## General Comments

'Germplasm conservation, in its various stages, includes a range of activities for which information is required or from which information is derived. This may refer to species, their sites of origin, or activities or stages of conservation. The action of recording, organizing, and analysing conservation data is known as documentation. It is fundamental for understanding germplasm and making decisions on its management. Germplasm increases in value as more is known about it; hence, the importance of its being well documented' (Jaramillo and Baena 2000).

### Information on this Module

This module contains one lesson, and includes its respective evaluation.

### Objectives

When you have completed this module you should be able to:

- Understand what documentation of plant genetic resources (PGRs) signifies, and its importance in the routine management and scientific use of a germplasm bank
- Define the stages of constructing a documentation system
- Document the most common operational procedures of a germplasm bank

### This Module's Lesson

The lesson for this module examines some main aspects of documenting germplasm during procedures for *ex situ* conservation.

### Bibliography

Throughout this module, a bibliography is provided for each section, that is, the *General Comments* and the *Lesson*. The bibliographies follow a format of two parts:

1. *Literature cited*, which includes those references cited in the text itself. Some of these citations were used to develop the original Spanish-language course on *ex situ* conservation and may therefore appear in Spanish or Portuguese. However, where practical, references to the English versions of the original Spanish-language documents are provided.
2. *Further reading,* which is a list of suggested readings in the English language. Most cover in depth the topics included in this module.

A list of *Acronyms used in the bibliographies* is also given. The idea is to save space by not having to spell out each institution's full name each time it appears in the references.

#### *Acronyms used in the bibliographies*

FAO Food and Agriculture Organization of the United Nations
IBPGR International Board for Plant Genetic Resources
IPGRI International Plant Genetic Resources Institute

### *Literature cited*

Jaramillo S; Baena M. 2000. Material de apoyo a la capacitación en conservación *ex situ* de recursos fitogenéticos. IPGRI, Cali, Colombia. 209 p. Available at http://www.ipgri.cgiar.org/training/exsitu/web/arr_ppal_modulo.htm (accessed 14 Dec 2004).

### *Further reading*

IPGRI. 1996. Descriptors for tomato (*Lycopersicon* spp.). Rome.

IPGRI. 2004. Descriptors lists. Available at http://www.ipgri.cgiar.org/publications/pubseries.asp?ID_SERIE=13 (accessed 14 Dec 2004).

Konopka J. 1988. Workshop on exchange of information. Plant Genet Resour Newsl 61:38.

Konopka J; Hanson J. 1985. Information handling systems for genebank management. *In* Konopka J; Hanson J, eds. Proc. Workshop held at the Nordic Genebank, Alnarp, Sweden, 21-23 Nov 1984. IBPGR, Rome. pp 21-28.

Painting KA; Perry MC; Denning RA; Ayad WG. 1993. Guidebook for genetic resources documentation. 295 p. Also available at http://www.bioversityinternational.org/publications/pdf/432.pdf

Stalker HT; Chapman C. 1989. Scientific management of germplasm: characterization, evaluation and enhancement. IBPGR, Rome. 194 p.

## Contributors to the Module

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## Next Lesson

In the next lesson, you will study the main aspects of germplasm documentation.

# Main Aspects of Germplasm Documentation

## Objective

To describe the main aspects of documentation as applied to procedures for *ex situ* conservation in a plant germplasm bank

## Introduction

At present, activities with PGRs are being coordinated globally through computer networks (e.g., SINGER), making possible the most efficient use of existing PGRs. However, they require accurate data that are easy to recover and use. Such data are generated within the germplasm banks where the PGRs are conserved.

In many germplasm banks, data on collections are currently found scattered among many sources such as electronic files, paper files, and field notebooks. Such a dispersion of data represents problems for standardizing data within the same bank and for exchanging information and germplasm between banks and institutions. A documentation system is therefore needed to support the bank as a source of information to help in its planning and operation, and in its interactions with other banks and entities.

Usually, a germplasm bank has limited time and few human and financial resources available. Hence, priorities must be set and decisions made as to which activities are more important than others. In any decision made, information will play a very important role, making it proper organization essential.

The *ex situ* conservation of germplasm involves many stages, that is, acquisition, multiplication, regeneration, characterization, evaluation, conservation, and distribution. Each stage includes a wide range of activities (see *Modules 2*, *3*, *4*, and *5*) that, in their turn, require or generate information. This information should be recorded, organized, and analysed to better understand the germplasm, make decisions on its management, and provide the added value that it deserves. This complex of activities to record, organize, and analyse information is known as **documentation**. This lesson briefly explores this theme, taking into account its importance as an essential component of conservation activities.

