-shippers etc.

N/A

**AGSS3** – Describe how you manage the availability of adequate cryopreserved material.

N/A

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

N/A

**Box 3.3.3.C 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. You could also add data on separation of differently infested material in separate cryotanks etc.

N/A

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

N/A

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

N/A

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

N/A

**Box 3.3..C4 Germplasm Supply**

**GS1** – Describe the policy of your genebank with respect to the sample size that you use for distribution purposes.

N/A

**GS2** – Please provide details of your routine methodology of containers etc. that you use to distribute cryopreserved material

N/A

**GS3** – Please provide information on any other aspects related to cryopreserved material supply.

N/A

**D. Field Genebank Collections**

**Box 3.3.1.D 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: crop/species specificity; whether or not sufficient seed stock is available; 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).*

N/A

**AGP2** – Indicate if 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?

N/A

**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.

N/A

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

**AGSS1** - Please provide details on the minimum/maximum amount of plants or organs (cuttings, bulbs, tubers, etc.) per plant that you distribute per accession (where relevant, differentiated by species groups, i.e. annual or perennial; woody or herbaceous; other) and/or whether an accession is clonally or sexually propagated).

N/A

**AGSS2** – Describe how you manage the availability of adequate organs per accession, including the use of an absolute lower minimum of plants per accession as the threshold to decide to multiply.

N/A

**AGSS3** – Provide here information on any other aspects that are relevant to manage plant material stocks.

N/A

**Box 3.3.3.D Ensuring Availability of Germplasm – Health Aspects**

**AGHA1** – Describe how you maintain field genebank (and any intermediate storage step) accessions with respect to health considerations, including whether you have a “policy” on accepting/planting only “disease free” planting material (as far as you can see or determine) accessions, at least for the quarantine pests and diseases.

N/A

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

N/A

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

N/A

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

N/A

#### **Box 3.3.4.D 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 annual or perennial species, clonally or sexually propagated accessions, and possibly other aspects.

N/A

**GS2** – Please provide information on any other aspects related to seed supply.

N/A

## **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.

Collection datasets are managed via the UKVGB database, based on the open-source GRIN Global system developed by USDA and The Crop Trust.

**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.

We manage passport, stock, characterization/evaluation, image as well as user/sMTA distribution data.



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

Users can browse our collections and associated characterization data at <https://grin-global.warwick.ac.uk> – the web portal shows the publicly available material only. Stock data is only available internally.

**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).

We supply accession specific data electronically as Excel spreadsheets if specifically requested, but requestors are directed to <https://grin-global.warwick.ac.uk> to access accession specific details. This data can be downloaded as .csv files.

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

We work closely with the University's Bioinformatics Research Technology Platform to maintain the database. The University also has a dedicated IT support team who are available for maintenance and development as required

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

The UKVGB database is held on a pair of centrally networked server managed by the University of Warwick IT services team, with daily backup and sufficient redundancy to ensure data security.

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

User access is tiered according to requirements; limited staff members have administrator level access.

#### **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?).

We supply accession specific data electronically as Excel spreadsheets if specifically requested, but requestors are directed to <https://grin-global.warwick.ac.uk> to access accession specific details.

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

All data available on our website are available for other web services. Our website is run through a local installation of the USDA developed GRIN-Global software, which has a well described schema. GRIN-Global is compatible with BrAPI (The Breeding API).

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

Data for publicly available UKVGB accessions are published in EURISCO, updated annually.

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

N/A

**IE5** - Describe the kind of information you distribute together with the germplasm to persons that request germplasm?

A packing list with accession number, taxonomic information and accession name is included, along with any information we hold on seed treatments applied. Requestors are directed to <https://grin-global.warwick.ac.uk> to access further accession specific details. We will provide details such as viability percentage if specifically requested.

*(Please consider the following data types: Passport, Characterization; Evaluation, and/or Germplasm management data (e.g. viability percentage; protocols followed for routine operations; etc.).*