Native seed collection for restoration

Introductory training for community volunteers and landholders

presented by Greening Australia

Today's Main Topics

Why Collect native seed?

Who collects uses and buys native seed?

Preparing to collect seed
- Where will the seed come from?
- Permits, Licenses and permission needed
- OH&S

Native seed collection
- Ethics and genetics consideration
- Types of different fruit
- How to collect different types of seed
- How to record seed collection details
- When is the best time to collect seed

Seed Handling and Storage
- How to dry seed
- Extraction and cleaning different seed
- Seed storage
- Keeping records
- Seed viability testing
- Further resources

Who collects and uses native seed?

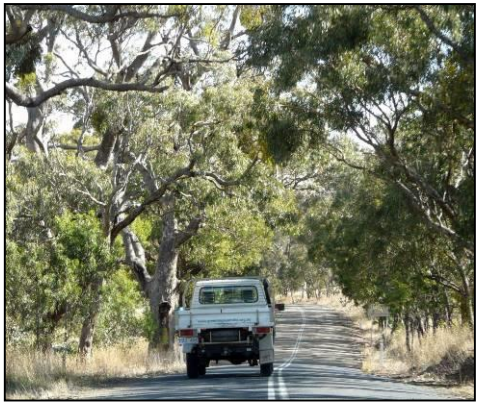
Who Collects: Greening Australia, private contractors, government departments, seed companies, plant nurseries and landholders

Who Purchases: Examples are, mining industry, plant nurseries, LLS, NPWS, science research, local councils, RTA, private contractors and landholders

Preparing to collect seed

Before you start collecting seed, you need to think about:

Where will the seed come from?



Source of images Greening Australia

Permits and Licences

To collect native seed, you need to have:

- The **permission of the landholder** to enter the property and to collect seed (e.g. local government, main roads, private land)

- Sometimes a **permit from the relevant authorities** – e.g. State or Commonwealth Department depending on the land tenure and the vegetation type or species.

- To collect from **protected, threatened species and Ecological Vegetation Communities** you will need a special permit.

Collection Permits - NSW

- A permit is required for protected or threatened plants on all land use

- A permit may be required for endangered vegetation communities such as, *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* on any land use**.**

- All permits in NSW is administered under: Office of Environment and Heritage:
- https://www.environment.nsw.gov.au/licences-and-permits/scientific-licences/apply-for-a-scientific-licence

- **Contact**: Biodiversity and Wildlife Team

  NSW National Parks and Wildlife Service Telephone: 02 9585 6406
  Email: **scientific.licensing@environment.nsw.gov.au**
  https://www.environment.nsw.gov.au/licences-and-permits/scientific-licences

  For legislation regarding protected and endangered plants:
  https://www.legislation.nsw.gov.au/#/view/act/2016/63/part4/div2/sec4.2

NSW National Parks & Wildlife Service
Office of Environment & Heritage

SCIENTIFIC LICENCE

Biodiversity Conservation Act 2016

Name and postal address of principal licensee

Mr Stephen Bruce
Greening Australia Capital Region
PO Box 538
JAMISON CENTRE ACT 2614

Nominated premises (where appropriate)

Your licence number is: SL100567

This licence is valid from: 31 December 2017

This licence will expire on: 30 December 2019

Additional authorisations:

Project Title: Bringing back understorey diversity

This class of biodiversity conservation licence granted under Part 2 of the *Biodiversity Conservation Act 2016* authorises the following activities: Pick, collect seed for propagation and revegetation purposes, excluding individually listed threatened species

This licence authorises the principal licensee and any associates named in **Attachment A** to conduct those activities authorised above, to those species, communities or materials listed in **Attachment B**, at the locations specified in **Attachment C** of this licence.

This licence also authorises the principal licensee to conduct research on National Park estate under clause 23 of the *National Parks and Wildlife Regulation 2009* (NPW Reg), where this forms part of a project approved by a delegated officer of the Office of Environment and Heritage (OEH).

This licence is granted subject to the provisions of *Biodiversity Conservation Act 2016*, Biodiversity Conservation Regulation 2017, the general conditions listed below, any special conditions as may be notified in writing to the licensee by the Environment Agency Head of the Department of Planning and Environment or a 'delegated officer' of OEH ("delegated officer") and the OEH 'Scientific Licensing Policy'.

.....

Signature of Delegated Officer

Date: 27 February 2018

.....

Signature of Principal Licensee*

Date: 1/3/18

* This licence is not valid unless it is signed by the principal licensee. By signing this licence the licensee agrees that they have read, understood and agree to comply with all of the conditions listed on the licence.

Permits Summary

Land Use	OEH Permit Needed	Permission required
National Parks and Nature Reserves	Only if collecting a protected or endangered plant or if the vegetation community is endangered (e.g. Grassy Box Woodlands)	Yes, permission only given if particular species cannot be sourced elsewhere or work is being undertaken in the reserve
Commonwealth Land	Only if the vegetation community or plant is threatened or endangered. Need an EPBC Act Part 13 permit for this activity.	Yes, permission of land manger. Notification given of when and where collecting.
State Forest	Only if collecting a protected or endangered plant or if the vegetation community is endangered (e.g. Grassy Box Woodlands)	Yes, from State Forests/Department of Primary Industry (DPI). Notification given of when and where collecting. Royalty payment.
Traveling Stock Reserves (Crown Land)	AS above	Yes, contact your Local Land Service
Private land e.g. farms	As above	Landholder permission. Fee may be required but often request a small amount of seed/ plants in return
Council Roadsides	AS Above	Yes, written or verbal permission. Council may require notification of when and where. Strict WH&S working by roadsides
State Highways e.g.. RTA, Vic Roads	As above	Yes, written or verbal permission. Authorities may require notification of when and where and require safety signage and other WH&S specifications
Crown Land e.g. Cemeteries	As above	Yes, local council or National Parks and Wildlife Service.
Voluntary Conservation Agreement on private land (Covenant)	As above	From landholder, only to be used for private use not commercial. Collect seed in the conservation area only if seed of the particular species is not available elsewhere, or is to be planted in the covenant or adjacent site.