## Documentation and Its Implications

'Documentation', in terms of work with PGRs, is understood to be the process of identifying, acquiring, classifying, storing, managing, and disseminating information on germplasm. Documentation implies the organization of a documentation system that will store and conserve data. Manual or computerized methods can be used, or a combination of these (Painting et al. 1993).

Germplasm banks also need a documentation system as a tool for setting priorities, planning activities, and managing resources. It helps counteract the dispersion of information, thereby facilitating better access to collections and, thus, more efficient use of germplasm. Usually, a documentation system is used to store, maintain process, analyse, and exchange data that are typical of conservation activities (Painting et al. 1993).

Germplasm banks differ in their activities and in the way these are organized, because of the different species they conserve as well as the human resources, budget and facilities available. Because documentation systems support all these activities, different banks will also have different systems. Although many documentation systems of germplasm banks show similarities in design and operation, each will differ to the extent that they are developed according to the bank's needs for documentation and information (Painting et al. 1993).

## Documentation System

### *Characteristics*

For a documentation system to be usable according to the bank's goals, it must possess particular characteristics (Painting et al. 1993), such as those mentioned below:

- *Veracity and/or validity of information.* For information retrieved from a documentation system to be useful, it should contain accurate, reliable, and up-to-date data. Otherwise, the documentation system would be useless.
- *Ease of data retrieval.* The system should facilitate the simple and rapid recovery of information. If certain information is needed regularly and several hours must be invested to locate it each time, then valuable time is being lost in recovery. It should be remembered that the documentation system should work for the user, not vice versa.
- *Easy operation.* When the documentation system is user-friendly, fewer errors will be found, making the system more accessible for other people. An easy-to-use system requires minimum training.
- *Flexible operation.* The documentation system should not be rigid. It should be able to cope with different information requirements and be adaptable to procedural changes in the germplasm bank.
- *Organized data.* Data should be organized into groups that are practical for recording, storing, maintaining, and recovering information, taking into account users' needs.

### *Stages for the establishment of a documentation system*

Constructing a documentation system, whether manual and/or computerized, requires planning and detailed analysis before it is designed. Indeed, the process should tend towards a detailed analysis if a flexible and user-friendly system is to be constructed. Six stages are involved:

- *Obtaining information on the bank's needs.* In-depth understanding of the germplasm bank's needs, establishment, and available resources is needed. This will provide essential information that will help develop documentation objectives. It will also help in decisions on the better use and management of available resources.
- *Defining documentation objectives.* These objectives may include the documentation of passport data, inventorying, procedures for seed management, data distribution, characterization tests, and evaluation. They may also include information dissemination. To define areas of documentation, the germplasm bank's fields of work and their needs and priorities for documentation must be clearly understood.
- *Analysing procedures.* This activity explores the bank's most relevant procedures, and determines each procedure's needs for resources and the distinct types of data it

generates and uses. The foregoing will greatly assist decisions on handling data in the best way possible, for example, the desirability of using computerized versus manual forms. Analysis will also indicate how one procedure is related to another. This information will help construct a flow chart that shows the relationships among procedures and information flow within the bank. It will also help in later decisions on the best way of handling data and defining documentation procedures.

- *Identifying significant descriptors*. The most important descriptors of accessions in the bank should be identified and organized into groups that facilitate the documentation system's operation and maintenance. These groups can be thought of as separate books, files, or forms in a manual system, or separate files in a computerized system (e.g., 'characterization of wild *Arachis*' or 'viability tests'). These groups are practical in terms of recording and using data, and recovering information.
- *Developing data formats and recording forms*. A major task is to simplify data recording, either manually or in screen formatting, for each stage of documentation.
- *Developing documentation procedures and implementing the system*. This is the final phase of constructing the documentation system. It involves establishing documentation procedures to facilitate the system's operation, their implementation, and the training of personnel in the system's use.

## Documenting Operational Procedures in a Germplasm Bank

A germplasm bank follows a sequence of steps or stages in managing germplasm from its entry to the bank to its storage or distribution. These **steps** or **stages** are called **operational procedures** and constitute the essence of data generation and processing. Usually, all the bank's procedures generate information that should be recorded and stored for later recovery or consultation (Painting et al. 1993). In general, there are two main large operational procedures, one related to the bank's management per se (acquisition, inventories, regeneration, distribution and conservation), and other related to the germplasm per se (characterization and evaluation); each one of them will have, in turn, nested suboperational procedures.

