Guide to handling of tropical and subtropical forest seed

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Publication date:
2000

Document Version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Schmidt, L. H. (2000). Guide to handling of tropical and subtropical forest seed. Danida Forest Seed Centre.

SEED DOCUMENTATION

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Extract from 'Guide to Handling of Tropical and Subtropical Forest Seed'
by Lars Schmidt, Danida Forest Seed Centre. 2000.

Other Chapters of the book Guide to Handling of Tropical and Sub-Tropical Forest Seed by Lars Schmidt soon available on www.dfsc.dk

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SEED DOCUMENTATION

14.1 Introduction

High physiological and genetic seed quality is tightly linked to a good record and documentation system. From a genetic point of view, seed without information on its origin, history and potential performance poses a risk and may be almost worthless. Seed records have different purposes for the different people involved, and the documentation system and contents including the level of detail vary accordingly. For example:

1. Seed documentation may be used as a planning tool for future seed procurement. Records on seed collection from various seed sources may provide useful information on productivity, seasonality and periodicity in seeding pattern, thereby saving time on initial surveys prior to collection. Success or failure of achieving good seed quality may often be ascribed to particular handling procedures. Records on seed handling correlated with seed quality may thus indicate sensitive aspects in the handling process and suggest improved procedures. Far too much re-invention and re-exploration is made because previous mistakes were not recorded. Poulsen and Thomsen (1999) have proposed a thorough seed procurement record and documentation system with the major purpose of improving procurement methods by analysing documented practices. The system covers all handling aspects from maturity criteria, collection and processing to testing and storage.
2. Internal database. In small units such as local forest departments, where seed collection, nursery operation and planting are under the same head, documentation may seem redundant. However, human memory has limitations, staff members move or resign, and the life time of trees, which can be important when tracing seed sources, tends to be longer than service in the forest sector.
3. Information and quality documentation for end user (customer). Documentation is a link between supplier and end user. It contains information on both seed source (origin) and test results. Good seed documentation becomes particularly important when seeds are dispatched to end users who are not in direct contact with those who collected

and handled the seed. This is particularly so in international transfer of seed (see chapter 15). Seed source details, genetic base and physiological quality are factors of major importance for the seed buyer.

4. Requirement from official authorities. Type and details of required seed documentation vary from one country to another and usually depend on quantity, type of disposal, and species. Small non-commercial seed lots distributed within the country e.g. in connection with research are rarely subject to any official requirement of documentation. Commercial seed lots are usually subject to the same type of accounting as any other commercial product. Seed transferred over international borders may be subject to particular regulations and documentation requirements. The topic is discussed in chapter 15; a few points should be summarised:

   a. Customs regulations. Normally only in importing countries. Commercial seed lots may be subject to general or specific import regulations e.g. on paying tax and duty, and official invoices are required.
   b. The importing country may require that imported 'living plant material' is free of pest and diseases. Where an official accredited laboratory carries out the examination and/or treatment, the seed lot is issued with an official 'Phytosanitary Certificate'.
   c. Export of forest seed has so far rarely been subject to regulations by the exporting countries. However, with the increasing concern of national right to genetic resources, export regulations are likely to become more common in the future, at least for some species and in some countries.

Seed suppliers usually design their own forms and documentation system. Examples of a number of forms are presented in the appendices to this chapter. It should be emphasised that both too much and too little information may be a nuisance. It is important that all relevant information on a seed lot is available, but not all information need to be provided to any user. For example, a label adhering to a submitted seed sample need only contain basic information on species, provenance, quantity etc., while additional information is submitted on a separate form. It is therefore important that each seed lot be allocated a unique seed identity number, which will appear on any information form of the same seed lot, and from which specific seed lot information can be retrieved.

Seed documentation is usually filled in on pre-designed forms during collection, processing or testing. However, several computer programmes are available which facilitate record keeping and documentation. Specially designed integrated systems allow all kinds of information to be stored and retrieved in the same system. Database systems are continuously under development, and electronic storage and data management systems are still becoming more common.

14.2 Documentation and Certification

Reliability of documentation is always a matter of confidence. If a seed collector states that they have collected seeds from 20 widely spaced, good phenotype trees in a superior stand, there is rarely a way to check whether it is true. Unfortunately, much seed is traded above its real quality on that account. A good documentation system is a way to avoid lapse, failures or direct dishonesty in seed procurement, and in turn achieve confidence from customers. The signature by the officer in charge of individual operations should be a guarantee of both appropriate methodology applied (e.g. in testing) and reliability of data. Certification is a further guarantee issued by an official, governmental accredited authority, e.g. a seed testing station. Certification does not necessarily mean that the seeds have a higher quality than those with more informal documentation, only that quality or authenticity is verified by an official authority. Therefore, certification is generally used only for special valuable seeds or in connection with special requirements, e.g.:

1. Genetic quality. Seed collected from trees of proven genetic superiority, e.g. from seed orchards or superior ('plus') trees in a natural stand with controlled pollination. Certificates may state 'Certificate of Origin' or seeds may simply be referred to as 'certified tree seed' (For. Com. 1994).
2. Physiological quality. Where seed testing is carried out according to the ISTA (or AOSA) rules (see chapter 8) by special accredited seed testing laboratories, an ISTA certificate of seed quality may be issued. An ISTA seed quality certificate is hence an assurance that seeds have been tested according to the rules.
3. Health and diseases. Governments often require imported seeds to have been certified by an official authority, stating that the seeds are not infected or carrying diseases. Such a 'Phytosanitary Certificate' states that seeds have been examined and 'to the best of our knowledge' been found free of special pests and fungi.

Some examples of official certificates are presented in appendix A14.2.

14.3 Codes and Accession Number System

The purpose of a seed coding and numbering system is to create a quick reference system across all handling procedures. It saves both time and space in writing when a species, seed source or seed lot is referred to with few letters or reference figures rather than writing a full detailed explanation every time it is encountered. Codes and accession numbers (in some systems called 'reference' or 'identity' numbers) make the use of computerised database management possible, and allow e.g. lots of information to be compressed into column form, and hence several columns on a summary data sheet (table A14.2C). In practical seed handling, a seed source and seed-lot reference or accession number is used. Species codes are used mainly in computer-based documentation. In seed trading, supplier and customer codes are normally used in connection with a full seed documentation system (Lauridsen 1994). Seed suppliers would often

create their individual system of documentation and data management, but some initial considerations should be made:

Codes and reference numbers should be unique, meaning that two species, two seed sources or two seed lots do not have the same code or number. Species may be referred to by three or four first letters of genus and species name, all in capital letters. Three is usually sufficient both to be unique and to recognise the species name from the code, but it becomes easier with four. However, even four is not a safe identification code. For example EUCAMICR may mean both *Eucalyptus microtheca* and *E. microcorys*. If one happens to have both these species in supply, they must be distinguished by other means. In fact there are very few examples where 4+4 letters can cause confusion.