** Permit always needed if collecting endangered plant or vegetation community (e.g. Box-Gum Grassy Woodland) on any land use. As a general rule NPWS exclude collection of individually listed threatened species. Collection of threatened species would only be permitted to a specific request and with specific conditions attached regarding use and end point of the material*

OH&S

Safety seed collecting

- Snakes
- Tripping and falling
- Cuts from secateur or saw
- Branches in the eye
- Dehydration and heat stress
- Hyperthermia from wet cold conditions
- Driving safely and to the conditions
- Vehicles are well maintained to ovoid breakdowns
- Mobile phones or a personal beacon locator
- Informing someone of your whereabouts
- First Aid Kit (carry small kit in backpack)
- Safety signage if working on road sides

Source of image Greening Australia

Personal Protective Equipment

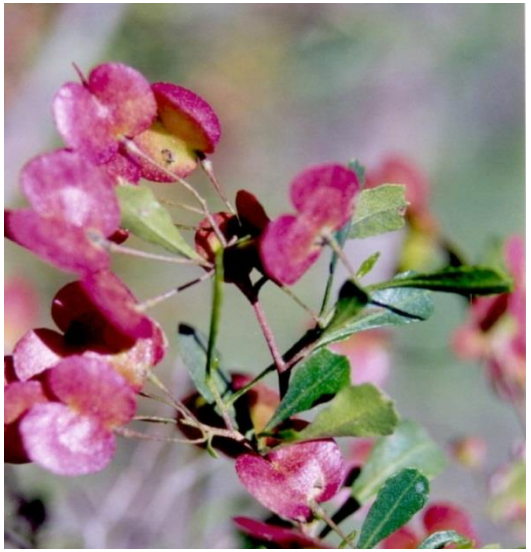
- Sun protection, hat, sunglasses, long sleeves and pants, sunscreen
- Gloves
- Enclosed shoes
- Gaiters
- Fluorescent vests
- Hard hats
- Dust masks for cleaning seed

What is Florabank?

:

- Best practice information about collecting, storing & using native seed

- Adopt practices that protect Australia's biodiversity



Source of images Greening Australia

Florabank Guidelines

The Florabank Guidelines were designed to help people set up seedbanks and collect seed for restoration.

1. Native seed storage for revegetation
2. Basic methods for drying, extraction and cleaning of native plant seed
3. Improving on basic native seed storage
4. Keeping records on native seed
5. Seed collection from woody plants for local revegetation
6. Native seed collection methods
7. Seed production areas for woody native plants
8. Basic germination and viability tests for native plant seed
9. Using native grass seed in revegetation
10. Seed collection ranges for revegetation

You can download and print these Guidelines

from the Greening Australia website if you want to learn more about seed:

https://www.greeningaustralia.org.au/publications/

Native Seed Collection

Source of images Greening Australia

The Seed Cycle

Flowers

Pollination

Fertilisation

Flower buds

Fruit set

Seed dispersed

Seed germinates

Adult tree

When will you collect?

- Each species has its own timetable of flowering, seed development and seeding. Most species ripen at the end of Spring into early Summer

- Pea family (Fabaceae) and many other hard seeded species are ready from November – January (Wattles, Daviesia spp).

- Grasses, November– March depending on species and season

- Myrtaceae family or hard woody fruits such as eucalypts & Hakea spp. are ready throughout the year. Many eucalypts ripen and are ready from October - December

Seed Ripeness

- Collect mature seed
- Mature seed retains viability longer than immature seed.
- Viable seed will germinate and grow successfully.

Source of images Greening Australia

Research your plant species

When you know your plant species, you can check local populations to see if they have had a good flowering year, if they are ready to collect & not predated.

Source of images Greening Australia

Ethics and genetics consideration

Source of images Greening Australia

Environmental Site Assessment

Some aspects of seed collecting could harm the collection site

- Plant species could be damaged by trampling
- Vehicles could damage the site
- Vehicles and plant material from other places could bring in weeds

Ethical Seed Collection

Use ethical collection practices

- Don’t collect more than 10% of the seed from any one plant. If plants have only a few seeds each don’t collect from more than 1% of the population (herbaceous species)
- Leave fauna habitat undisturbed
- If possible return plant material such as twigs and discarded capsules to the collection site

Source of image Greening Australia

What is Provenance?

- Provenance → origin of a seed source
- Forestry term
- Some populations performed better
- Provenance = Genetic adaptation to local environmental conditions

Source of image Linda Broadhurst CSIRO

Provenance variation in *Acacia acinacea* (Gold Dust Wattle) from Vic into NSW

Provenance cont…

Does provenance matter?

Factors that can influence provenance:

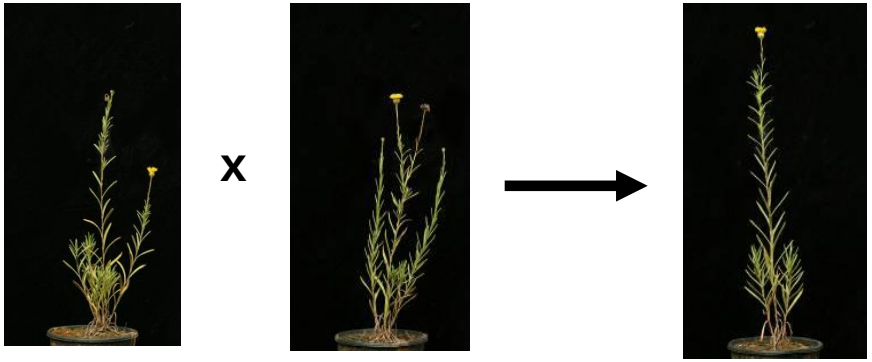
- **Breeding system**: Ability to self pollinate (Grasses), provenance not so important
- **Environmental differences** (match soils, climate, aspect)
- **Highly modified landscapes**: Provenance not so important
- **Sourcing from large, genetically diverse population is much more important than local provenance**
- **Follow the new strategy of climate-adjusted seed collecting :**

(Hancock,N., Harris, R., Broadhust,L. and Hughs, L.2018. Climate-ready revegetation. A guide for natural resource managers).

