Drying, extraction and cleaning of native seed

Introduction

Seed drying and extraction involves the removal of seed from the fruit following collection. These processes should be carried out as soon as possible after collection and care must be taken to avoid any damage to the seed, which may reduce viability and longevity. Seed is rarely fit for immediate storage following collection, requiring either drying or de-pulping, extraction from the fruit and further cleaning. The methods for drying and extraction are many and varied and depend very much on the type of fruit, seed and equipment available. For dry fruit (woody capsules of eucalyptus, melaleuca, callistemon; cones of casuarina, callitris; pods of acacia, daviesia; follicles of grevillea, hakea), drying with some form of heat is required as part of processing the seed. However, for fleshy fruit (many rainforest species), drying may not be desirable and instead the fruit or berry may need to be de-pulped or packaged in some way for storage.

Pre-drying

Immediately after collection, the seed is particularly susceptible to damage from adverse environmental conditions. Freshly collected fruit normally has a high moisture content and is susceptible to mould if stored inappropriately for even a few days.

You should be sure of what the seed actually looks like before collecting plant material. Use a hand lens, or in some cases a binocular microscope (most schools have one), or a cut test to make sure that the true seed is being collected. Use a very sharp blade to cut through the fruit.

Where possible, impurities such as twigs and leaves should be removed to assist in the cleaning process, and the fruit should be well aerated. As the leaves and small twigs dry out and become brittle, they break into small pieces which can be very difficult to separate from the seed. Fruit that remains secured on branchlets (eucalyptus, casuarina and hakea) should not be removed. In the case of casuarina, the branchlets (needles) should be removed promptly (before they dry out and segment), leaving only the cones. Examine the collection sheets or bags carefully before and during extraction as sharp sticks make holes, which allow loss of small seed.

Drying

The drying process is used to avoid the development of mould, open the fruit and prepare the seed for extraction. Whatever method is used, it is important to ensure that seedlots (a seedlot is a unique batch of seed of a species from a location) are not mixed in the drying process.

It is important to use containers that allow air circulation, particularly when the material is enclosed. Plastic bags or sheeting should be avoided as they encourage condensation, which may initiate seed germination or reduce its storage life.

Small quantities of fruit can be dried in envelopes, paper bags or open containers in a room (15°–30°C) with good air circulation. Ensure the containers are in a position where the seedlots cannot be knocked over or contaminated.

For large quantities, fruit can be spread out on sheets or tarpaulins but it should be turned regularly to avoid uneven drying. It should be spread out where there is shelter from adverse weather conditions or packed away when necessary.

Natural drying

The collected material is dried by spreading it in a thin layer exposed to either direct sun (woody fruit) or cooler shaded conditions (for sensitive species) and to free air circulation. This can be done by either laying the fruit out on ground sheets or suspending it in racks in the open or under shelter. A careful watch on the weather is required where material is dried in the open and sheets should be packed away at night where several days drying are required.

Don't underestimate the amount of condensation that can be produced by collected plant material and be careful to leave the sheets open as much as possible. Turn the material regularly to encourage even drying and discourage mould outbreaks (especially where there is a thick layer of material containing leaves).

Ensure that the seed is not accessible to pests. Ants, birds and rodents can remove or eat the seed and other animals can be a nuisance.

Avoid re-wetting of the fruit during drying since this can retard or prevent seed drop and lead to a rapid loss in viability in extracted seed. Seed can tolerate reasonably high temperatures for short periods but only if the humidity is low. Severe damage to seedlots can occur if air circulation is poor and the humidity and temperature within the drying material are allowed to rise.

Natural drying is ideal for warm to hot dry conditions but may not be suitable for less reliable climates and during the winter months. In such cases it may be necessary to spread the material out in a dry area, such as an enclosed shed with a concrete floor.

Artificial drying

An alternative to natural drying is using solar extractors, glasshouses or artificial heat from ovens or drying rooms. One popular and low cost method for drying seed is to use a greenhouse or purpose-built propagation igloo. These are available in kit form and typically involve plastic stretched over a metal frame. Good air circulation is essential in keeping the temperature down inside such structures and you may also need to erect a shadecloth cover in summer.

The temperature must not exceed 35°–38°C and must be combined with good air circulation to quickly reduce humidity as the fruit dries.

With immature and very moist material, it is wise to initially dry the material for 1 to 2 days at a lower temperate (20°C), then gradually increase the temperature to 35°C.

Install a simple digital thermometer in the drying area to keep a check on temperature. These are typically battery operated and display temperature (0°–60°C) and the maximum and minimum for each day. It is important to monitor the extremes in temperature as too high a temperature may result in rapid decline in viability.

Silica gel or silicon dioxide is a low cost and easy method for final drying of small quantities of seed. After air drying, place a sachet of silica gel with the seed in a sealed container. Use a ratio of about 2:3 silica gel to seed – more silica gel for greater drying capacity. At room temperatures (25°) 100g of silica gel can absorb about 7g of moisture. Indicator dye is usually included in the silica gel to signal when the gel has absorbed as much moisture as it can. At this point the silica gel should be dried in an oven.

Drying time depends on a number of factors, for example, the volume of material, initial moisture content and the structure of the fruit. Seed should be ready for cleaning after 3 to 5 days, but may take up to a week or more where there is a large volume of leaf and fruit

material or woody fruit.
In the case of acacias, a heat treatment at 40°–45°C for 24 hours promotes brittleness in the pod, which assists in the extraction process. The hard-coated acacia seeds are also more resistant to the higher temperatures.
You can monitor the change in seed moisture content during drying by weighing a seed parcel at regular intervals using an accurate digital balance. Equilibrium moisture content is reached when the weight of seed no longer changes. Be careful that the seed parcel stays the same throughout drying, for even minor losses of seed can mask the comparatively small changes in weight due to moisture loss.
A rule of thumb is that when the seed 'crackles' as it passes through your hand it is dry.