Seed-source reference number may consist of numbers, letters or a combination. Letters may refer to species, location, type of seed-source etc. Letters referring to species may cause confusion in case several species are collected from the same seed source. As an example of a seed source reference system, the National Tree Seed Programme (NTSP) in Tanzania uses a system consisting of three components (Rasmussen 1992):

- two capital letters, referring to one of the three regional seed centres (RC) responsible for the seed source.
- a three digit serial number referring to seed source identity within the particular RC.
- one capital letter referring to type of seed source e.g. Z (= seed collection zone), I (= identified stand), S (= selected stand), A (= seed production area), P (= provenance seed stand), and O (= seed orchard).

For example, seed source number MO149S thus refers to a seed source located in the area under the Morogoro RC, it is number 149 of their seed sources, and is a selected stand.

Seeds delivered at the central processing station (forest office, seed centre etc.) may already have been given a provisional or temporary seed-lot number for identification in the field. At the beginning of the handling procedure the seed lot is given a new seed-lot number according to a pre-decided system, which may differ from place to place. As with seed source the identification or accession number may contain letters, figures or both, which may be related to species, seed source, year of collection etc. (Lauridsen 1994).

Australian Tree Seed Centre uses a continuous 5 digit number for each species (ATSC 1995 (see table A14.2C)). Danida Forest Seed Centre uses a system where seed lots are numbered in sequence as they enter the seed bank, the year of accession being indicated. A seed lot with identity number 5320/92 means a bulked seed lot number 5320 received in 1992 (Lauridsen 1994). At the NTSP in Tanzania the seed-lot accession number consists of three components: 1) the seed source number (according to the system described above), 2) a

two digit number indicating year of collection, and 3) a capital letter indicating number of collection in the particular seed source. Seedlot accession number MO149S/91B thus refers to the second seed collection (indicated by B) in 1991 (indicated by /91) from above mentioned Morogoro seed source number 149, which is a selected stand (Rasmussen 1992).

As the above examples show, the options are vast and the individual seed supplier must decide on a system, which is appropriate under the particular operation conditions. The most important is that identity or reference numbers are unique, so that two seed sources or seed lots will not have the same number. Once the seed lot number has been allocated, it should be entered on all seed forms and labels subsequently used for that seed lot.

Codes and reference numbers for seed suppliers and customers may include letters for country code, region, project etc.

14.4 Seed Documentation Systems

Complete seed documentation systems consist of a variable number of standard forms, which are filled in during seed handling. Examples of seed documentation systems are given by Bowen (1980), Rasmussen (1992), Lauridsen (1994), and ATSC (1995). Willan (1985) gives examples of forms used by forest seed centres and suppliers all over the world. A compilation and modification of some of these forms appears in appendix A14.1 of this chapter. Additional examples of filled in forms used by various seed centres are shown in appendix A14.2. Although computer software has replaced much of the cumbersome manual recording and registering, predesigned forms remain essential for recording in the field or laboratory. Information and records filled in forms may be transferred to computer systems to facilitate both statistical calculation and other data management. Computer data management will be further discussed in section 14.6. A discussion of some of the components of the seed documentation forms of appendix A14.1 is given in section 14.4.1 to 14.4.5 below. An overview of the forms is presented in table 14.1.

Table 14.1. Overview over seed record and documentation forms. Figures in parentheses refer to appendix A14.1. (compare also table 14.3).

Seed source records	Seed source information form (A14.1A) List of seed sources (A14.1B) Country map of seed sources (A14.1C)
Collection and seed handling records	Collection and handling records (A14.1D) Seed procurement accounting form (A14.1E)
Seed testing records	Seed sampling form (A14.1F) Seed test forms (A14.1G1+2)
Seed stock and dispatch records	Seed stock and dispatch form (14.1H)
Customer information	Seed lot summary data sheet (A14.1I) Labels for containers (A14.1J)

14.4.1 Seed source records

Seed source information is recorded on forms like the example in appendix A14.1A. The records provide information on the origin of the seed, i.e. from where the seeds were collected including the ecological conditions of the site and type of seed source. Ecological information such as altitude, rainfall, temperature, and soil type, is essential for matching the right seed source with the particular planting environment. Also seed zone and provenance contain information about site conditions. Seed zones are the largest units in seed collection. The classification of seed zones is based on climatic factors (temperature, precipitation), physiographic structure (topography, geology, soils) and geographical elements (vegetation). It is envisaged that the genetic variation within a seed zone is less than between two different zones (Albrecht 1993). Seed zones serve as a broad guideline for transferring seeds for national plantation programmes (Barner and Willan 1985). The provenance name refers more specifically to where the species grows. A seed zone (sometimes called region of provenance) may thus contain several identified provenances. A provenance name normally refers to a relatively well identifiable place on a map, e.g. a lake, hill or nearest larger town. The provenance concept (see chapter 3) implies that there is a reasonable uniformity and exchange of genetic material within the population that makes up a provenance. Hence, provenance contains two types of information 1. ecological and 2. genetic uniformity.

The ecological information of provenances may be a more specific guideline on provenance choice for particular planting sites than seed zone. For example, if one were to plant *Pinus caribaea* at a lowland moist site, it would probably be advisable to purchase seed from a lowland moist provenance. The provenance name refers to where the species grows, no matter whether it is a natural forest or it was introduced. However, for exotic species the origin should, if possible be indicated. If a seed source in Salima, Malawi, was established from a Petford provenance of *Eucalyptus camaldulensis*, it is a Salima provenance, but the origin of Petford is indicated.

The type of stand gives information on the genetic history and sometimes quality of the seed source. Neither natural stands nor most plantations have been subject to selection for quality. A natural stand often has a wider genetic base than a plantation unless the natural stand is a small isolated group of trees, e.g. a small relict of a previous large stand. Both natural stands and plantations can be upgraded to selected or certified seed sources or seed stands. The latter involves some selection since inferior individuals must be eliminated to upgrade the average genetic quality. Where a seed source has been established based on genetic results from an improvement programme, the seed source is referred to as a seed orchard. Both generation (1st, 2nd etc.) and mode of establishment (clonal or seedling) are indicated in the seed source record (see also discussion on seed sources in chapter 3).

Much information on seed-source forms has only relevance to the seed collector or supplier. That pertains to e.g. information on ownership, accessibility, size, age and productivity of the stand. Also details

on flowering and fruiting periods, potential local labour availability and other pure collection details are of little interest for the seed customer, while being highly relevant for the seed supplier. Only information that refers directly or indirectly to seed quality is transferred to the form submitted to the customer (appendix A14.1I).

Seed sources are conveniently listed in an easily overviewed table (A14.1B). Listing may be done according to species or seed source. The latter is sometimes more appropriate where seed sources contain and serve as source for more species e.g. many mixed natural forests. Computer databases can easily shift between seed source listing and species listing. Eventually, seed sources are conveniently plotted on a national or regional map indicating seed-source reference number (appendix A14.1C).