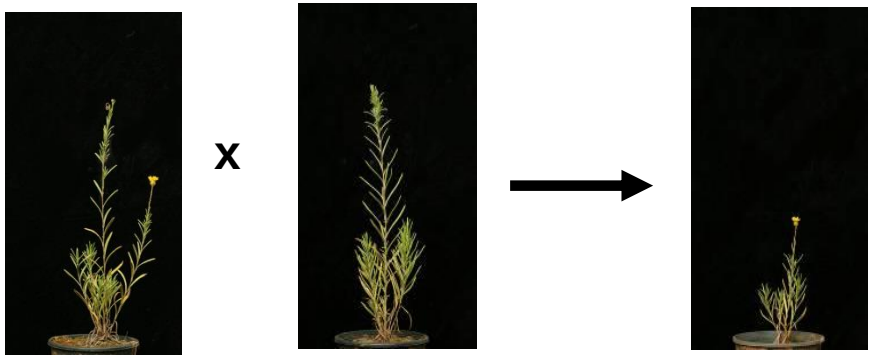
Provenance cont

Rutidosis leptorhynchoides (Button Wrinklewort)

Local **Local** **Local genes**



Local **Foreign** **Mix of local and foreign genes (outbreeding depression)**



Source. Dr M. Pickup: Greening Australia Capital Region

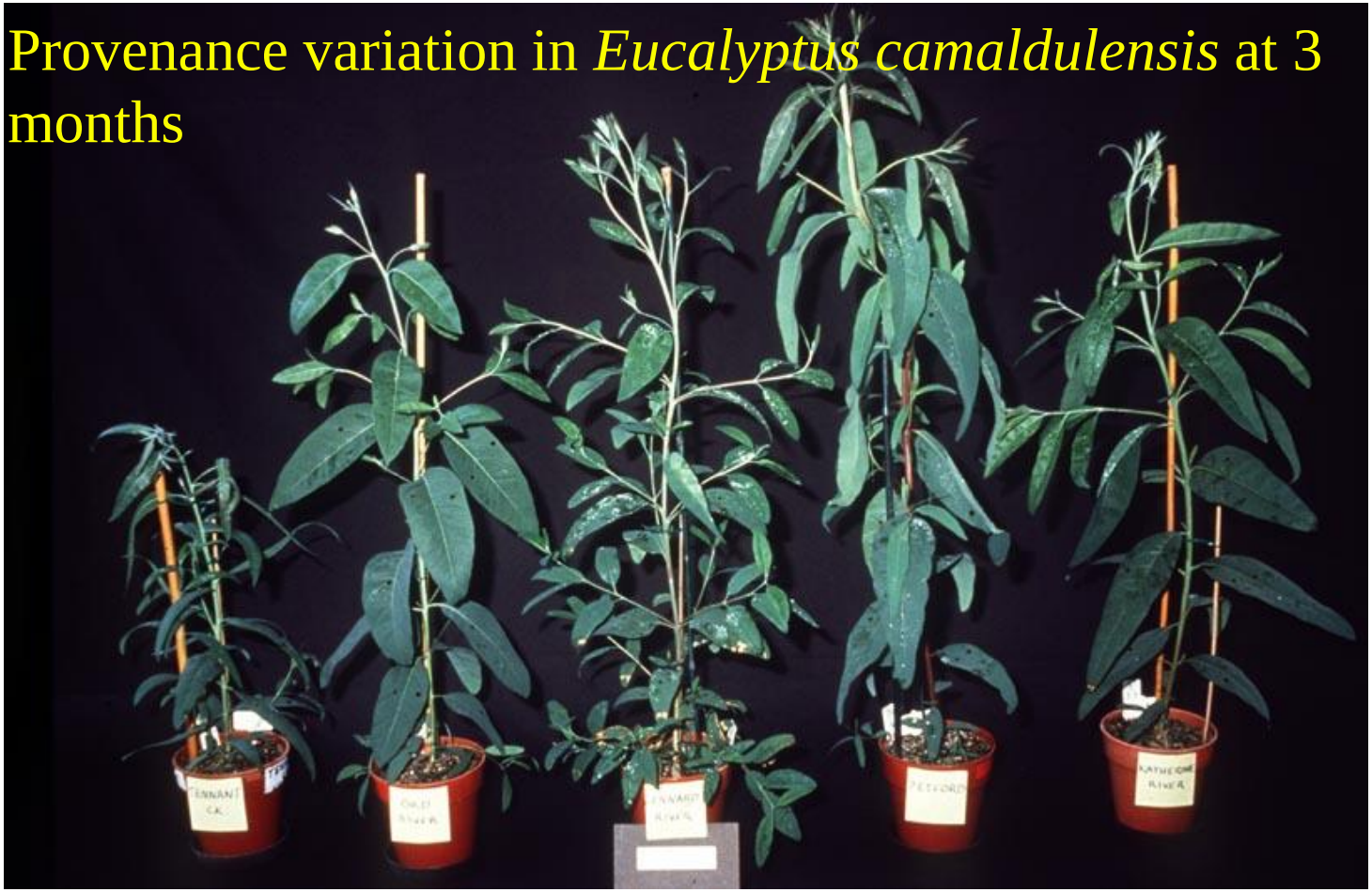
Examples of sub-species variation

Dodonea viscosa subsp *cuneata*

Dodonea viscosa subsp *angustissima*

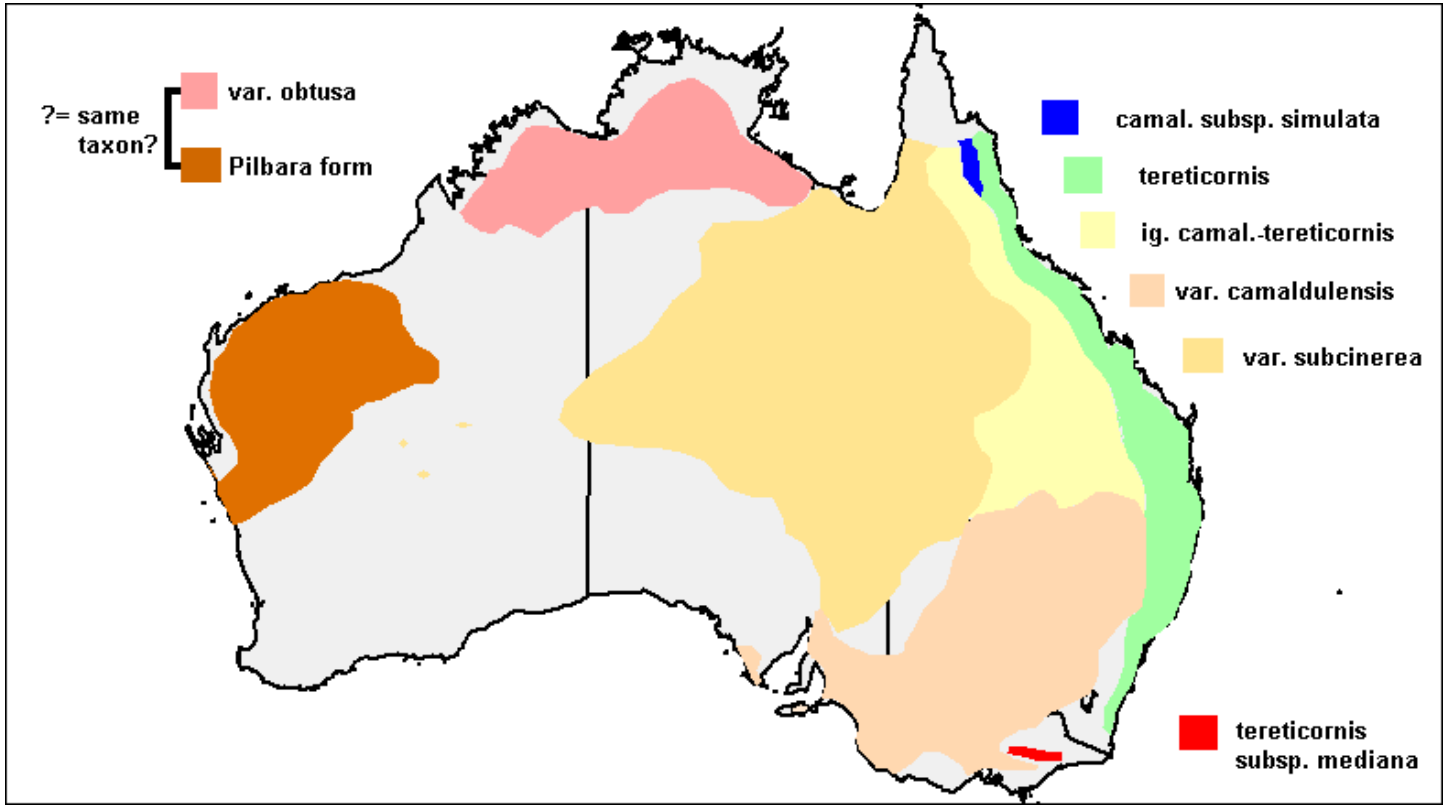
Dodonea viscosa subsp *spatulata*