Usually, procedures for banks that handle seeds, vegetative planting materials in the field, or *in vitro* materials can be diagrammatically outlined, whereby priority for documentation can be observed for each procedure (Figure 1). It should be remembered that the preparation of these and the setting of priorities for documentation are a function of the bank's type and objectives. In some cases, few activities will be diagrammed (e.g., banks that conserve only one species) and in others, multiple activities (e.g., international germplasm banks).

### *Documenting common procedures*

The most common procedures in germplasm banks include activities such as registration of samples (data of accessions), collection, cleaning, drying, viability testing, inventorying, distribution, and regeneration. These require, for their documentation, the use of descriptors (Figure 2), which, on being recorded, constitute conservation data. For the purposes of this lesson, only some are mentioned. Others can be consulted in IPGRI's lists of specific descriptors (IPGRI 2004; IPGRI and CIP 2003) and yet others are mentioned in the topic on germplasm characterization and evaluation (*Module 4*, *Lessons 1* and *2*).

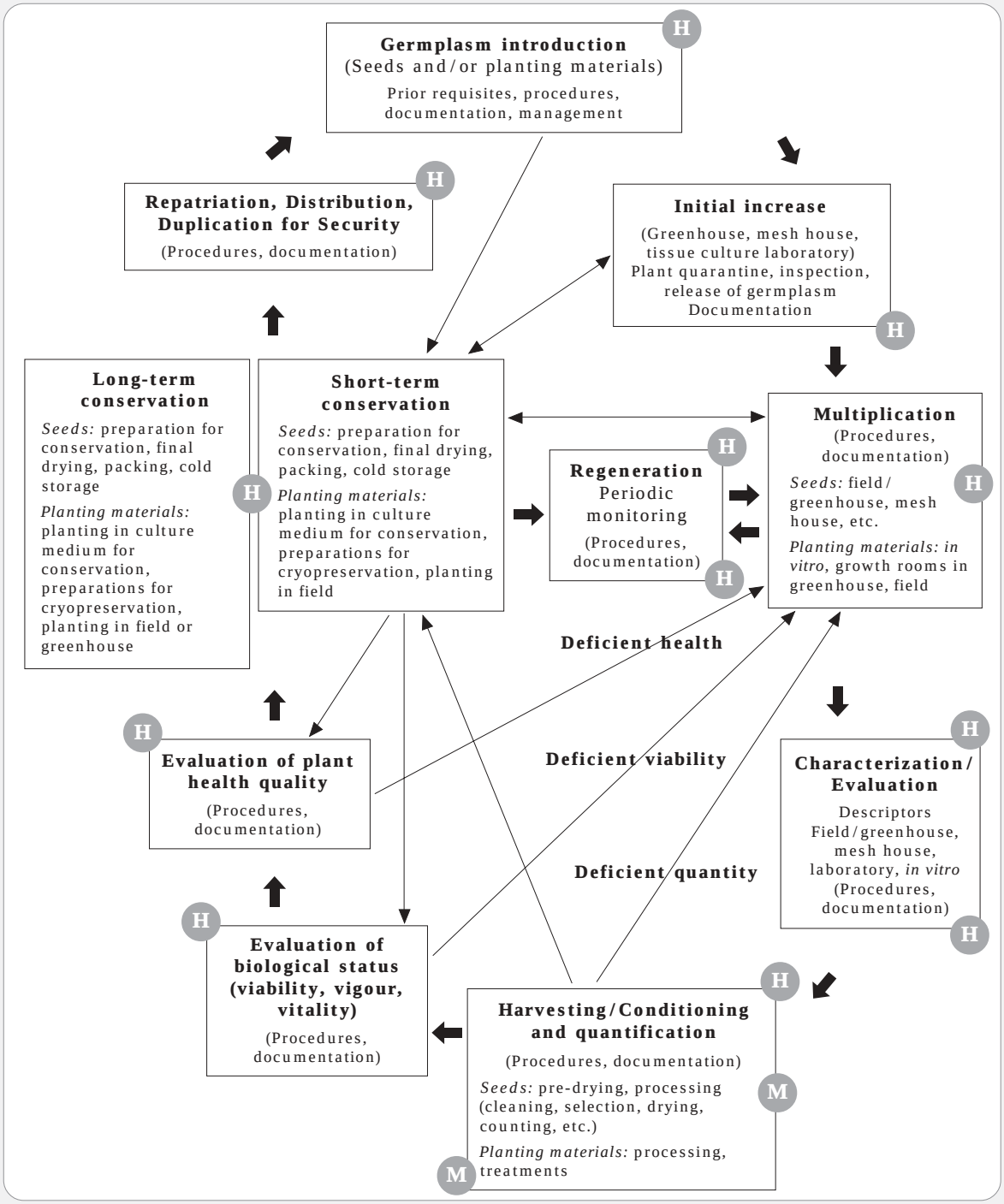


Figure 1. General operational procedures of a germplasm bank and its documentation priorities. H = high priority; M = medium priority; thick arrows indicate normal flow of operations; thin arrows indicate conditioning. (From *Flow Chart for Germplasm Management at GRU, CIAT*, redrawn by B Pineda.)