14.4.2 Collection and seed handling records

For each individual seed lot, procedures and conditions during seed collection and processing are recorded (A14.1D). As the seed-source reference number appears in the form, collection and handling records can be linked to the particular seed source where the seed was collected.

The collection form contains two measures on genetic quality viz. genetic base and selection of seed trees. Genetic base is indicated by the number of and distance between parent trees of the seed lot. This information is important if the plants to be raised may be considered as seed source some time in the future (see discussion on genetic base, chapter 3). Information on phenotypic selection of seed trees applies in particular to natural stands and plantations, since selection is already implicit where seeds are collected from seed stands or seed orchards. Phenotypic selection of seed trees is usually done during collection (section 3.3).

Information on field handling, transport and possible field processing are particularly important for the further processing at the central processing station. It is envisaged that the first part of the seed-handling and processing form is filled in and signed by the person responsible for the collection, before the seed lot incl. form is handed over to the processing station.

Many details on collection and handling appearing on the form have relevance only to those involved in seed collection and processing. The information may be used by the seed supplier as a guideline during the succeeding processing of the particular seed lot, and to improve procedures for future seed lots. Seed-handling records are especially pertinent where different people are involved in different processes. For example, if field collection records tell that a seed lot was collected during moist weather, the processing officer may give priority to rapid processing of this seed lot. It is therefore an advantage that the seed-collection and handling form follows the seed lot during seed handling and is filled in gradually during handling (Poulsen and Thomsen 1999), see also appendix A6.2.

Expenses of seed collection and processing are recorded on form

A14.1E. The accounting system helps to estimate the actual procurement expenses, which form a major component during calculation of seed price (chapter 15). This information may also be used to identify areas where gains in efficiency can be made. It is also useful during planning when demand is matched to potential sites for collection.

14.4.3 Seed testing records

Samples for seed testing are frequently drawn from the bulk seed lot and submitted to the seed-testing laboratory. A seed sampling form (A14.1F) should accompany the samples. The form is a documentation that sampling was undertaken according to the rules of representativeness as stated in section 11.4.

Seed testing documentation contains results of standard seed testing procedures such as seed weight, moisture content, purity and viability/germination plus sometimes special test (chapter 11). For laboratory tests special working forms are used (form A14.1G1 and A14.1G2). The results are summarised in a seed testing section of the seed-lot summary data form (A14.1I). If other viability test than germination is carried out (cutting, X-ray, TTZ etc.), the form should state which type of test has been carried out. Since viability declines with time, the date of testing is important. Regular viability tests are pertinent for long-time storage, and for seed with short viability. Obviously the latest record should be the one submitted to customers.

Testing for seed-borne pests and pathogens may be carried out in connection with general seed testing or by special laboratories. The latter is often a requirement during international transfer, where the phytosanitary condition must be documented on a Phytosanitary Certificate (A15.2). A phytosanitary certificate always states that the seed is found free of special pathogens, since otherwise it would not be issued. Often it is issued only after treatment of the seed. The document will then state which type of pesticide has been used. This should also always be indicated on more informal seed documentation forms.

14.4.4 Seed stock and dispatch records

These records are essential for management of seed stores, sales or other modes of disposal. In addition the seed-stock records contain the basic information to be used in seed catalogues (chapter 15).

The seed stock and dispatch record contains a list of species, provenance, seed lot number, date of collection etc. (appendix A14.1H). In large seed stores it may be advantageous to indicate also the storage location in order to find seeds quickly. Seed stock currently changes as new seed lots are collected and enter into the stock, and seed lots are dispatched for sale or local nursery sowing. It is essential that both outgoing and incoming seed lots be consciously registered to keep trace of the seed stock. Where seed of different age is available in the stock, the 'first-in - first-out' principle is adopted. Data of incoming and outgoing stock are essential also for planning future seed collection.

Computer databases are particularly useful for stock and dispatch records. Even where the documentation system is mainly manual, tables formed in word processing programmes may be useful for record keeping since new lines can be added as new seed lots appear or parts of seed lots are dispatched.

14.4.5 Customer information

Labels are attached to the seed sample submitted to the customer. The label contains only basic information such as species, seed lot number, quantity etc. as indicated in form A14.1J. Submitted seed lots may be accompanied by copies of seed handling and testing forms, or information may be compiled into a separate summary data form (A14.1I). In addition to the essential seed lot information, the summary form contains brief recommendations on handling from receipt to sowing.

14.5 Updating and Maintenance of Data

Data management consists of collecting, storing and distribution of data. As any new seed lot involves several forms and registers, one would soon end up with piles of paper, if it were all kept in files. Much information may be relevant only to few people and for short time. Both ledger systems and computer databases tend to accumulate vast numbers of outdated data, and a system of erasing irrelevant data soon becomes an important task in data management. In general, information should only be kept as long as it is needed, and distributed only to those for whom it is relevant. Supplier as well as customer must consider which type of information need to be maintained and what can be eliminated. Seed testing records would, for instance, normally be of no use once the seed has been sown. Of utmost importance is that the seed origin of any plantation can be traced back to its seed source. If a seed lot happens to give rise to an exceptionally good (or bad!) performance, it is important that the customer (and supplier) is able to trace the source from where the seeds were collected.

Generally, seed-source information is kept as long as the (potential) seed source is there, whether seed is still collected from there or not. However, current information is obviously only updated in those seed sources regularly used. The seed collector must be aware of this since e.g. changed ownership or administration may necessitate new arrangements on collection. If appropriate measures were taken during collection to assure the genetic quality (number, spacing and performance of mother trees), and the seed supplier is likely to keep seed source records, then information on seed source may be redundant for the tree planter. However, in practice such information tends to get lost for various reasons during the lifetime of a forest plantation. Therefore it is advisable that the tree planter keeps essential seed-source information that will enable him/her to trace the seed source.

For the seed supplier, information on a particular seed lot becomes irrelevant once the last seed has been dispatched. In some computer database systems a seedlot will automatically be deleted if its final

value is nil. However, the seed supplier should keep records on dispatched seed lots, both as a service to the customer in case some records are lost, and in their own interest since it will help to identify particularly valuable (or poor!) seed sources and provenances.

A simple system of records is shown in table 14.2.

Table 14.2.
Example of seed records maintained by the seed supplier (upper) and customer (lower). If plantation E.Rift/2 happens to show excellent performance, the customer (UNHCR/34) will be able to trace the seed lot (AM/1838/97) from the supplier (NTSP/IG), which in turn will be able to trace the seed lot AM/1838/97 back to seed source IN/281.

