North Coast Regional Seed Bank Network - Standard Operating Procedures

REVISED 2025 v5

STEP 3 - Post Harvest Drying, Seed Extraction & Cleaning

These Steps of the Standard Operating Procedures of the North Coast Regional Seed Bank Network are to inform the activities of all members and associates collecting, processing and storing native seed within the network. The information in each Step is based on the Florabank Guidelines and the advice of experienced seed collectors.

Detailed guidance on seed collecting and processing should be gained by completing the free online Florabank Guideline modules available at:
https://www.florabank.org.au/guidelines

TOPICS COVERED UNDER THIS STEP

1. Equipment Checklist – Processing Seed
2. Staying Safe while Extracting and Cleaning Seed
3. Record Keeping
4. Summary of Post Harvest Processing (Figure 1)
5. Post harvest drying and separating of seed
6. Extracting seed
7. Cleaning seed
8. Air Drying Seed Ready for the Next Steps

FLORABANK GUIDELINES RELATED TO THIS STEP

Module 8: Post Harvest Drying, Seed Extraction and Cleaning

https://www.florabank.org.au/guidelines?link=Module8

Note: Florabank Module 9: 'Seed Drying and Storage' is covered under the North Coast Regional Seed Bank procedures at Step 6: Drying Seed and Packing for Storage. This step is mainly undertaken by the Seed Bank facility at the Botanic Garden in Coffs Harbour after seed lots are entered into the Seed Bank database.

1. EQUIPMENT CHECKLIST – PROCESSING SEED

Personal Protective Equipment (PPE)

- dust mask (P3) or respirator rated to Australian standard for toxic dust,
- eye protection and/or dust proof googles
- leather gloves or disposable gloves,
- ear protection (when required with machinery)
- closed in shoes,
- long pants and long sleeve shirt, and a lab coat if available.

Record keeping and drying/storage bags/tarps

- The Field Data Sheet booklet – to add processing notes for the seed lot
- Labels, tags and marker pens – to label the seed lots through the process.
- Paper bags or calico bags of a variety of sizes - for post harvest drying/storage
- Tarps for laying out larger volumes of seed bearing plant material to separate and dry

Note: Having a shelving unit with wire mesh shelves in a cool dry area is very useful to make good use of space for post harvest drying and to allow good air circulation.

Processing Equipment

- Secateurs to prune off non seed bearing plant materials such as leaves and stems
- Large trays (cafeteria style) and smaller trays: to dry seed or collect sieved seed
- Containers of a variety of sizes (ice cream or yoghurt size) to collect seed from trays ready to clean and then store in paper bags
- Paint brush, dustpan and brush – for moving seed into containers, cleaning up
- Sieves of a variety of mesh sizes with collecting buckets. mesh sizes often used are: 0.8mm, 2.0mm, 4.0mm, 7.1mm
- Large rubber bung or other implements to crush or agitate the fruit/seed pod
- Fan to assist in winnowing seed
- Large plastic tubs or garbage bins for collecting chaff and non seed material

Other equipment

- Fine measuring scales to weigh seed, pre and post drying (record in FDS)
- Scalpel, pine point pliers or tweezers to dissect seed (for example, to do cut test)
- Field lens (10x) or magnifying glass, and or microscope

Seed processing and cleaning machinery
Refer to the Florabank Guidelines for information on specialised equipment such as an aspirator to clean seed. The operation of machinery involves higher risk and requires training. These operating procedures focus on methods by hand.

2. STAYING SAFE WHILE EXTRACTING AND CLEANING SEED

Due to dust and air-borne irritants, seed processing is a high risk activity. Staff and volunteers must be aware of potential risks and follow Work Health and Safety procedures.

Wear Personal Protective Equipment (PPE)
See Equipment Checklist.
After cleaning seed, shower as soon as possible and wash clothes and PPE.

Irritants in Seeds
Seeds can contain irritants which may impact on skin and/or breathing for some people (e.g. *Acacia sp*. and *Dodonaea sp*.). When undertaking seed extraction and processing if you notice a physical reaction stop processing and follow appropriate first aid steps including to wash the affected area with copious amounts of clean water.

Dust Mites
Seed may contain dust mites which can cause painful itchy lumps on the skin or other allergic reactions if the exposure level is high. To protect against dust mites seed can be moved out into the sun on racks or tarps to help reduce the level of dust mites.
PPE should also be left in the sun to reduce dust mites.

[PHOTO: PPE – showing dust mask and eye protection]

3. RECORD KEEPING

Reminder: Track the Seed Lot through all the Processing Steps

It is vital for tracking the provenance of the seed lot to tag or label all seed lots through the drying, extraction and cleaning steps with the unique seed lot collection number from the Field Data Sheet.

It is recommended for each seed lot to have two labels: a label INSIDE the seed lot container with the FDS number, as well as a label or tag on the outside, should the outside label or tag be dislodged at any point in the process.

Any special techniques used in the drying, extracting and cleaning process or other notes on seed lot processing should be recorded and added to the Field Data Sheet as these notes may help to improve the efficiency or effectiveness of seed processing methods for the future processing seed lots, especially if a particular method may have an impact, good or bad, on subsequent seed germination rates.

4. SUMMARY OF POST HARVEST PROCESSING

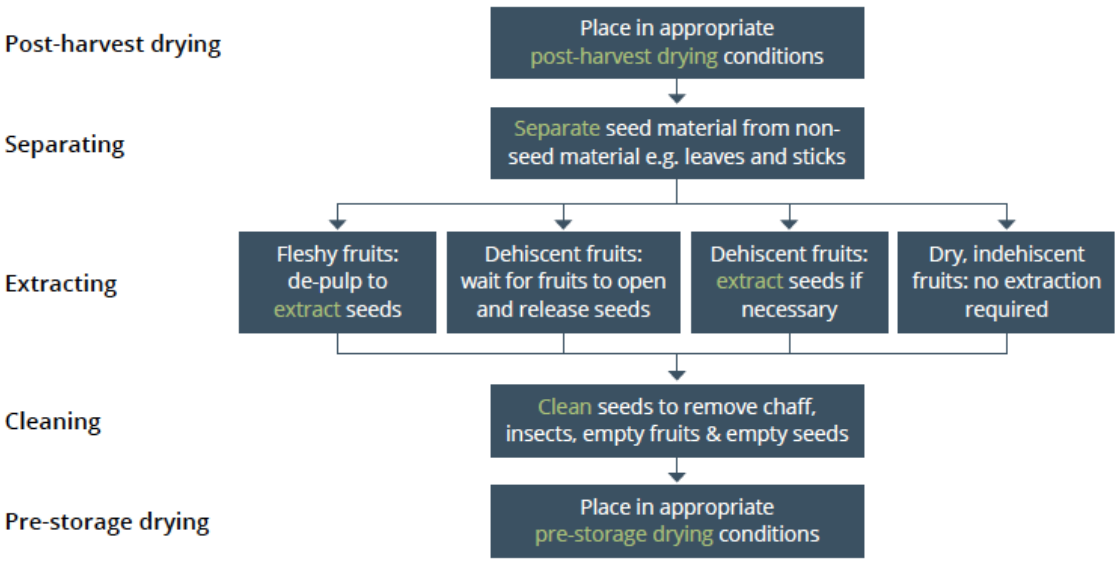

Figure 1. Summary of procedures for post-harvest drying, separating, extracting and cleaning and pre-storage drying (Florabank Guidelines, 2024 Module 8).

5. POST HARVEST DRYING & SEPARATING OF SEED

The post harvest separating of non fruit/seed materials and post harvest drying is very important to prevent the loss of seed from mould, disease and insect attack. It is also required for many fruits to open up as they dry so as to release the seed inside.

Post harvest drying is an initial drying step of seed and is NOT the same as drying the extracted and cleaned seed for long term storage. The drying of seed for longer term storage requires very low moisture content – see section 8 below.

Introduction to Post-Harvest Drying

Mature Seed
When mature seeds arrives from the field to the hub or processing centre the seed should be stored under dry conditions with good air flow. Ideally kept as cool as possible (15-25C) and in as low Relatively Humidity (RH) as is possible (ideally below 50% RH)

Immature Seed
For immature fruits/seeds retain the seeds within the fruits on stems or branches in ambient or natural conditions for 1-2 weeks or until fruits show signs of ripening (e.g. colour change or opening of capsules) and then dry the seed as for mature seed.

SEPARATING **(Of other plant materials from the fruit and seed pods.)**

As required after the harvesting of the seed bearing materials, remove non-seed bearing material as soon as possible such as loose leaves, twigs, branches and any empty seeds or fruits. This initial cleaning is important for reducing potential insect damage while the fruit/seedpods are dried and to reduce the amount of space required for drying and processing.

DRYING METHODS

P1 Post-harvest handling of fleshy fruit

Fleshy-fruited species should be processed as soon as practical after collection. Fleshy fruits can be stored in plastic bags in a cool dry area and the bags opened regularly to remove moisture and prevent fungal development. Go to: Extraction of Seed – Fleshy Fruits.
All fleshy fruits should be treated as potentially poisonous or an irritant, and gloves should be worn.

P2 Post-Harvest Drying of Non-Fleshy Fruit
(such as woody capsules, seed pods, nuts and grains)

It is important to use containers and materials that allow air circulation. Plastic bags should be avoided as they encourage condensation and the growth of mould. Plastic tarps can be used for large-scale drying of seed-bearing materials on a floor or on mesh trays above the ground.

Place seed-bearing materials for drying in sturdy paper bags, calico or other open-weave material bags, in a well-ventilated area or on open mesh racks or shelving. Leave enough space in each bag so that seeds can be spread in a thin layer to allow free air circulation. It is vital to ensure the seed lots are labelled and are not mixed during the drying process.

For larger quantities, spread fruit out on sheets or tarps under shelter, and turn regularly to avoid uneven drying. Minimise access to the drying seed by ants, birds and rodents.

Calico bags containing seed in a well ventilated area
Large quantities of material containing seed placed on tarps to dry (right).
Photos: L Commander and P. Gibson-Roy, (Florabank, 2024).

6. EXTRACTION OF SEED

For an overview of seed extraction and cleaning methods see this video (https://www.youtube.com/watch?v=F01XSu_U8H4) from the Adelaide Botanic Garden or this video by Kew Botanic Garden in the UK.

Extracting seeds from fleshy fruit

Fleshy fruits should have the flesh removed (de-pulping) as soon as possible after collection so that the separated seed can be dried and further processed. This is generally for fruits that contain multiple seeds. De-pulping is not always necessary, especially for fleshy fruits containing a single seed and for fruits that can be dried readily.

The seeds of some species, such as the Acmena/Syzygium group, are likely to dehydrate readily when the flesh is removed, and proper care and refrigeration will be necessary.

P3 De-pulping fleshy fruits

Use one or more of the following methods suitable for the species:

- Store fruit in a plastic bag under cool conditions or soak in water until the flesh becomes soft (changing the water regularly to avoid fermentation), then wash through an appropriately sized sieve to remove the flesh but to keep the seed.
- Manually de-pulp using high-pressure water stream or maceration using a rubber bung to squash flesh, taking care not to damage the seed. A sieve can be used to retain/drain the seed.
- Fruit with a hard endocarp can be put into a blender set at low speed and filled with water, although the blades may need to be padded and care taken not to damage seed. Alternatively, use a magnetic stirrer if available.
- Soak in an enzyme that breaks down the fruit, such as pectinase.

Once the seed is separated from the fruit, it is ready for drying (if suitable) before final cleaning and storage.

De-pulped seeds ready for final cleaning. Right: the cleaned seeds (Photos: Florabank).

Extracting seeds from dehiscent fruit
(Dehiscent fruits are fruits that open to release seeds)

After post harvest drying, some form of seed extraction is usually required to separate the seed from the fruit. Prior to processing inspect the dried fruit to check the fruit has fully opened before starting the extraction.

P4 Seeds that only need to be shaken to release the seed

For some species it is only necessary to shake or beat the dried seed bearing material to release the seed. A set of large sieves of different mesh sizes appropriate to the seed size and with a fitted collecting bucket will make this process more efficient and clean the seed in

[INSERT PHOTO: Sieve set and collecting bucket]

P5 Threshing

For species where the seed remains firmly lodged within the fruit after drying, some form of hand threshing with tools may be required. Useful hand tools may include: a rubber bung, nutcracker, hammers, vice, screwdrivers and pliers.

Some fruits, such as legumes, can be gently crushed in a calico bag to release the seed. Other fruits or pods may require rubbing between a hand (wearing a sturdy glove) or a hand-held large rubber bung and a corrugated rubber mat, or in a sieve to abrade the fruit, allowing seeds to drop through the gaps once they have escaped the fruit structure.

Check the seed regularly using a hand lens or magnifying lens while threshing to ensure the seed itself is not being damaged by the extraction method.

Hand-held rubber bung threshing/crushing fruits to extract the seed. Florabank

[INSERT MORE PHOTOS OF THRESHING METHODS AND EQUIPMENT]

P6 Heating

For certain species such as *Banksia sp.*, which have very woody follicles, extreme heat may be used. Heat the follicles in an oven at 35-45°C for 30 minutes, or just until the follicles open.
Be careful not to leave fruit in the oven for an extended period as this can damage the embryo and reduce seed viability.

7. CLEANING SEED

See this video from Kew Botanic Gardens for an overview of seed cleaning methods.

The aim of cleaning seed is to remove as much non seed material from the seed lot as is readily feasible to reduce the chances of impurities spoiling the seed in storage. Cleaning seed is a compromise between the time and effort required and of preventing the loss of viable seed through unnecessary processing. The seed lot does NOT need to be 100% pure seed for storage or later use.

Special machines such as aspirators and vacuum separators can separate seed from non seed material based on relative weight. See the Florabank Guidelines (module 8) for photos and more information. This information proved in this Seed Bank Network Step focuses on hand methods such as sieving and winnowing with a fan which do not require special machines.

A seed lot purity test may be conducted to guide the level of effort: refer to Step 7 in this procedure or to the Florabank Guidelines module 10.

P7 Sieving

Sieves are generally used where the seed is either smaller or larger than most of the impurities. Choose the sieve sizes you will need by examining the size of the seed. Some trial and error may be involved on choosing the best combination of sieves for the seed species being cleaned. Write notes on the Field Data Sheet.

A set of quality sieves of various mesh sizes or apertures is very useful. The mesh sizes often used are: 0.8mm, 2.0mm, 4.0mm, 7.1mm. It is best to buy a few collecting buckets which fit to the base of the sieve set.

The top sieve (largest sieve aperture) allows the seed to fall through to the second sieve which captures the seed but allows dust and finer materials to fall through.

Place several handfuls of threshed material into the top sieve and shake in a circular motion, or rub gently with a rubber bung until most of the seed has passed through.

When the seeds have gone through the top sieve, discard inert matter and place seed in a container or bags for further processing.

P8 Floating of Impurities

This method should NOT be used after seeds have been threshed as the threshed seeds may have been damaged and absorb water.

For species with water-impermeable (hard) seed coats, floatation is sometimes an effective treatment for seed cleaning as the heavier waterproof seed will sink while many impurities will float. Place seeds into a bowl or container with water. Most impurities float to the surface including pest damaged or empty seeds (immersion can also kill pest larvae) while filled seed sink to the bottom. Carefully remove impurities by scooping them from the surface. Drain water off and dry seed thoroughly in paper bags before storage.

A cut test should be performed on a sample of the seed floating to the surface to ensure it is not viable. Some water dispersed seeds will naturally float.

P9 Winnowing

Winnowing and the use of vacuum devices can be used where there are weight or shape differences between the seed and impurities – allowing the impurities to float away.

Lay a tarp or sheet on the ground with a large waste tub or bin on top. Carefully pour the seed-bearing material from one container into another container in front of a fan or a current of air that you can regulate from low to high. You may need to do some trial and error for the air current setting. Viable seeds should fall into the container while the lighter impurities and chaff should fall/float into the waste tub/bin below or on to the tarp.

Repeat the process of pouring the material into the container until only the seed remains.

P10 Cleaning by hand

For species that still have some dispersal parts attached (e.g., *Asteraceae* sp.), light rubbing may be required to separate the chaff from the seed. This can be done using the palms of both hands or fingers. Alternatively, a bung with a corrugated rubber base can be used to gently rub material across a rubber sheet. It is recommended to test this method on a small

sample of the collection first, which can then be inspected for damage to the seed material. The hand-cleaned material can also be sieved or winnowed.

8. AIR DRYING OF SEED READY FOR THE NEXT STEPS

After the seed is processed the seed lots should be stored in labelled paper bags in a cool, and dry place, or in a fridge to be ready either for local use in the short term (months), and/or to transported to the Seed Bank facility in Coffs Harbour for further drying, testing and longer term storage.

Depending on the species of plant the seed may be able to be dried further for longer term storage (years). The most common type of seed is called "Orthodox" and can be dried and stored for years. Other types of seed are called "Recalcitrant" and cannot be dried and often must be used quickly after harvest. The third type of seed is called "Intermediate" and may be dried to a degree but not too much and stored for a period.

The drying of seed is critical for seed longevity in storage with seed life generally doubling for every 1% reduction on moisture content.

For most types of seed that are to be stored for a longer period (years) the seed should be dried further using a desiccant, such as silica beads in an air tight container, or in a low humidity controlled environment room and then packed into moisture proof foil packets to prevent rehydration from the air.

The drying of seed for long term storage is usually done by the Seed Bank facility in Coffs Harbour and the detailed procedure is explained at Step 6 of the Seed Bank flowchart: 'Seed Drying and Packing for Storage, and in the Florabank Guidelines module 9.

Transporting the Seed to the Seed Bank facility in Coffs Harbour

The air dried seed lots, in labelled paper bags, together with the original copy of the Field Data Sheet for each seed lot, should be packed into an ordinary mail satchel/box or express mail satchel (but not sent by registered mail) and mailed to the seed bank.

Seed lots may also be hand delivered to the entrance counter at the Botanic Garden in Coffs Harbour where it will be conveyed to the Seed Bank facility inside the Botanic Garden.

PROCESS

1. Email the Seed Bank Coordinator to advise of a seed lot deposit being sent:

Email: **seedbankNCR@gmail.com**
When the seed lot is received a reply email will be sent to acknowledge receipt.

2. Mail Seed Lots to:
'Seed Bank Coordinator, North Coast Regional Botanic Garden,
PO Box 648, Coffs Harbour, NSW, 2450.

Or
3. Hand deliver seed lots to: **The Information Centre counter at the entrance to the Botanic Garden, corner of Hardacre Street and Coff Street, Coffs Harbour**,

Or
4. If prior arrangement has been made with the Seed Bank Coordinator, drive to the Seed Bank facility via the service road inside the Botanic Garden. The service road is at the corner of Coff Street and Curacoa Street, crossing a pedestrian path to a gate with a sign at the entrance: "Seed Bank and Herbarium".