| No. | Descriptor | Accession | Collection | Cleaning | Drying | Viability | Inventory | Distribution | Regeneration |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Number of accession | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2 | Reference for lot | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 3 | Collection type | | | | | ✓ | ✓ | | ✓ |
| 4 | Scientific name | ✓ | ✓ | | | | | | |
| 5 | Cultivar name/pedigree | ✓ | | | | | | | |
| 6 | Donor's name | ✓ | | | | | | | |
| 7 | Donor's identification number | ✓ | | | | | | | |
| 8 | Other accession numbers | ✓ | | | | | | | |
| 9 | Acquisition date | ✓ | | | | | | | |
| 10 | Date of last regeneration or multiplication | ✓ | | | | | | | |
| 11 | Collector's number | | ✓ | | | | | | |
| 12 | Collector's organization | | ✓ | | | | | | |
| 13 | Trip identifier | | ✓ | | | | | | |
| 14 | Collection date | | ✓ | | | | | | |
| 15 | Country of collection | | ✓ | | | | | | |
| 16 | Province/state | | ✓ | | | | | | |
| 17 | Location of collection site | | ✓ | | | | | | |
| 18 | Latitude of collection site | | ✓ | | | | | | |
| 19 | Altitude of collection site | | ✓ | | | | | | |
| 20 | Origin (if different to collection site) | | ✓ | | | | | | |
| 21 | Source of collection | | ✓ | | | | | | |
| 22 | State of sample | | ✓ | | | | | | |
| 23 | Sample type | | ✓ | | | | | | |
| 24 | Common or local name | | ✓ | | | | | | |
| 25 | Number of sampled plants | | ✓ | | | | | | |

Figure 2. Significant descriptors used to record data during the general documentation of plant genetic resources (from Painting et al. [1993] and adapted by B Pineda).

(Continued)

Figure 2. (Continued.)

| No. | Descriptor | Accession | Collection | Cleaning | Drying | Viability | Inventory | Distribution | Regeneration |
|---|---|---|---|---|---|---|---|---|---|
| 26 | Land use | | ✓ | | | | | | |
| 27 | Vegetation type | | ✓ | | | | | | |
| 28 | Genetic erosion | | ✓ | | | | | | |
| 29 | Soil type | | ✓ | | | | | | |
| 30 | Crop use | | ✓ | | | | | | |
| 31 | Cultural practices | | ✓ | | | | | | ✓ |
| 32 | Identification number(s) of photography | | ✓ | | | | | | |
| 33 | Identification number of herbarium | | ✓ | | | | | | |
| 34 | Topography | | ✓ | | | | | | |
| 35 | Slope | | ✓ | | | | | | |
| 36 | Aspect | | ✓ | | | | | | |
| 37 | Annual rainfall | | ✓ | | | | | | |
| 38 | Season of monthly rainfall | | ✓ | | | | | | |
| 39 | Soil pH | | ✓ | | | | | | |
| 40 | Soil texture | | ✓ | | | | | | |
| 41 | Date of cleaning seed | | | ✓ | | | | | |
| 42 | Reference for cleaning method | | | ✓ | | | | | |
| 43 | Total seed estimate | | | ✓ | | | | | |
| 44 | Proportion of empty seed | | | ✓ | | | | | |
| 45 | Seed treatment | | | ✓ | | | | | |
| 46 | Operator (cleaning) | | | ✓ | ✓ | | | | |
| 47 | Reference for drying method | | | | ✓ | | | | |
| 48 | Determination of final moisture content (%) | | | | ✓ | | | | |
| 49 | Date of determination of final moisture content | | | | ✓ | | | | |
| 50 | Total dry weight of seeds | | | | ✓ | | | | |

(Continued)

Figure 2. (Continued.)