Suppliers records

Species	Seed lot	Provenance	Customer	Seed source
ACACMANG	AM/1838/97		UNHCR/34	IN/281
ACACMANG	AM/1839/97		UNHCH/34	IN/281
ACACMANG	AM/1840/97		SALI/02	IN/430
ACACMANG	AM/1841/97		SALI/02	IN/435

Customers records

Species	Plantation	Seed lot acc. no.	Provenance	Supplier code
ACACMANG	E.Rift/2	AM/1838/97		NTSP/IG
ACACMANG	E.Rift/3	AM/1838/97		NTSP/IG
ACACMANG	W.Rift/1	AL/0018		NTSP/IG
ACACMANG	W.Rift/3	AL/1112		NTSP/IG

14.6 Data Management Systems

Data relating to seed sources, seed lots, sales etc. can be handled entirely manually by filling in, filing, copying and submitting forms like the ones shown in appendix A14.1. More extensive use of personal computers and development of their storage and operation capacity, plus development of user-friendly database programmes are nowadays replacing much of the laborious copying work and manual filing system. Databases can be used for statistical analysis and searching, and data storage requires much less space than manual systems. Establishment of computer networks allows quick and efficient entry and reading of data from linked computer terminals. It is therefore especially suitable for handling large numbers of seed lots. Computer systems do not, however, entirely replace manual systems, since forms must often be filled in the field or in the laboratory without access to terminals. An entirely electronic data management system is sensitive to power cuts and computer breakdown and a combination of manual and electronic systems are often preferred.

14.6.1 Manual systems

Most manual data management systems use a set of standard formula like the ones presented in this chapter. Permanent records such as seed source or plantation data were previously almost exclusively filed in ledgers, a system that is still much used. The ledger system is robust and simple but quite time consuming.

The viscard system is a loose-leaf filing system using hard index cards arranged according to a pre-decided system e.g. species or seed lots. The cards are filed in boxes, arranged so that one or two data lines containing key information is visible without taking out the whole card. Because the cards are relatively small (and expensive), the viscard system is used mainly for particular information like address catalogues, seed-stock register, seed-testing register or the like (Lauridsen 1994).

Loose-leaf systems are more flexible than the ledger system and more practical for filing. Original or photocopy of standard forms is normally filed in ring binders according to different systems e.g. species, seed lot, customer, supplier or other system.

14.6.2 Computer database systems

Documentation may be filed in standard forms in ordinary word processing systems, but with much data, the system becomes awkward. Simple databases may be set up in DOS based programmes like Dbase and Paradox. Newer databases based on Windows systems, e.g. Access, allow statistical analysis and combination of data from different registers. A complete seed documentation database system has been established for an Indonesian tree seed project (Purmono 1996). Examples of data entry screens for seed source and seed lot respectively are shown in figure appendix A14.3.

A database consists of a number of registers, each containing one or more key fields plus a number of data fields. Key fields are used for searching information and combing information from different registers. Examples of key fields are species codes, seed source accession code, seed lot accession code, supplier code etc. The same key fields may appear in different registers. Data fields contain specific information related to each register. For example, a seed source register contains data fields of provenance name, locality, ownership etc. Data fields are unique for each register. For a full seed procurement programme, the registers shown in table 14.3 may be needed.

Table 14.3. Seed registers for a database system on seed procurement including key fields and data fields for each register. Slightly modified from Lauridsen (1994). Note that the data fields contain the same type of information as listed in the forms in appendix A14.1.

Register	Key fields	Data fields
Species register	Species code	Species name (latin) incl. author, synonyms, common name
Seed source register	Seed source code/reference no., species code	Provenance name, locality details, owner, collection regulation, collection fee etc.
Seed supplier register	Supplier code	Name of supplier, address, phone etc.
Seed collection data register	Seed lot identity no., seed source code/reference number, species code, (supplier code)	All data obtained through collection and processing (except data contained in the seed source register)
Seed quality register	Seed lot identity no.	Main results from the seed test data forms
Seed stock register	Seed lot identity no.	Seed quantity received, seed customer code, date reserved/ordered, date dispatched, weight reserved/dispatched
Seed customer register	Seed customer code	Name of customer, address, phone etc.

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APPENDICES

Appendix A14.1	Forms and registers for seed documentation
A14.1A:	Seed source information form
A14.1B:	List of seed sources
A14.1C:	Country map of seed sources
A14.1D:	Collection and handling records
A14.1E:	Seed procurement accounting form
A14.1F:	Seed sampling form
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Appendix A14.2.	Examples of seed documentation forms used by seed centres
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A14.2C:	Seed stock register, Australian Tree Seed Centre
A14.2D:	Germination test record form, Australian Tree Seed Centre
A14.2E:	Summary seed record form, Australian Tree Seed Centre
Appendix A14.3.	Examples of screen pictures and data entry forms in a computerised seed documentation system

Appendix A14.1
Forms and registers for seed documentation

Appendix A14.1A

SEED SOURCE INFORMATION FORM

Species information

Seed source reference No. Seed zone _____
Provenance name _____
Species (botanical): Species code: _____
Common name: _____

Seed source classification:
☐ Unclassified, ☐ Seed zone, ☐ Identified stand, ☐ Selected stand, ☐ Seed production area,
☐ Provenance seed stand, ☐ Seed orchard

Location description

Seed source location: District/county
Region/state Country _____
Geographical coordinates: Latitude: ° 'N/S , longitude: ° 'E/W
Altitude: m.a.s.l
Koeppen climatic code*: ☐ Af, ☐ Am , ☐ Aw, ☐ Aw1, ☐ Bsh, ☐ Bsk, ☐ Bwh, ☐ Bwk,
☐ Cfa, ☐ Cfb, ☐ Cw, ☐ Cw1, ☐ Cs, ☐ D

Rainfall regime: ☐ Summer, ☐ Uniform, ☐ Winter, ☐ Bimodal
Mean annual rainfall (mm): _____
Length of dry season (<60mm) (indicate months): _____
Mean annual temperature (°C):
Mean daily min. temp coldest month (°C): ____, Mean daily max. temp hottest month (°C): ____
Absolute min. temperature (°C): _____
Other information:

Site description

Terrain : ☐ Flat, ☐ Hilly, ☐ Mountainous, ☐ Ridge top
Slope: ☐ Flat or gentle (<5%), ☐ Intermediate (5-10%), ☐ Steep(11-45%) , ☐ Sheer
Aspect: ☐ North, ☐ East, ☐ South, ☐ West, ☐ Level
Soil type: pH: _____

Stand description

Total area: hectares
Type of stand: ☐ Unknown ☐ Natural stand ☐ Plantation, Planted year _____
☐ One species ☐ Mixed species, Associated species: _____
_____

Accessibility

Distance to nearest forest station:
Accessibility road, ☐ 2WD, ☐ 4WD,
Walking distance from nearest road accessible by 4WD _____
Collection permit: ☐ Required ☐ Not required

Seed production

Flowering period Fruiting period _____
Harvestable fruit production (estimated): Kg , or seed production (estimated): Kg

Labour availability

Name(s) of nearest village: _____
Distance from seed source to nearest village: _____
Available labourers: _____

Other Information:

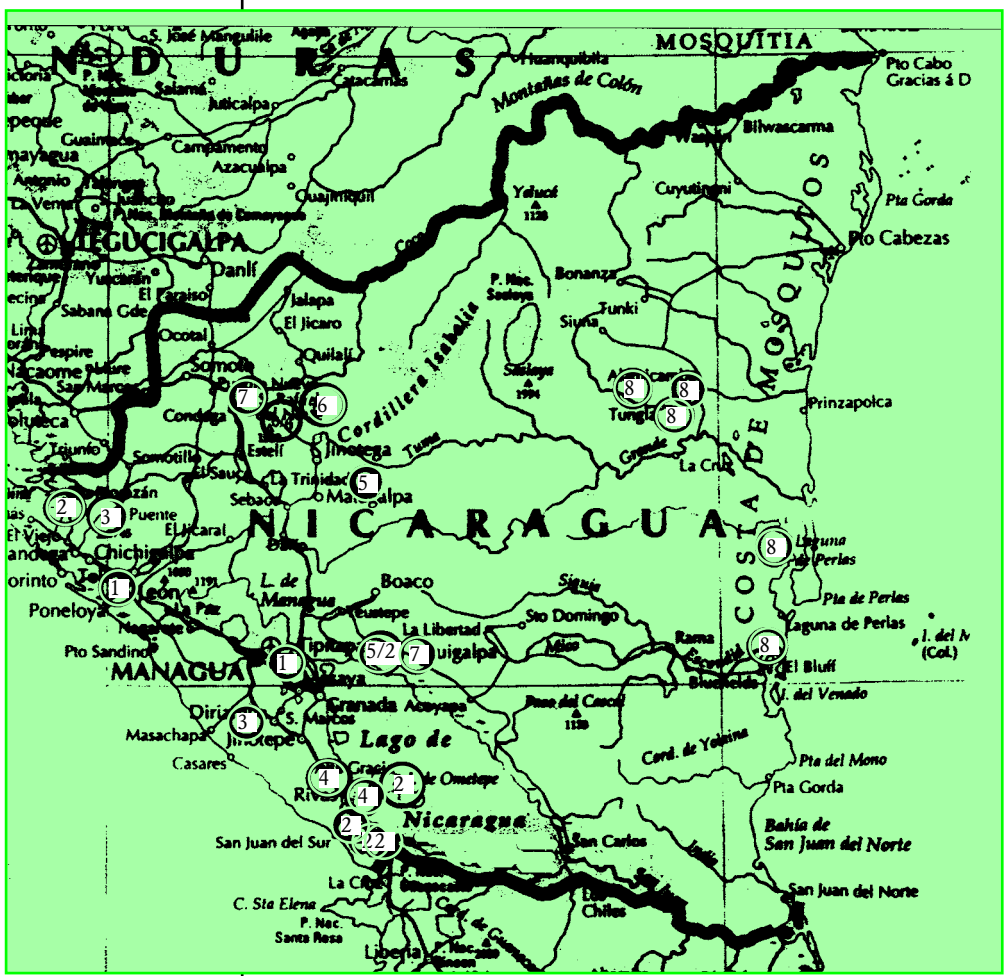
*** Koeppen climatic codes**

Af:	Permanent humid	Cfa:	Humid subtropics, east side of continents, incl. montane.
Am:	Monsoonal, short dry season	Cfb:	Temperate, maritime
Aw:	Subhumid, drier than Am	Cw:	Highland, subhumid
Aw1:	As Aw but bimodal rainfall	Cw1:	As Cw but bimodal rainfall
Bsh:	Semi arid, hot "steppe", Sahel"	Cs:	Mediterranean.
Bsk:	Semi arid, warm to cold	D:	Temperate continental, also tropical & subtropical montane
Bwh:	Arid, hot desert		
Bwk:	Arid, warm to cold		

LIST OF SEED SOURCES

Seed source	Species	Provenance (origin)	Seed zone	Seed source classification *	Area (ha)	Accessibility

* U= unclassified Z= Seed collection zone I= Identified stand S= Selected stand P= Provenance seed stand O= Seed orchard



Example from Nicaragua. 1 *Albizia guachapele;* 2 *Bombacopsis quinata*; 3 *Cedrela odorata*; 4 *Gliricidia sepium*; 5 *Hymenea courbaril*; 6 *Pinus maximinii*; 7 *Swietenia humilis*; 8 *Swietenia macrophylla*.

COLLECTION AND HANDLING RECORDS

Species information

Provisional seed lot no. Suppliers seed lot no. _____
Species name (botanical): Species code: _____
Provenance name: _____
Common name: _____
Seed source ref. no. Country _____

Fruit collection

Collection date:
Collection methods: ☐ From the tree, ☐ From ground after shaking, ☐ From ground after natural fall
☐ Other, indicate details _____
Genetic representation: Number of parent trees collected from: _____
Average spacing between parent trees: _____
Phenotypic selection of seed trees: ☐ Yes ☐ No
if yes, indicate criteria: ☐ Height, ☐ Straightness, ☐ Branching habit, ☐ Health, ☐ Others, pls. indicate: _____

Quantity of fruits collected
Container used: Number of containers filled: _____
Total weight of containers including fruits: _____
Weight of empty containers: _____
Weight of fruits before processing: _____

Field handling and transport

Condition of fruits during collection:
No. of days from collection to field handling:
Field handling: ☐ None, ☐ After-ripening, ☐ Drying, ☐ Extraction, pls. indicate method: _____
_____
If extracted, please indicate volume or weight of extracted seed fraction: _____
Moisture content (moisture meter) after field handling: %
Temporary field storage: Duration _____ days, Mode and condition of transport _____
_____

_____ _____
Date Signature of collection officer

Date arrived: Quantity (kg) : Fruits, Seeds

Apparent condition at arrival: _____

Moisture content at arrival (moisture meter): %

After ripening: Date: , Method/conditions:

Seed extraction: ☐ Sun drying, temperature Duration days

☐ Kiln drying, temperature Duration days

☐ Depulping, pls. indicate method: _____

☐ Other method, pls. indicate _____

Other processing: ☐ Dewinging, pls. indicate method _____

☐ Cleaning, pls. indicate method _____

☐ Other, pls. indicate _____

_____

Pest and diseases: ☐ Infected or diseased seeds noted in seed lot, pls. indicate type: _____

_____

☐ Seed treatment, pls. indicate type _____

Seed storage information

Date of entry into storage: Quantity (kg) : Moisture content %

Suspected storage physiology: ☐ Unknown, ☐ Orthodox, ☐ Recalcitrant, ☐ Intermediate

Storage unit: ☐ Seed, ☐ Dewinged seed , ☐ Entire fruit, ☐ Dewinged fruit, ☐ Depulped fruit,

☐ Other, pls indicate: _____

Storage conditions:

Packing and containers: ☐ Open plastic bag, ☐ Sealed plastic bag, ☐ Sealed glass, ☐ Tins,