Examples of provenance variation in species



This species, *Eucalyptus camaldulensis* has now been separated into five sub-species!

Provenance variation on a continental scale: *Eucalyptus camaldulensis*



Locations of some well-known provenances of *Eucalyptus camaldulensis* and *E. tereticornis* in relation to boundaries between infraspecific taxa

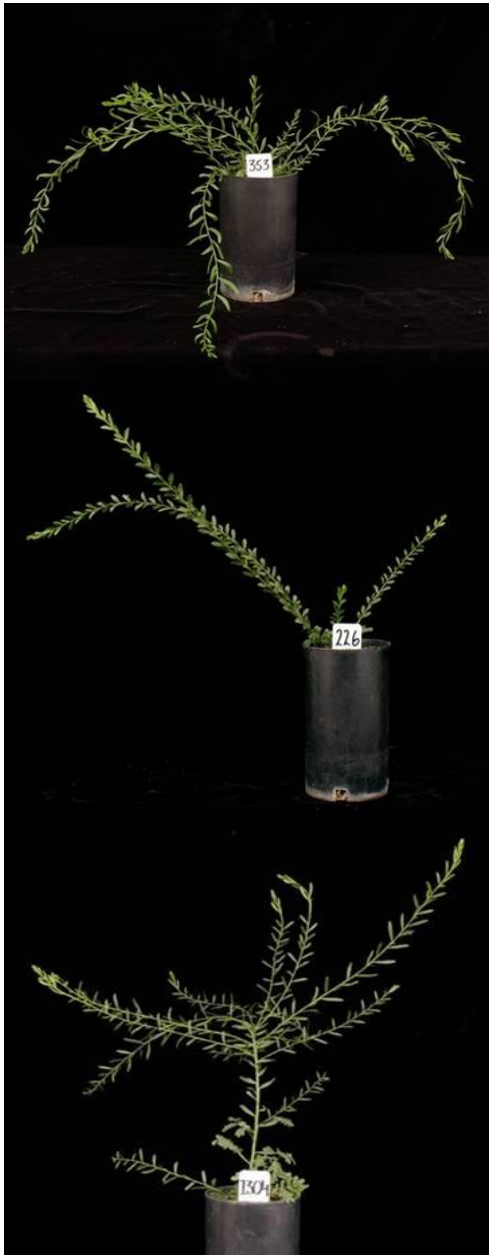
Adaptation

- The altitude, climate and soil type have a big influence on a plant's survival.

For example:

- If you collect seed from plants at a high altitude, wet site and plant them at a lower altitude, dry site they may not survive the warmer, drier conditions (e.g. Snow Gum, Ribbon Gum, Acacia dealbata)

- If you collect seed from plants in gravelly soil on a hill they may not survive the low wet loamy site (*Banksia*, *Acacia gunnii*)



Genetics

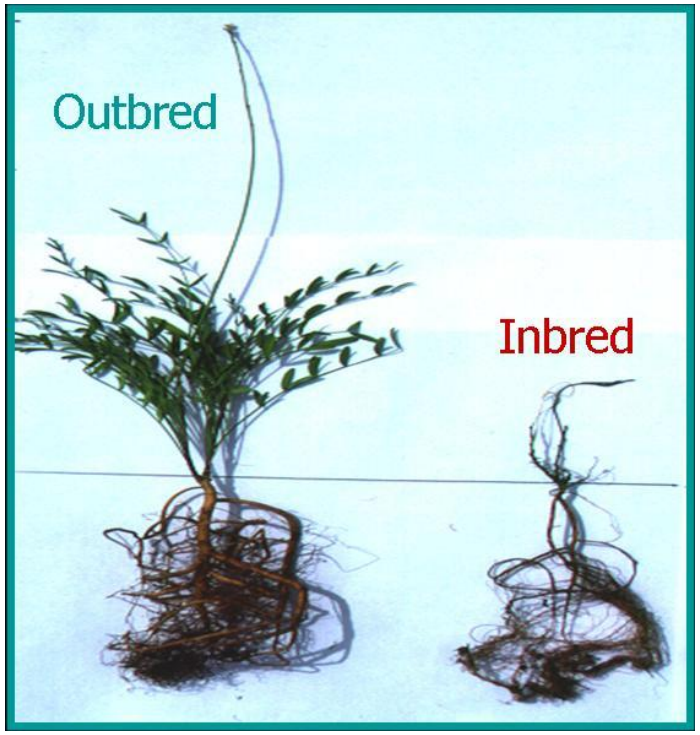
Genetics – when, what and why?

Production Stage	Recommendation	Why?
Seed Sourcing	A) **Source from a large, healthy population**	• Reduce chance of **inbred seed** • Good **genetic base**
	B) **Match with local climate and soil conditions**	• Ensures **provenance** is maintained – but A) is more important
	C) **For hybridising species source from populations where species is dominant**	• Reduces the chance of collecting **hybrid** seed

Source. Dr M. Pickup: Greening Australia Capital Region

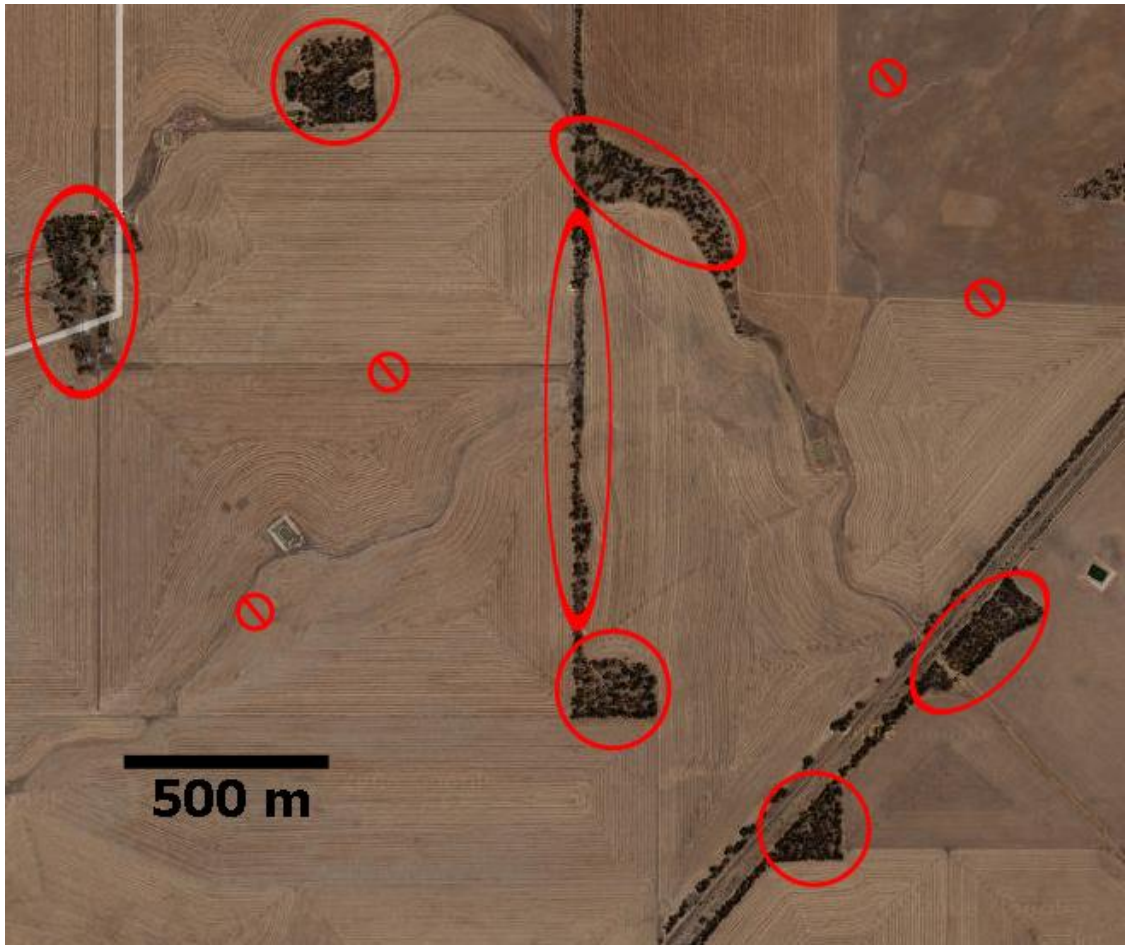
Example of poor genetics

Outcrossing versus inbreeding



Source: Pickup, M. Sex in Seed Production Areas: What are the big issues? 2008 Greening Australia Capital Region

Avoid collecting from isolated trees



Source: L. Broadhurst CSIRO

To obtain the best genetic quality seed from a site

When collecting seed, you can get good genetic quality seed if you:

- Choose from **large, healthy natural populations** (of at least 200 + plants)
- Collect from **widely spaced, healthy parents** (at least 10 – 20 plants, preferably more)
- **Avoid neighbouring plants** (they are related)
- **Avoid isolated plants** (they can't cross-pollinate so are likely to have inbred, unhealthy seed)

Summary

1. Make sure plant Identification is correct

2. Choose a site with similar climate, altitude, soils

3. **Choose sites to collect from that are healthy and large population (most important)**

Types of different fruit

Woody Capsules:

Eg. Eucalypts, Callistemon, Leptospermum, Melaleuca

Source of images Greening Australia

Types of different fruit

Seed Pods: Most common type of fruit.

eg. Wattle, Hardenbergia, Indigofera, Bush Peas

Source of images Greening Australia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Types of different fruit

Papery Capsules:

Eg. Bursaria, Lomandra, Dodonaea, Wahlenbergia, Bulbines,

Source of images Greening Australia

Types of different fruit

Seed Follicles:

Found in the Proteaceae Family, Hakea, Grevillea and Banksia.

Source of images Greening Australia

Types of different fruit

Berries and Drupes:

- Berries are fleshy fruits with multiple seeds (lack stony centre): Dianella, Solanum
- Drupes have a fleshy layer and a seed enclosed in a hard stony casing: Persoonia, Leucopogon (hard to germinate)

Source of images Greening Australia

Types of different fruit

Cones:

Gymnosperms produce seeds in cones: Callitris, Casuarina,

Source of images Greening Australia

Types of different fruit

Achenes: Clematis, Helichrysum, Xerochrysum, Cassinia

Helichrysum collinum

Scaly Buttons (*Leptorhynchos squamatus)*

Yam Daisy (*Microseris lanceolata)*

Source of images Greening Australia

Equipment Preparation and Collection Methods

The equipment you need for seed collection will depend on the species you are collecting:

- Understorey shrubs and forbs
- Trees
- Grasses

Collection Methods for Understorey shrubs and forbs

These are often hand-collected.

- Use secateurs to cut seed heads off branches or stems into a bucket or pouch
- Use hands to strip seed from small forbs and shrubs
- Use a drop-sheet or tub to collect seed shaken from a bush

Source of images Greening Australia

Hand Collecting

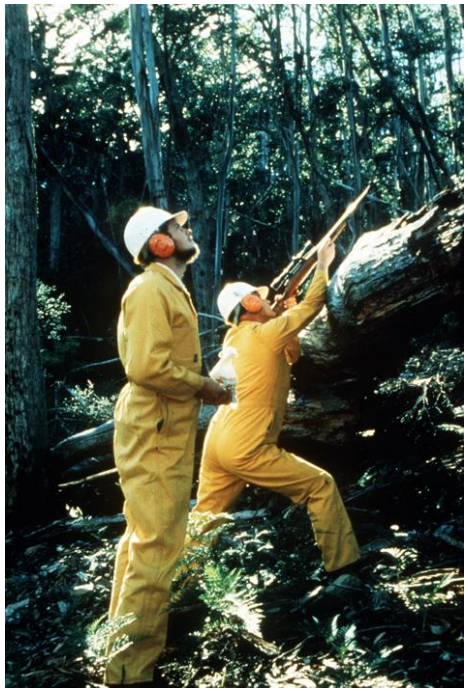
Source of images Greening Australia

Collection Methods for Trees

Source of images Greening Australia

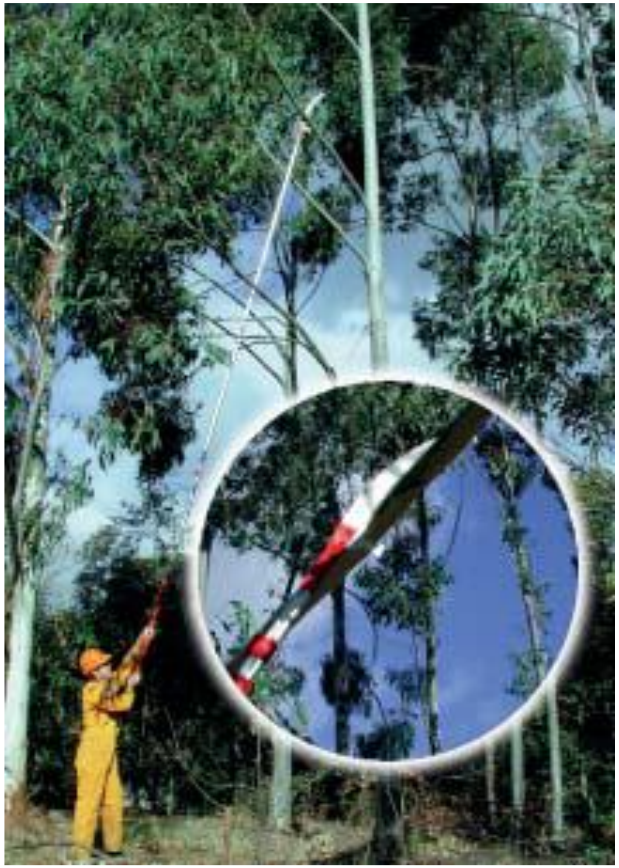
Collecting From Trees

Don’t try this at home! You will need extra training to collect seed at heights, to use a firearm, operate a cherry picker or climb trees. Keep safe.



Source: *Australian Tree Seed Centre: Operations manual* CSIRO 2001

Collecting from trees cont…



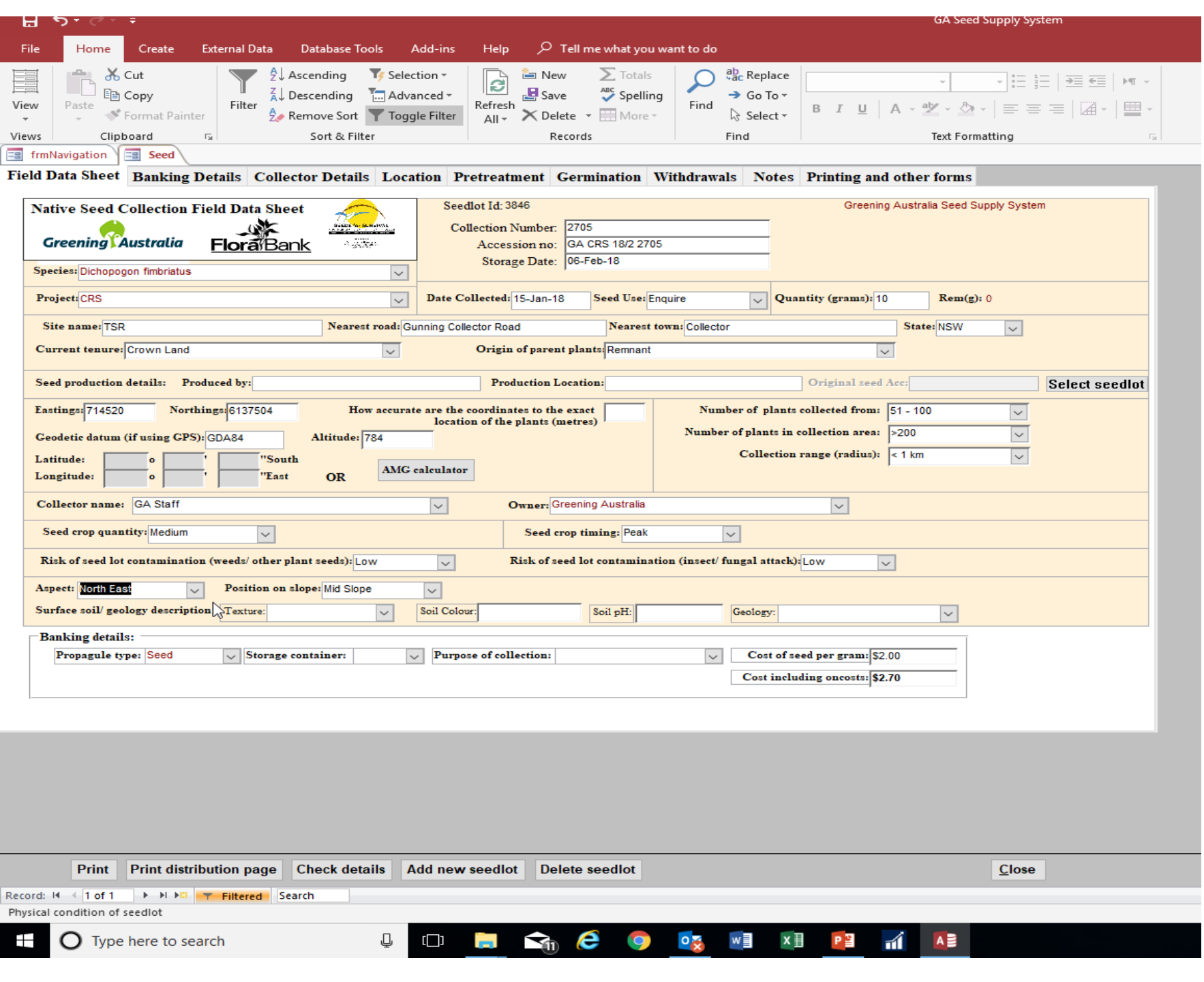
Source:*Australian Tree Seed Centre: Operations manual*
CSIRO 2001

Keeping Records for seed

Source of images Greening Australia

Keeping Records

- Unidentified seed that has no records with it can't be used and should be discarded
- Have field recording data-sheets ready before you start collecting
- You can use Greening Australia Seed Collection Field Data Sheet for each batch of seed


GA Seed Supply System
File
Home
Create
External Data
Database Tools
Add-ins
Help
Tell me what you want to do
View
Paste
Cut
Copy
Format Painter
Filter
Ascending
Descending
Remove Sort
Selection
Advanced
Toggle Filter
Refresh All
New
Save
Delete
Totals
Spelling
More
Find
Replace
Go To
Select
Views
Clipboard
Sort & Filter
Records
Find
Text Formatting
frmNavigation
Seed
Field Data Sheet
Banking Details
Collector Details
Location
Pretreatment
Germination
Withdrawals
Notes
Printing and other forms
Native Seed Collection Field Data Sheet
Greening Australia
FloraBank
Seedlot Id: 3846
Greening Australia Seed Supply System
Collection Number: 2705
Accession no: GA CRS 18/2 2705
Storage Date: 06-Feb-18
Species: Dichopogon fimbriatus
Project: CRS
Date Collected: 15-Jan-18
Seed Use: Enquire
Quantity (grams): 10
Rem(g): 0
Site name: TSR
Nearest road: Gunning Collector Road
Nearest town: Collector
State: NSW
Current tenure: Crown Land
Origin of parent plants: Remnant
Seed production details:
Produced by:
Production Location:
Original seed Acc:
Select seedlot
Eastings: 714520
Northings: 6137504
How accurate are the coordinates to the exact location of the plants (metres)
Geodetic datum (if using GPS): GDA84
Altitude: 784
Latitude: o ' "South
Longitude: o ' "East
OR
AMG calculator
Number of plants collected from: 51 - 100
Number of plants in collection area: >200
Collection range (radius): < 1 km
Collector name: GA Staff
Owner: Greening Australia
Seed crop quantity: Medium
Seed crop timing: Peak
Risk of seed lot contamination (weeds/ other plant seeds): Low
Risk of seed lot contamination (insect/ fungal attack): Low
Aspect: North East
Position on slope: Mid Slope
Surface soil/ geology description
Texture:
Soil Colour:
Soil pH:
Geology:
Banking details:
Propagule type: Seed
Storage container:
Purpose of collection:
Cost of seed per gram: $2.00
Cost including oncosts: $2.70
Print
Print distribution page
Check details
Add new seedlot
Delete seedlot
Close
Record: 1 of 1
Filtered
Search
Physical condition of seedlot
Type here to search

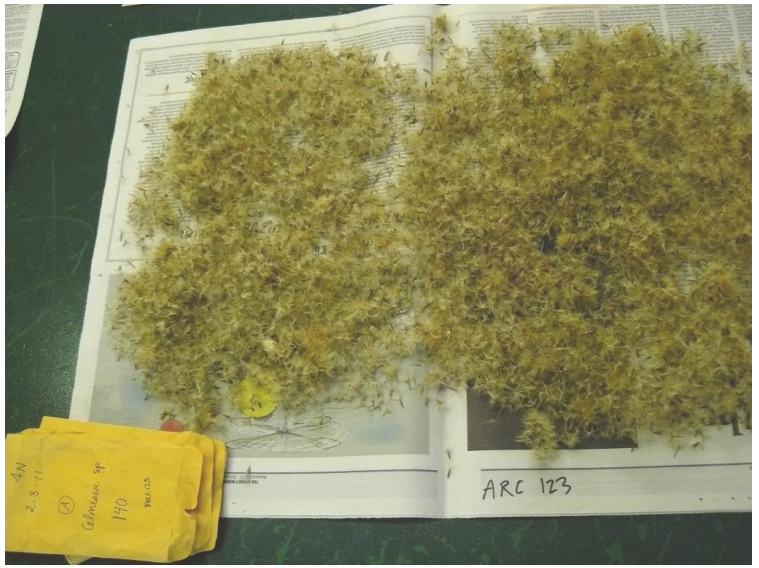
Collected your seed, what next?
Drying, extraction and cleaning

- **Drying** – most important step
- **Extraction** – removing seed from pods and other material
- **Safety issues** – allergies from dust is a common problem. Make sure you wear good quality dust masks or respirators and work in an open area with good ventilation.

Source of image Greening Australia

Drying Methods

Source of images Greening Australia



Source of images Greening Australia

Cleaning Methods

Source of images Greening Australia

Seed Cleaning Machinery

Source of images Greening Australia

Source of images Greening Australia

ANBG Zig-zag Aspirator

Basic seed storage requirements

Ensure that seed is:

- Fully mature before collecting
- Inspect for insect pests and control if necessary
- **Well dried** (most important step) and cleaned
- Store in airtight containers (food preserving glass jars for small amounts are the best)
- Cool storage will increase the life of the seed
- Store at constant temperature (well insulated room for bulk quantities)
- Keep good records (for example Excel spreadsheet, seed collection sheets, databases)
- **Use Florabank Guidelines to help**

Seed storage:

Carbon dioxide treatment for pests

Silica to absorb moisture

Source of images Greening Australia

Source of images Greening Australia

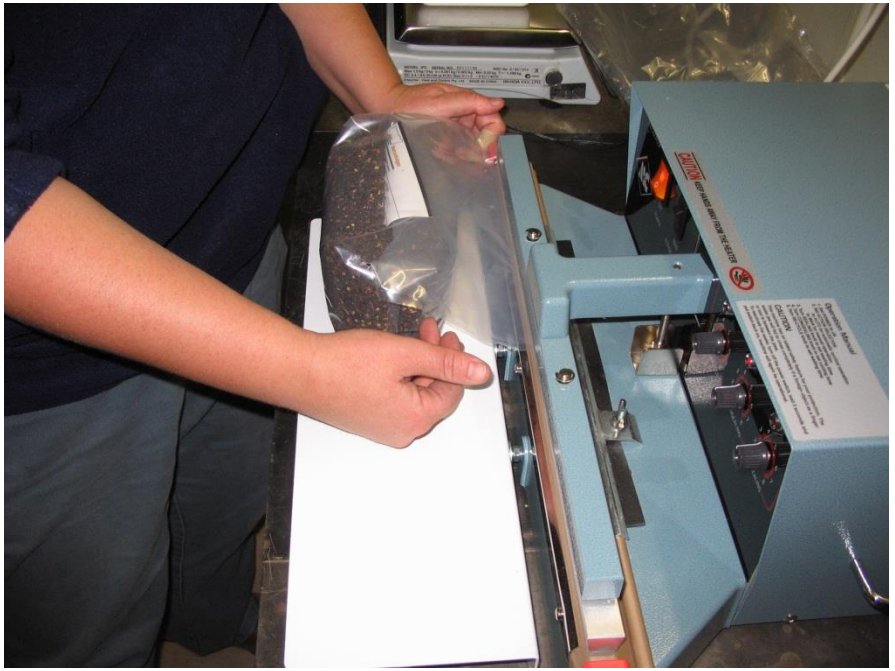
Maximising Seed Viability

Use sealed containers or heat sealed bags to store dry seed because once the seed is dry, you need to avoid moisture fluctuations. Reduce air in sealed bags. Use silca gel in jars or bags of seed.

Fridges don’t have constant humidity, so use well sealed containers for your seed if storing in a fridge

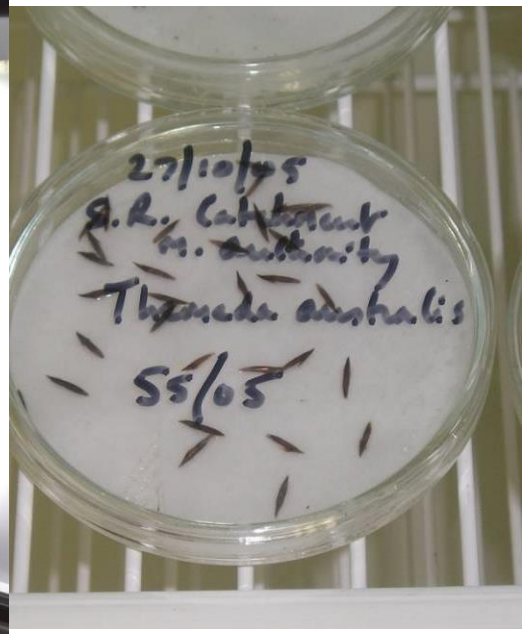
Photo: Royal Botanical Gardens Kew,: https://www.kew.org

Seed Storage and Dispatch Records



Source of images Greening Australia

Seed Viability & Germination Testing



Source of images Greening Australia

Further Resources

Title	Author
What Seed is That?	Bonney, Neville
Wattle: Acacias of Australia (CD)	BR Maslin
Eucalyptus, an illustrated guide to identification	Brooker, Ian & Kleinig David
Native Trees and Shrubs of South-Eastern Australia	Costermans, Leon
Ausgrass: Grasses of Australia (CD)	D Sharp, BK Simon
Grassland Flora, a field guide for the Southern Tablelands (NSW & ACT)	Eddy, Mallinson, Rehwinkel, Sharp
Australian Seedsman	Grant, Harold
Australian Seeds: A guide to their collection, Identification and Biology	Luke Sweedman, David Merrit
Euclid: Eucalypts of Southern Australia (CD)	MIH Brooker, AV Slee, JR Connors, SM Duffy
Seed Collection of Australian Native Plants, 2nd Edition	Ralph, Murray
Growing Australian Native Plants from Seed	Ralph, Murray
From Seeds to Leaves	Stewart, Doug & Robyn
Florabank (online)	www.florabank.com.au

Questions and Discussion

Thank you for your participation