| No. | Descriptor | Accession | Collection | Cleaning | Drying | Viability | Inventory | Distribution | Regeneration |
|---|---|---|---|---|---|---|---|---|---|
| 51 | 1000-seed weight for small seeds | | | | ✓ | | ✓ | | |
| | 100-seed weight (for large seeds) | | | | ✓ | | ✓ | | |
| 52 | Reference for viability method | | | | | ✓ | | | |
| 53 | Date of viability test | | | | | ✓ | | | |
| 54 | Viability (%) | | | | | ✓ | | | |
| 55 | Operator (viability) | | | | | ✓ | | | |
| 56 | Location of seeds in storage | | | | | | ✓ | | |
| 57 | Total quantity of seeds | | | | | | ✓ | | |
| 58 | Minimum quantity of seed permitted | | | | | | ✓ | | |
| 59 | Number of packages/containers | | | | | | ✓ | | |
| 60 | Supply date | | | | | | | ✓ | |
| 61 | Quantity of seeds sent | | | | | | | ✓ | |
| 62 | Reference for receiver's address | | | | | | | ✓ | |
| 63 | Plant health certificate number | | | | | | | ✓ | |
| 64 | Exports permit number | | | | | | | ✓ | |
| 65 | Receiver's imports permit number | | | | | | | ✓ | |
| 66 | Postal registration number | | | | | | | ✓ | |
| 67 | Regeneration site | | | | | | | | ✓ |
| 68 | Collaborator | | | | | | | | ✓ |
| 69 | Reference for plot | | | | | | | | ✓ |
| 70 | Planting date | | | | | | | | ✓ |
| 71 | Transplanting date | | | | | | | | ✓ |
| 72 | Planting density | | | | | | | | ✓ |
| 73 | Germination in field (%) | | | | | | | | ✓ |
| 74 | Number of plants established | | | | | | | | ✓ |
| 75 | Days from planting to flowering (no.) | | | | | | | | ✓ |
| 76 | Reproduction system | | | | | | | | ✓ |
| 77 | Harvest date | | | | | | | | ✓ |

***Registering samples.*** The registration of samples consists of assigning each sample (or accession) a unique identification number and recording data received with the samples, including those known to be descriptors of the accession. The data recorded would include:

- Accession number (a unique number assigned to each accession)
- Other numbers associated with the accession (e.g., code numbers for collectors and donors)
- Scientific name (genus, species, subtaxa, and authorities)
- Common name(s) of the cultivated species
- Cultivar name(s) or pedigree
- Date of acquisition of sample (incorporation into the germplasm bank)
- Date of last regeneration

***Collection data*** are also known as **passport data** and refer to the data reported when the sample was first collected. They form an essential part of the information on the conserved germplasm. These collection data or descriptors can be numerous, depending on the degree of detail in which information is needed. FAO and IPGRI have jointly prepared a list of passport descriptors of many crops (Box 1) to provide uniform coding systems for common passport descriptors of various crops (FAO and IPGRI 2001). This list should not be regarded as a basic list of descriptors because, to fully describe the germplasm, other passport descriptors must necessarily be recorded.

The passport data most commonly documented on registering samples include (Figure 2):

- Collection date
- Collector's name, number, and institute
- Country and province or state of collection
- Locality, latitude, longitude, and altitude of collection site
- Origin of sample (e.g., household garden, market, or farm)
- State of sample (e.g., wild, landrace, or advanced cultivar)
- Number of sampled plants

We point out that these collection descriptors are considered as 'essential' for registering samples. However, many more may be used, depending on the level of detail at which information is to be recorded at the germplasm bank. For example, some banks may wish to record ethnobotanical data, and others further information on the collection site and environment (e.g., topography, soils, and vegetation).

***Seed cleaning.*** The seeds to be conserved in a germplasm bank should be, as far as possible, clean and free of broken seeds, residues, or infested or infected seeds. To save time, some banks do not document this procedure; others consider that such data have little practical or scientific value. Nevertheless, information could be collected on seed management during harvest and conditioning to permit corrections where necessary. Some descriptors suggested for this procedure are:

- Accession number
- Date of procedure
- Method used
- Total number of seeds
- Empty seeds (%)
- Operator (name of person who carried out the test)