☐ Other, pls. indicate: _____

Storage atmosphere: ☐ Normal atmosphere, ☐ CO_2, ☐ Other, pls. indicate: _____

Light conditions: ☐ Light, ☐ Dark

Humidity: ☐ Ambient, ☐ Controlled, approx. percentage %

Temperature: ☐ Ambient ☐ Controlled, degrees: °C

_____ _____

Date Signature

SEED PROCUREMENT ACCOUNTING FORM

Species information

Provisional seed lot no. Suppliers seed lot no. _____

Species name (botanical): Species code: ____

Provenance name: _____

Common name: _____

Seed source ref. no. Country _____

Collection costs

Work type	basic unit	number	number x units	price per unit	total price
Crop survey					
Transport to, within and from site					
Labour cost : Supervisors Prof. collectors Casual workers					
Field accomodation					

Processing cost

Work type	basic unit	number	number x units	price per unit	total price

Total procurement cost

Collection + processing costs	
Quantity of clean seed	kg
Procurement cost per kg	

Appendix A14.1F

SEED SAMPLING FORM

Species information

Seed lot no. Seed source ref. no. Species code _____
Species name (botanical): Provenance name: _____
Common name: _____
Country _____

Fruit collection

Date of sampling: _____
Purpose of sampling: ☐ Moisture content
☐ Purity
☐ Seed weight , 1000 grain
☐ Germination
☐ Vigour
☐ Other, indicate details _____

Type of samples: ☐ Composite of primary
☐ Submitted of composite
☐ Working sample

Number of primary samples _____ from number of bags or containers, or
Number of primary samples _____ from _____ kilograms of seed

Weight of sample g

Notes on sampling method:

_____ _____
Date Signature

SEED TEST FORM I: Weight, purity and moisture content sheet

Seed lot no. _____ Seed source name :_____ Seed source ref. no: _____ Analysis no: _____

Species _____

Date of completed germination analysis:

1000-grain weight (8x100) seed	
Replicate	X
1	
2	
3	
4	
5	
6	
7	
8	
Sum	
Average X = (n=8)	
Weight of 1000 seed = gram	

Range (=Largest - smallest) =

Estimated standard deviation:
Range / 2.85* =

Var. Coeff: $\frac{100 \times \text{std.}}{X}$ =

Not to exceed 4.0

New analysis yes no

* Table value for n=8

Purity

Replicate	Weight of total sample	Weight of impurities	Weight of pure seed	Percentage impurities	Percentage pure seed
A	g	g	g	%	%
B	g	g	g	%	%
Average					

Difference between A and B:

Max difference according to ISTA:

New analysis yes no

Moisture content

Replicate	Weight of empty container	Weight of fresh sample	Weight of oven -dry sample	Difference = weight of water	Moisture content
A	g	g	g	g	%
B	g	g	g	g	%
C	g	g	g	g	%
D	g	g	g	g	%
Average					%

Difference between A and B.

Moisture content = ____ %

Max difference according to ISTA ____

New analysis yes no

Remarks (extra analysis, analysis errors, mech. seed damage etc.)

SEED TEST FORM II: Germination test sheet

Seed lot no: _____ Seed source name :_____ Seed source ref. no: _____ Analysis no: _____

Species: _____

Date of completed germination analysis

Summary	Purity (%)	1000 seed wgt (g)	No. of seed/kg	Moisture content (%)	Germ. Cap. (%)	Rate of germ. (%)

Germination

Replication	Normal germination after days							Total norm. Germ. (a)	Fresh not germ. (b)	Abnormal germ. (c)	Dead seed		Total (a-e)	Rotten (mouldy seed) (f)	Polyembryony (g)	Insect damaged seed (h)	Remarks (unlined field)	
											Empty (d)	Full (e)					Calculated germ. % (i)	Living seed (ex. Emp. Seed) (j)
A																		
B																		
C																		
D																		
Total																		
Av. %																		

Germination table / Cabinet type _____
Germination substrate: _____
Germination temp. ° C _____
Pretreatment:
Method _____
Time _____
Temp. (°C) _____

Damage Fungi Insects Other
None
Small
Average
Large

Difference in germination % A-B-C-D (%) _____
Max. Difference (ISTA) (%) _____
New analysis yes no
New analysis start _____
New analysis number _____
Germination test done by _____

SEED STOCK AND DISPATCH FORM

Seed lot no: _____ Seed source name :_____ Seed source ref. no: _____

Species: _____ Provenance: _____

Seed test			Dispatch			
Viability	No of viable seeds per kg	Test month / year	Date	Customer code	Quantity	Balance stock

SEED LOT SUMMARY DATA SHEET

Seed lot no. _____ Supplier _____
Species name (botanical): _____ Provenance name: _____
Common name : _____
Country _____

Seed source information

Seed source location: _____ Region/state _____ Country _____
Geographical coordinates: Latitude:_____ ° 'N/S , longitude:_____ ° 'E/W
Altitude: _____m.a.s.l
Mean annual rainfall (mm): _____ Rainfall regime: ☐ Summer ☐ Uniform ☐ Winter ☐ Bimodal
Soil type: _____ pH _____
Stand type: ☐ Natural stands ☐ Plantation
Seed source type: ☐ Unclassified, ☐ Seed zone, ☐ Identified stand, ☐ Selected stand,
☐ Seed production area, ☐ Provenance seed stand, ☐ Seed orchard
Other information: _____

Collection data

Collection date: _____
Genetic representation: Number of parent trees collected from: _____
Average spacing between parent trees: _____
Phenotypic selection of seed trees: ☐Yes ☐ No
Selection criteria: ☐ Height, ☐ Straightness, ☐ Branching habit, ☐ Health, ☐ Others, _____

Test results

Date of (latest) test _____
Purity: _____%
Moisture content : _____%
1000 grain seed weight: _____

Germination percentage _____
Viability:
Measured by : ☐ TTZ
☐ Cutting
☐ X-ray
☐ Other:_____
No. of viable seeds per gram: _____

Seed treatment

Seeds treated with: _____
Date of treatment _____

Recommended seed handling before sowing

Pretreatment:
- ☐ Scarification, method and duration: _____
- ☐ Stratification, method and duration: _____
- ☐ Soaking in water, duration: _____
- ☐ Leaching, duration _____
- ☐ Manual extraction, method: _____
- ☐ Other, _____

Inoculation:
- ☐ Mycorrhiza, species / type: _____
- ☐ Rhizobium, species/ type: _____
- ☐ Frankia, species/ type : _____

_____ _____

Date Signature

Appendix A14.1J

SEED LABELS

SEEDLOT PROVISIONAL NO.: _____

SPECIES: _____

SEED SOURCE (REF.): _____

SACK NO.: _____ OF TOTAL _____ NOS. OF BAGS

QUANTITY IN SACK: _____kg/g _____litres

COLLECTED BY: _____

_____

_____

COLLECTED DATE: _____

Appendix A14.2
Some practical examples of seed documentation forms used by seed centres

Appendix A14.2A
Example of certification of seed source issued by the OECD

..... Country ..... State	Issued under the O.E.C.D. Scheme for FOREST REPRODUCTIVE MATERIAL	..... [1] Certificate no.
Category[2]	Tested	Untested
Name of produce[2]	.. Seeds ..... Plants .....Vegetative material	
Nature of source[2]	Identified Selected stand(s)	Orchard Clone

PROVENANCE OR REGION OF PROVENANCE

Name..... Reference no in nat. List ..... Altitude .....