Extraction

After drying, most fruit will require some form of extraction to separate the seed from the rest of the material. Shaking or beating of the dried material will release all the seed in some species. In other species the seeds can remain locked or attached to the fruit, requiring additional processing. A careful inspection should be made to ensure that the fruit have fully opened before starting the extraction process, although it is unlikely that any further opening will occur after a week or so of drying. Ensure that all the seed has been removed before discarding the waste.
Threshing the fruit by hand or with an implement or machine is often required to release seed from pods, for example, in acacias. You will find some hand tools useful, such as a vice, blowtorch, nutcracker, hammers, screwdrivers and pliers.
Mechanical threshers are essential for handling large quantities of plant material efficiently. Where they are used, care must be taken to ensure that the seed is not damaged. Even hard-coated seed can be cracked under severe threshing, but this will result in shorter storage life. In general, the longer the material takes to go through the thresher, the more likely that it will be damaged. It is preferable to run the material through quickly several times. There are many types of mechanical threshers available commercially, and as many home-made versions produced through innovation and adaptation of existing equipment, such as garden threshers and blowers.
Extreme heat extraction may be used for certain species, including banksia and hakea, which have very woody follicles. High temperatures (80°–1000C for 30 minutes) or, alternatively, exposure to fire (home barbeques are suitable for small seedlots) may be used to open the fruit. Care is needed when the fruit open to ensure that the more delicate seed is not damaged.
Some banksia species may need 2–14 days soaking in water after heat treatment (See Encyclopaedia of Australian Plants, Vol 2, p284, W. Rodger Elliot and David L.) Jones. The Threatened Flora Seed Centre and Kings Park and Botanic Garden, Western Australia, use this method.

Depulping

Fleshy fruits are normally de-pulped but if the fleshy coverings are thin, removal may not be required.
De-pulping may need some or all of the following:

- storing the fruit in a plastic bag under cool conditions
- soaking in water until the flesh becomes soft (changing the water regularly to avoid fermentation)

- manual de-pulping using high-pressure water stream or maceration.

Fruit with a hard nut surrounded by flesh can be put into a blender set at low speed and filled with water, although the blades may need to be padded.
After the pulp is removed, seed can be separated by flotation in water or sieving.
Fruit that do not split open when dry can be stored as they are.

Cleaning

Once the seed is separated from the fruit it is ready for final cleaning before storage. The aim of cleaning is to separate the full, viable seed from impurities, which may include empty seed and fruit, sticks, leaves, dirt, and so on. Impurities can affect storage volume and seed viability (sowing rates) and may harbour harmful pests and pathogens. Complete cleaning of a seedlot may not always be possible or necessary, as in the case of eucalyptus or native grass seed that comprises fertile seed and chaff. The level of cleanliness adopted is usually a compromise between time, effort and loss of viable seed.
There are a number of methods for achieving clean seed including manual cleaning, sieving, blowing, winnowing and flotation. The ease of germination and purity of cleaned seed is influenced by the amount of care taken in the removal of impurities following collection and prior to drying.
Larger impurities like sticks can be easily removed by hand and this is normally the first process.
Screens or sieves are frequently used where the seed is either smaller or larger than most of the impurities. Sieves range from kitchen sieves to pieces of domestic flywire to purpose-built, mechanised screens. A combination of different screen sizes is often used to progressively remove the rubbish. Different screen shapes (round, oblong or square) and materials (mesh or perforated plate) suit different species and some trial and error is required to identify what works best on a particular species. A set of screen and sieve sizes and configurations are essential tools for seed extraction.
Winnowing and vacuums are used where there are weight or shape differences between the seed and impurities. These methods are particularly useful for separating full from empty seed. A simple method is to pour the material in front of a regulated air current (such as a domestic fan) located on a clean floor. If the method works properly, the good seed falls in one area and impurities in another. A vacuum cleaner or garden vacuum/blower with some form of suction control is effective in separating light fluffy seed. Screens can be used to control what is sucked into the vacuum. The same basic principles are adapted and developed in a range of different ways in machines built for seed extraction. Sometimes the air column/vacuum is combined with vibrating sieves in a single-pass cleaning machine.
A quick immersion in water is an effective treatment for cleaning species with hard seed coats. Impurities tend to float to the surface while good seed sinks. After removal of the impurities, the water is drained off and the seed thoroughly dried before storage.
Once clean, the seed needs to be securely bagged and labelled to ensure identification at a later stage.
This guideline outlines general principles and ideas but seed extraction and cleaning are areas ripe for the use of initiative and invention. The tools required can be very basic or very complex, giving seedbanks a wide choice of options to suit their seed cleaning requirements and their budget. Seedbanks in some areas may be able to utilise the seed

cleaning facilities of some of the larger agricultural seed cleaning operations on a contract basis.

Safety issues

Some plants are toxic or may cause allergic reactions and contact should be avoided with plant material, sap, or dust from drying and cleaning processes: for example, some acacia pods contain cyanide compounds.

Be alert to allergic reactions.

Do not consume food or drink in the seed preparation area.

Wear gloves (latex) and a respirator during the cleaning process or when handling materials that are dusty or contain fine hairs.

Wash your hands after handling seeds.

Clean seed in a well-ventilated area or use an extraction fan to remove dust. A simple method is to use a household electric fan to create a gentle breeze across your working area to blow dust, but not seed, aside.

A dust extractor should be used where large quantities of such materials are handled.