***Box 1***

**Multi-Crop passport descriptors**

1. **Institute code (INSTCODE)**
   Code of the institute where the accession is maintained. The codes consist of the 3-letter ISO 3166 country code of the country where the institute is located plus a number. The current set of Institute Codes is available from the FAO website (http://apps3.fao.org/wiews/).
2. **Accession number (ACCENUMB)**
   This number serves as a unique identifier for accessions within a genebank collection, and is assigned when a sample is entered into the genebank collection.
3. **Collecting number (COLLNUMB)**
   Original number assigned by the collector(s) of the sample, normally composed of the name or initials of the collector(s) followed by a number. This number is essential for identifying duplicates held in different collections.
4. **Collecting institute code (COLLCODE)**
   Code of the Institute collecting the sample. If the holding institute has collected the material, the collecting institute code (COLLCODE) should be the same as the holding institute code (INSTCODE). Follows INSTCODE standard.
5. **Genus (GENUS)**
   Genus name for taxon. Initial uppercase letter required.
6. **Species (SPECIES)**
   Specific epithet portion of the scientific name in lowercase letters. Following abbreviation is allowed: 'sp.'.
7. **Species authority (SPAUTHOR)**
   Provide the authority for the species name.
8. **Subtaxa (SUBTAXA)**
   Subtaxa can be used to store any additional taxonomic identifier. Following abbreviations are allowed: 'subsp.' (for subspecies); 'convar.' (for convariety); 'var.' (for variety); 'f.' (for form).
9. **Subtaxa authority (SUBTAUTHOR)**
   Provide the subtaxa authority at the most detailed taxonomic level.
10. **Common crop name (CROPNAME)**
    Name of the crop in colloquial language, preferably English (i.e. 'malting barley', 'cauliflower', or 'white cabbage').
11. **Accession name (ACCENAME)**
    Either a registered or other formal designation given to the accession. First letter uppercase. Multiple names separated with semicolon without space. For example: Rheinische Vorgebirgstrauben;Emma;Avlon
12. **Acquisition date [YYYYMMDD] (ACQDATE)**
    Date on which the accession entered the collection where YYYY is the year, MM is the month and DD is the day. Missing date (MM or DD) should be indicated with hyphens. Leading zeros are required.
13. **Country of origin (ORIGCTY)**
    Code of the country in which the sample was originally collected. Use the 3-letter ISO 3166-1 extended country codes.

(Continued)

***Box 1.*** (Continued.)

**14. Location of collecting site (COLLSITE)**
Location information below the country level that describes where the accession was collected. This might include the distance in kilometres and direction from the nearest town, village or map grid reference point (e.g. 7 km south of Curitiba in the state of Parana).

**15. Latitude of collecting site[1] (LATITUDE)**
Degree (2 digits), minutes (2 digits), and seconds (2 digits) followed by N (North) or S (South) (e.g. 103020S). Every missing digit (minutes or seconds) should be indicated with a hyphen. Leading zeros are required (e.g. 10----S; 011530N, 4531--S).

**16. Longitude of collecting site[1] (LONGITUDE)**
Degree (3 digits), minutes (2 digits), and seconds (2 digits) followed by E (East) or W (West) (e.g. 0762510W). Every missing digit (minutes or seconds) should be indicated with a hyphen. Leading zeros are required (e.g. 076----W).

**17. Elevation of collecting site (masl) (ELEVATION)**
Elevation of collecting site expressed in metres above sea level. Negative values are allowed.

**18. Collecting date of sample [YYYYMMDD] (COLLDATE)**
Collecting date of the sample, where YYYY is the year, MM is the month, and DD is the day. Missing data (MM or DD) should be indicated with hyphens. Leading zeros are required.

**19. Breeding institute code (BREDCODE)**
Institute code of the institute that has bred the material. If the holding institute has bred the material, the breeding institute code (BREDCODE) should be the same as the holding institute code (INSTCODE). Follows INSTCODE standard.

**20. Biological status of accession (SAMPSTAT)**
The coding scheme proposed can be used at 3 different levels of detail: either by using the general codes (in boldface) such as 100, 200, 300, 400 or by using the more specific codes such as 110, 120 etc.

**100) Wild**
- 110) Natural
- 120) Semi-natural/wild

**200) Weedy**

**300) Traditional cultivar/landrace**

**400) Breeding/research material**
- 410) Breeder's line
  - 411) Synthetic population
  - 412) Hybrid
  - 413) Founder stock/base population
  - 414) Inbred line (parent of hybrid cultivar)
  - 415) Segregating population
- 420) Mutant/genetic stock

**500) Advanced/improved cultivar**

**999) Other** (Elaborate in REMARKS field)

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1. To convert from longitude and latitude in degrees (°), minutes ('), seconds (''), and a hemisphere (North or South and East or West) to decimal degrees, the following formula should be used: d° m' s''=h *(d+m/60+s/3600) where h=1 for the Northern and Eastern hemispheres and –1 for the Southern and Western hemispheres i.e. 30°30'0'' S=–30.5 and 30°15'55' N=30.265.

(Continued)

***Box 1.*** (Continued.)

**21. Ancestral data (ANCEST)**
Information about either pedigree or other description of ancestral information (i.e parent variety in case of mutant or selection). For example a pedigree 'Hanna/7*Atlas/Turk/8*Atlas' or a description 'mutation found in Hanna', 'selection from Irene' or 'cross involving amongst others Hanna and Irene'.

**22. Collecting/acquisition source (COLLSRC)**
The coding scheme proposed can be used at 2 different levels of detail: either by using the general codes (in boldface) such as 10, 20, 30, 40 or by using the more specific codes such as 11, 12 etc.

**10) Wild habitat**
- 11) Forest/woodland
- 12) Shrubland
- 13) Grassland
- 14) Desert/tundra
- 15) Aquatic habitat

**20) Farm or cultivated habitat**
- 21) Field
- 22) Orchard
- 23) Backyard, kitchen or home garden (urban, peri-urban or rural)
- 24) Fallow land
- 25) Pasture
- 26) Farm store
- 27) Threshing floor
- 28) Park

**30) Market or shop**

**40) Institute, Experiment station, Research organization, Genebank**

**50) Seed company**

**60) Weedy, disturbed or ruderal habitat**
- 61) Roadside
- 62) Field margin

**99) Other** (Elaborate in REMARKS field)

**23. Donor institute code (DONORCODE)**
Code for the donor institute. Follows INSTCODE standard.

**24. Donor accession number (DONORNUMB)**
Number assigned to an accession by the donor. Follows ACCENUMB standard.

**25. Other identification (numbers) associated with the accession (OTHERNUMB)**
Any other identification (numbers) known to exist in other collections for this accession. Use the following system: INSTCODE:ACCENUMB;INSTCODE:ACCENUMB;... INSTCODE and ACCENUMB follow the standard described above and are separated by a colon. Pairs of INSTCODE and ACCENUMB are separated by a semicolon without space. When the institute is not known, the number should be preceded by a colon.

**26. Location of safety duplicates (DUPLSITE)**
Code of the institute where a safety duplicate of the accession is maintained. Follows INSTCODE standard.

(Continued)

***Box 1.*** (Continued.)

**27. Type of germplasm storage (STORAGE)**
If germplasm is maintained under different types of storage, multiple choices are allowed, separated by a semicolon (e.g. 20;30). (Refer to FAO/IPGRI Genebank Standards 1994 for details on storage type.)

**10) Seed collection**
11) Short term
12) Medium term
13) Long term
**20) Field collection**
**30) *In vitro* collection (Slow growth)**
**40) Cryopreserved collection**
**99) Other** (Elaborate in REMARKS field)

**28. Remarks (REMARKS)**
The Remarks field is used to add notes or to elaborate on descriptors with value 99 or 999 (=Other). Prefix remarks with the field name they refer to and a colon (e.g. COLLSRC:riverside). Separate remarks referring to different fields are separated by semicolons without space.

SOURCE: FAO and IPRGI (2001).

***Seed drying.*** In a germplasm bank, orthodox or intermediate seeds are dried to reduce their moisture content to acceptable levels without affecting their viability. This procedure is applicable only to seed germplasm collections. Usually, on receiving the sample, the initial moisture content is first determined. If this is very high, then the seeds are dried, using a suitable method, to reduce moisture content to the desired level. Once seeds are dried, some banks determine the total weight of the dried seeds and the 100- or 1000-seed weight, depending on their size. The most commonly used descriptors for seed drying are:

- Accession number
- Initial moisture content
- Drying method
- Date of measurement
- Final moisture content
- Total dry weight of seeds
- 1000-seed weight
- 100-seed weight (for large seeds)

***Seed viability.*** Germination under laboratory conditions is defined as the emergence and development of those essential structures that indicate, for the class of seed being analysed, the seed's ability to become a normal plant under favourable conditions. The results of this test indicate the percentage of live seeds of an accession that can produce plants under appropriate conditions (*Module 3, Submodule C, Lessons 1* and *2*). In terms of bank management, the viability of seeds must be known, as it indicates when a sample should be regenerated. Otherwise, the accession could be lost if its viability drops to very low levels. Typical descriptors for a seed viability test are:

- Accession number
- Lot reference (any date, code, or number that uniquely identifies the accession's regeneration or multiplication cycle)

- Collection type (e.g., whether base or active collection)
- Reference for method used (e.g., absorbent tissue or tetrazolium test)
- Viability (%)
- Operator (name of person who carried out the test)

***Storage.*** Once the seeds have been dried and cleaned, and their percentage of viability recorded, they are stored in cold rooms (or under normal conditions, according to case). The following data or descriptors are recorded:

- Accession number
- Lot reference
- Collection type
- Location in cold room
- Total quantity of seeds stored per accession
- 1000-seed weight
- 100-seed weight (for large seeds)
- Minimum quantity permitted for seeds (this parameter helps determine when more seeds should be produced or multiplied)

***Germplasm distribution.*** Linked to the information mentioned above on storage, information on the distribution of germplasm that the bank carries out should also be recorded. For example, some banks continually distribute germplasm for improvement programmes or for exchange with other banks. In these cases, to maintain efficient control over the bank's holdings of materials, a record must be kept of the materials being distributed. Typical descriptors that should be considered are:

- Accession number
- Lot reference
- Date of exit of material
- Quantity of seed sent
- Data on receiver
- Plant health certificate number (if applicable)

Small banks, which have a very limited distribution of materials, would probably not need a sophisticated documentation system. Recording distribution information in a book or other means would be sufficient.

***Duplication for security.*** The maintenance of germplasm duplicates for security is a major conservation activity in banks. For its documentation, the descriptors used are those of FAO's World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture (WIEWS) (Box 2). They provide codes for locating the institution where a given germplasm is kept, in addition to other pertinent data.

***Regeneration or multiplication.*** Regeneration or multiplication is carried out in response to data obtained through the seed monitoring control or during the growth cycle of the vegetative propagated species, which is conducted at given intervals of time to test the viability of each accession in storage and ascertain the quantity of seeds it has. The principal data or descriptors used to record regeneration or multiplication are:

- Accession number

***Box 2***

**Descriptors used by FAO's World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture (WIEWS)**

1. **Location of safety duplicates (DUPLSITE)**
   Code of the institute where a safety duplicate of the accession is maintained. The codes consist of 3-letter ISO 3166 country code for the country where the institute is located plus number or an acronym as specified in the Institute database that will be made available by FAO. Preliminary codes (i.e. codes not yet incorporated into the FAO Institute database) start with an asterisk followed by a 3-letter ISO 3166 country code and an acronym. Multiple numbers can be added and should be separated with a semicolon.
2. **Availability of passport data (i.e. in addition to what has been provided) (PASSAVAIL)**
   0 Not available
   1 Available
3. **Availability of characterization data (CHARAVAIL)**
   0 Not available
   1 Available
4. **Availability of evaluation data (EVALAVAIL)**
   0 Not available
   1 Available
5. **Acquisition type of the accession (ACQTYPE)**
   1 Collected/bred originally by the institute
   2 Collected/bred originally by joint mission/institution
   3 Received as a secondary repository
6. **Type of storage (STORTYPE)**
   Maintenance type of germplasm. If germplasm is maintained under different types of storage, multiple choices are allowed, separated by a semicolon (e.g. 2;3). (Refer to FAO/IPGRI Genebank Standards 1994 for details on storage type.)
   1 Short-term
   2 Medium-term
   3 Long-term
   4 *In vitro* collection
   5 Field genebank collection
   6 Cryopreserved
   99 Other (elaborate in REMARKS field)

SOURCE: Quek et al. (1999).

- Lot reference
- Collection type
- Regeneration site
- Plot reference (of field, furrow, and plot number)
- Planting date
- Planting density
- Germination in the field (%)
- Established plants (no.)
- Days from planting to flowering (no.)
- Harvest date
- Cultural practices

***Germplasm characterization and evaluation.*** Germplasm characterization refers to the recording of highly inheritable descriptors (or data) that are readily seen and are expressed in all environments (*Module 4, Lesson 2*). They mostly include:

- Accession number
- Plant descriptors (morphological characterization)
- Susceptibility to abiotic stress (evaluation)
- Susceptibility to biotic stress (evaluation)
- Biochemical markers (molecular characterization)
- Molecular markers (molecular characterization)
- Cytological characteristics

### *Data analysis*

The data generated in different processes may be analysed according to requirements (Franco and Hidalgo 2003). Depending on the level of requested analyses and reports required by the germplasm bank, statistical analysis tools can be used (see *Module 4, Lesson 2*).

## Evaluating the Lesson

After this lesson, which is the last of this course, you should be familiar with the main aspects of plant germplasm documentation, particularly those procedures that are common to germplasm banks dedicated to *ex situ* conservation.

Before finishing the course, do one of the following exercises:

1. If you have personal experience in germplasm documentation, select one of the operational procedures used in your bank and briefly illustrate it with the descriptors used by the bank.
2. If you do not have personal experience with germplasm documentation, give your opinion on the process and its importance for *ex situ* conservation. Base your answer on the contents of the lesson and list of recommended reading.

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### *Further reading*

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## Next Activity

Review the lessons and prepare for the final evaluation as required by the course teachers.

**Thank you for your dedication and interest in the matter of conserving germplasm for the benefit of humanity**