Further information .....

Latitude Longitude or Map reference

.....

Region/County/District/ Forest Compartment

ORIGIN: Indigenous Unknown Introduced from .....

Optional information .....

.....

PRODUCE	Nature	Age	Quantity	Packages No. and nature
	Seeds			
	Plants			
	Parts of pl.			
Exporter		Consignee		

It is certified that the forest reproductive material described above has been produced in accordance with the O.E.C.D. Scheme for Forest Reproductive Material and has been registered under Master Certificate No. .....

Designated Authority ..... 20..

Name and Address .....
Date and Signature

[1] To be stated on container labels
[2] Delete the words that do not apply

Appendix A14.2B
Example of collection and handling form used by Kenya Forest Seed Centre

Kenya Forest Seed Centre

SEED COLLECTION REPORT

Species …….. Collection date ……..

Collector …… Collection No. ……..

LOCALITY

District …….. Location ……..
Forest Station …… Block/Compartment ……
Longitude …….. Latitude …… Elevation ……..
Detailed location (sketchmap with directions and distances a MUST on back of page):
Persons to contact (in case) ……..
……..

SITE/SOIL

Topography: flat/mountainous Slope: gentle/medium/steep
Soil type …… Depth ……..
Soil colour …… Drainage ……..
Soil texture …….. Stoniness ……

STAND

Land use: Forest/agriculture/pasture/open range/roadside/plantation/town
Density: Open/group/dense
Associated species ……..
Natural stand/plantation Age if natural: Young/middle aged/old
If plantation: Year of planting …… Original sources of trees ……..
Form: Boles: Single/forked/multistem Length of clear bole……m
Crown: Narrow/average/wide …….. Flat/pointed ……..

COLLECTION

Type of collection: Seed orchard/selected seed stand/selected single trees/general/established seed stand
If selected trees/seed orchard/established stand number of trees/clones
collected from ……..
If general/seed stand: how many trees collected from ……..
Minimum distance between collection trees: ……..
Method of collection: ground/crown Others (specify) ……
Weight of collected fruit (kg)…….. Viability (cutting test) ……..
Remarks ……

SEED HANDLING

Temporary storage method before extraction ……..Duration ……..
Extraction method …….. Duration ……
Drying method after extraction …… Duration ……..
Temporary storage method before delivery …….. Duration ……
Weight of fruits/extracted seeds ……kg
Weight of fruits/extracted seeds received to Muguga …… kg
Weight of fruits/extracted seeds received at Muguga …… kg
Date of delivery to Muguga ……..
Remarks ……..
……..

Signature: Officer in Charge ……

Appendix A14.2C
Example of a page in a computerized seed stock register. Danida forest Seed Centre.

ACC_NO	DATEREC	QUAN_ORIG	QUAN_BAL	LASTUPDATE	Stock_Check	Stock_diff
01012/81	04-10-83	7500	2716	14-02-95	2730	-14
01013/81	04-10-83	11000	5722	06-03-97	5735	-13
01014/82	06-07-83	750	388	14-02-95	403	-15
01015/82	06-07-83	700	323	14-02-95	336	-13
01016/82	06-07-83	600	393	14-02-95	393	-18
01017/82	06-07-83	850	585	14-02-95	504	81
01018/82	06-07-83	800	446	14-02-95	464	-18
01022/82	13-05-82	42455	18624	27-09-96	18764	-140
01027/82	08-07-82	6600	3992	14-02-95	3930	62
01028/82	08-07-82	6600	4143	14-02-95	4143	98
01034/82	10-06-84	1000	562	14-02-95	575	-13
01035/82	11-05-84	2217	547	14-02-95	505	42
01036/82	11-05-84	1633	564	14-02-95	439	125
01037/82	12-12-85	9064	2990	10-01-96	3010	-20
01038/82	12-12-85	4425	1130	10-01-96	1099	31
01039/82	12-12-85	8418	4720	06-03-97	4740	-20
01040/82	12-12-85	12447	5463	06-03-97	5355	108
01041/82	12-12-85	1859	605	10-01-96	615	-10
01042/82	11-08-83	3887	1422	02-11-99	1428	4
01043/82	11-08-83	2539	800	10-01-96	805	-5
01044/82	11-08-83	2668	825	10-01-96	835	-10
01045/82	10-02-83	7000	4054	06-03-97	4065	-11
01046/82	10-02-83	3000	2810	10-01-96	2830	-20
01047/82	10-02-83	2000	920	02-02-98	955	-35
01051/82	01-09-82	8000	2325	19-03-98	2374	-49
01052/82	10-02-83	49600	39000	20-12-95	39320	-320
01053/82	10-02-83	39700	35450	06-03-97	35845	-395
01054/82	10-02-83	10000	4811	30-01-97	4790	21
01057/82	14-10-82	30000	24177	17-01-97	24123	54
01058/82	14-10-82	53000	32388	02-02-98	32440	-52
01059/82	14-10-82	30597	24438	10-01-96	24617	-179
01060/82	14-10-82	30080	2716	17-01-97	2796	-80
01061/82	14-10-82	20000	1637	10-01-96	1645	-8
01062/82	14-04-83	2000	375	10-01-96	383	-8
01065/82	14-04-83	1000	335	10-01-96	343	-8
01066/82	14-09-83	7000	4050	10-01-96	4070	-20
01067/82	25-01-83	4000	561	10-01-96	560	1
01068/82	02-08-84	10000	7000	02-11-99	7050	-40
01069/82	03-06-84	5500	1791	10-01-96	1795	-4
01070/82	03-06-84	8500	4400	06-03-97	4425	-25
01071/82	03-06-84	7000	2288	10-01-96	2295	-7
01072/82	03-06-84	11000	7820	10-01-96	7845	-25
01073/82	03-06-84	11000	8785	10-01-96	8825	-40
01074/82	03-06-84	10800	9360	10-01-96	9395	-35
01075/82	04-06-83	11000	8605	10-01-96	8579	26
01076/82	03-06-84	11000	5400	10-01-96	5420	-20
01077/82	03-06-84	11000	6692	10-01-96	6730	-38
01078/82	03-06-84	11000	8206	06-03-97	8235	-29
01079/82	03-06-84	11000	7776	10-01-96	7855	-79
01080/82	03-06-84	7500	4162	06-03-97	4170	-8
01081/82	03-06-84	4350	2596	02-11-99	2590	16
01082/82	03-06-84	11000	4505	10-01-96	4520	-15

Appendix A14.2D
Example of germination test record form used by Australian Tree Seed Centre

CSIRO AUSTRALIA

Division of Forestry
Australian Tree Seed Centre
A Division of the Institute of Plant Production and Processing

Germination Test Sheet

Species.....Seedlot/Field No.....

Origin.....Alt.....(m) Collection Date.....

Supplier.....Date received.....Amount.....

Method.....Rep. weight.....g Replications.....

Stratification period.....Start of test..... Germination began.....

Av. viability for species is...../10g ± .....

Based on.....Tests Count days.....

Examined	Test Period											
No. of germinations/dish												
Squash test/firm/dish												
Individual Av. Viability/10g												
Individual Av. germination %												

Bulk Calculation

Av. of.....replications = ...

Av. viability = ... /10 g

Av. of germination % = ...

Index

Alb= Albino
Cot=Abnormal cotyledon
Abn rad= Abnormal radicle
Abn Hyp= Abnormal Hypocotyl
Mol=Mouldy seedling

Enter on CARD ☐ Seed Analyst.....Comments.....

Private Seed Test ☐

Retest ☐

Write off ☐

Appendix A14.2E
Example of summary seed record form used by Australian Tree Seed Centre

« SEED RECORD »

Forest Research CSIRO

Seedlot No.	Species code	BOTANICAL NAME	Store code	Cost code
16009	ACM	Eucalyptus acmenoides		5

EXACT LOCALITY OF COLLECTION

Dbase: 5 : 3 km NNW : C
hinchinbrook DLD
Barakula State Forest

Forest Type:

Associate Trees: E. punctata ssp. longirostrata, E. melliodora, Angophora costata, Callitris glauca

Latitude (°S'): 26°22'
Longitude (°E'): 150°27'

Altitude (m): 330
Aspect:
Slope: Flat

Geology and Soil: Orange-brown loamy sand
pH: 4.5-5.0

PARENT TREE(S)

No. of parents: *In bulk* – / *I tree* 1
D.B.H.: 54 (cm)
Total Height: 15 (m)
Form: Fair

Remarks:

Fumigation
method: CO_2
date: Nov '86

Computer database updated:

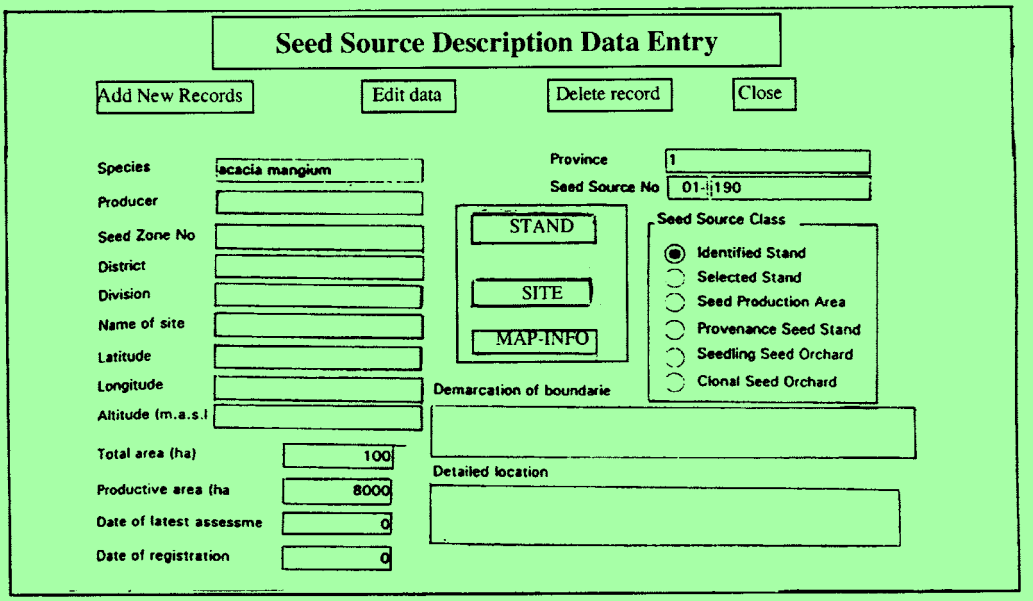
SEED

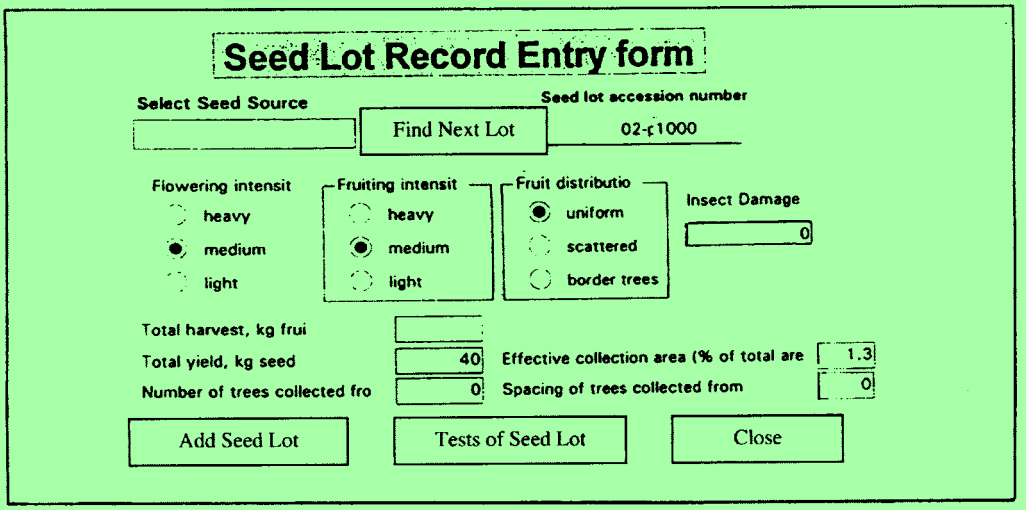
Collector: C. Gardiner, D. Crawford
Collectors No.: CG230
Collection date: 3 November 1986
Project: ALCOA
Identified by: J. Turner
Condition: Good
Storage: Tin Room Temp
Storage date: 30 July 1987
Quantity: 376g

GERMINATION

Method	Date From	Date To	Viability/10 g or (%)
TVR 30°C	6.10.87	26.10.87	375
TVP 25°C (A)	16.8.95	14.9.95	275

Appendix A14.3
Example of screen data entry forms used in a computerized seed documentation system in Indonesia (form Purnomo 1996, plus SIS database





Appendix A14.3 (cont.)
Example of screen data entry forms used in a computerized seed documentation system in Indonesia (form Purnomo 1996, plus SIS database

SEED QUALITY DATA

Seed lot accession number: 07-newest-12

SPECIES:

Botanical name:	*Abies procera*	English name	noble fir
Common name:	don't know	Local name:	-

Pretreatment:

Day of germination (days)	0	Insects (X-ray) (%):	0
Germination (%):	0	No. germs/gram:	0
1000 seed weight (gr):	0	T.Z. pure red (%):	0
Purity (%):	0	Cutting. Fresh (%):	0
Moisture (%):	0	Viable seeds/kg:	0

Remarks:

Date of finished test:

Seed test no.: 0

Test carried out by:

Signed: