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Seed propagation

Propagating plants can be as easy as sowing a few seeds in a pot. For other plants a little bit of technical know how might just be the difference between success and failure. These notes are a combination of knowledge and experience from myself, Peter Macqueen and the Society for Growing Australian Plants.

Introduction to Hygiene

Hygiene is very important when propagating plants and in the operation of a nursery- even a home nursery.
Most problems can be prevented or controlled by :

- good hygiene
- observation for potential problems
- efficient control of disease or pest when first noticed.

The main problem that we need to prevent is **damping off** – a water born fungal disease.

Damping off in a seedling tray

Rhizoctonia damage of young stems and roots

How to minimise these problems?

- cultural practices – healthy plants = less disease
- bleach trays and pots
- use new or pasteurized mix
- chemical control if and when necessary
- nutrition management
- environmental management

Propagation mix treatments.

Propagation mixes may be treated to minimize the risk of infection of propagated plants.
This may be achieved by

- solar sterilisation (using plastic sheeting over mounds of mix on a concrete slab in the sun for 2 days)
- steam pasteurising using a steam generator and air to heat mix to 65 degrees C for 30 minutes
- steam sterilisation - not commonly used where media is heated to 100 degrees C for 30 minutes killing all micro fauna and flora.
- Chemical control - most chemicals are now being phased out of common usage due to environmental concerns**.**

If you are buying propagation mix make sure you buy from a reputable supplier and that the mix conforms to Australian Standard. Refer to fact sheet
http://www.wattletreehorticulture.com.au/docs/resources/potting%20mix%20fact%20sheet.pdf

Disinfection of nursery benches, containers & tools

Some form of disinfection is essential to prevent disease problems – in particular damping off diseases. Various chemicals are used to sterilise: all pots, trays, tubes before propagation, all work areas before propagation and the benches and the floor of propagation house as required.
The 2 most common products used are Chlorine and Phytoclean®.
If you use **Chlorine or household bleach** you will need to make up a concentration of 5000ppm. That will equate to 50ml per litre if the Chlorine is pure. If the product has a lower concentration you will need to work out the correct application rate. The incorrect application rate is ineffective and therefore wasteful.

Safety Precautions when using Chlorine
Use only at recommended rate.
Care must be taken as Chlorine can cause skin irritation and bleach clothes.
Always use safety equipment

If you use **Phytoclean**® you will need to make up a solution based on the label recommendation. Phytoclean® is relatively safe and very much more effective than bleach as a sterilant as it is more stable.

Propagation media

The mix used in nurseries to propagate plants varies a great deal. Most use a mix that has the following characteristics:

- high air filled porosity (25-50%)
- high water holding capacity
- pasteurized or treated in some way to avoid pathogenic infection
- low conductivity
- slightly acidic pH

The most common ingredients used in Australia are :

- peat moss (or coco peat)
- coarse sand
- crusher dust
- vermiculite
- perlite

A good standard propagation media used for the germination of seeds is as follows:

3	part perlite
2	part peat moss
1	part coarse sand

Fertiliser such as Mini-Osmocote® may be applied either at seed sowing time or shortly after the plants start to grow.

Seed Propagation

Introduction

Seed propagation allows large numbers of plants to be easily produced. Flowering annual plants and vegetables are grown from seed as are many trees and shrubs. Like any form of propagation there are advantages and limitations of producing plants from seed.

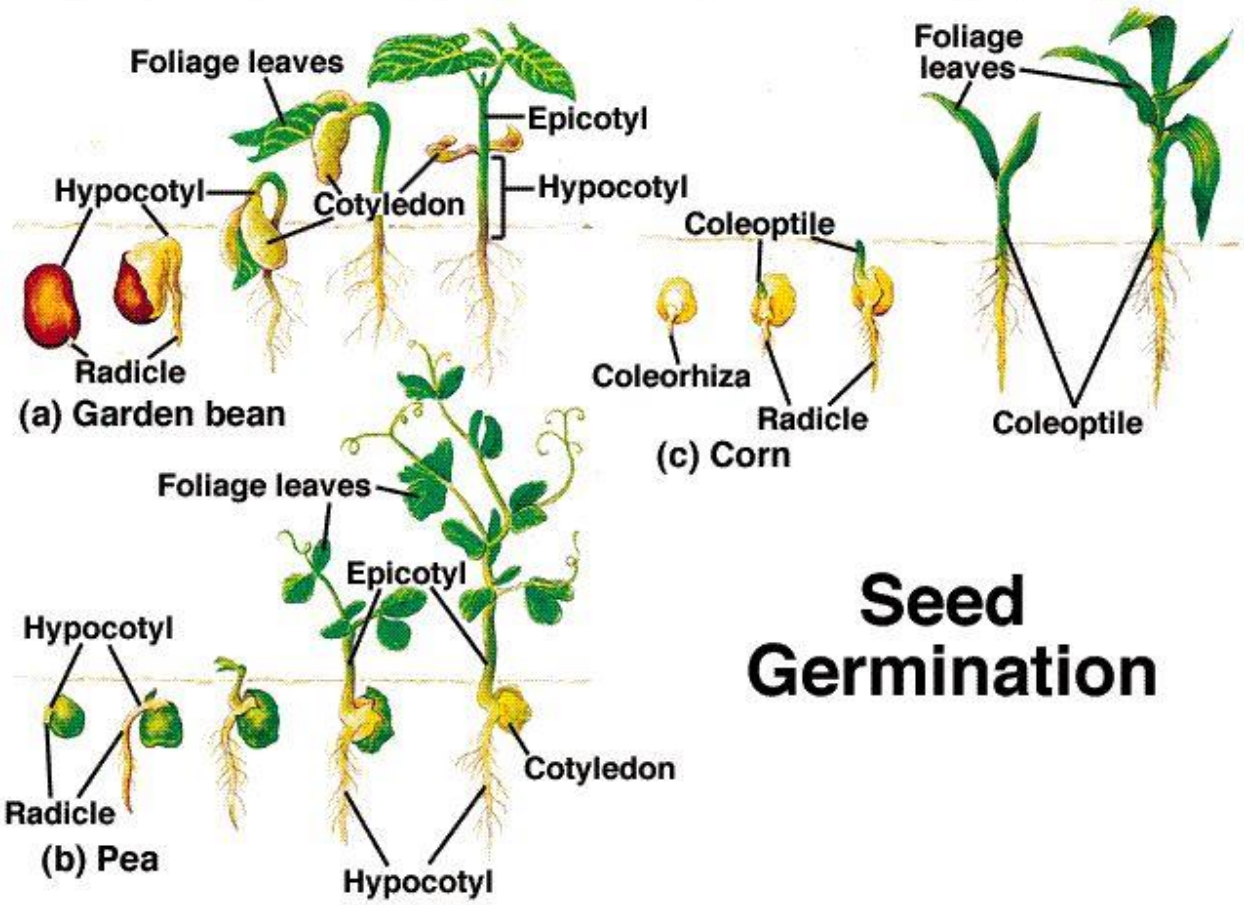
Advantages

- Large numbers of plants produced
- Seed is easy to move around the country
- Only method for some plants
- Likely to produce a more quickly growing product
- Retains genetic diversity
- Many plants germinate very easily

Limitations

- Not all plants produce viable seeds
- Most cultivars cannot be reproduced from seed
- Seedling variability
- Generally slower to produce flowers and fruits
- Some species slow to germinate

For bush regeneration using local provenance seed is very important for a range of reasons – note discussion points below!



The above terms are used to describe the process of germination. For germination to occur plants need

1.

2.

3.

4.

Treating and sowing seed

Seed pre-treatment

Some seeds will have germination inhibitors that prevent the seed from germinating when sown. These require specific treatments before they will germinate. The following section is adapted from the Society for Growing Australian Plants website.

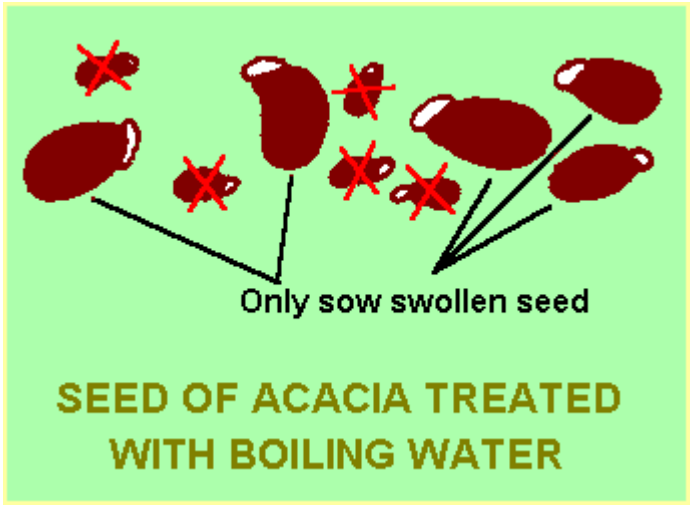
Boiling Water

This is the most common pre-treatment method and is used with seeds such as Senna, Acacia and all of the 'pea' family in which the hard seed coat forms a physical barrier which is impervious to water.

These plants are often native to areas where bushfires occur at regular intervals - the heat of the fire cracks the hard coat and allows moisture to reach the embryo inside. Pouring boiling water over the seeds simulates this effect.

The seeds to be treated are placed in a container, covered with boiling water and allowed to stand overnight. Seeds that soften and swell to 1.5-2 times their original size can be sown; those that don't swell are retreated. Any seeds which float are usually infertile and can be discarded. Seed that does not swell after several repeated soaking may need to be treated differently, such as by abrasion - see below.

In some cases seeds will not tolerate excessive time in boiling water and respond better to a one minute immersion in boiling water followed by cooling down. Acacia species native to areas where relatively quick grass fires occur may be in this category.



Abrasion
This can be used as an alternative to boiling water. Seeds are abraded between two sheets of fairly fine sandpaper to reduce the thickness of the seed coat. This can be cumbersome and an alternative is to glue sandpaper to the inside surfaces of a small plastic container, put the seeds in and then shake the container vigorously.

Stratification
A type of dormancy often encountered with seed of species native to alpine or semi-alpine habitats is a requirement for a period of cold conditions prior to germination. This requirement can be accommodated by placing seed in a closed container (containing moist vermiculite or similar material) in a refrigerator for 1-3 months before sowing. This procedure is referred to as"stratification" and examples of seed requiring this treatment are Banksia canei, B.saxicola, Eucalyptus kybeanensis, E.pauciflora, E.regnans and E.delegatensis.

The method has also been applied with some success to non-alpine plants such as Anigozanthos sp. (Kangaroo Paws).

Fire
Apart from the "pea" flowers and acacias, some other seeds seem to require the passage of a bushfire to germinate. Flannel Flowers (Actinotus helianthi), for example, are usually seen at their best in the wild in the seasons immediately following a bushfire. This effect can be simulated by sowing the seed in a terracotta pot (not plastic for obvious reasons!) and setting fire to leaf litter and twigs placed on top. The fire should be maintained for 2 - 3 minutes. This method has worked but is really a "last resort" method as it is difficult to have any real control over the amount of heat delivered to the seeds. Once the ash has cooled, the pot is watered and maintained as for any other seed raising container.

Smoke
Research in South Africa and Western Australia has shown that smoke is a critical factor for promoting germination of seeds in areas subject to bushfires. The following articles outline some of the general principles involved:
Review of the Promotive Effects of Smoke on Seed Dormancy
Smoke Germination of Australian Plants; T Vigilante et al. RIRDC; Publication no: 98-108
Smoke Stimulates the Germination of Many Western Australian

Plants
On a large scale, an apparatus like that below can be used to apply smoke to batches of seed. However, this is not particularly practical for the average home propagator.

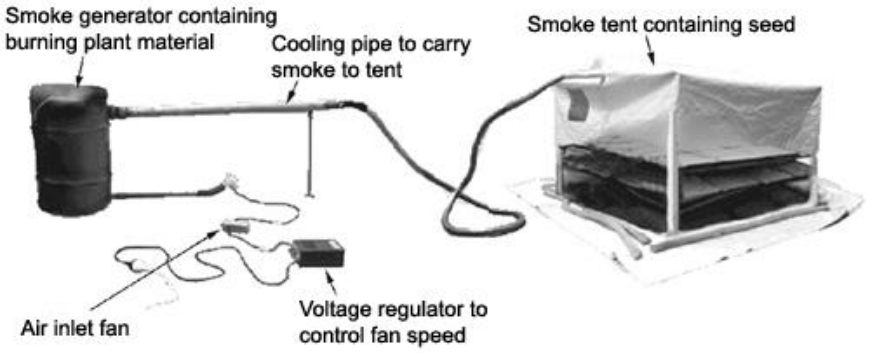


Diagram from Rural Industries Research and Development Corporation Short Report No.48

One practical method of applying smoke treatment is the use of smoked water as a pre-treatment where seed is soaked for 12 hours in a 9:1 water: smoke-water solution. Smoke water can be produced by bubbling smoke through a container of water for about 60 minutes after which the solution is frozen until needed. However, even this is a bit messy. Fortunately, some shortcuts are available:
Smoke Water: A product called "Regen 2000 Smokemaster" is available, although it's not the sort of item stocked by your average garden centre and the smallest package is about 10 litres. Further details from the Regen 2000 web site.

Smoked Vermiculite: "Regen 2000 Germinator" is a dry granulated smoke-infused product, specifically designed for use on seed trays. Small quantities, sufficient for small-scale use, can be obtained from Nindethana Seed Service. The Wildflower Seed Company (PO Box 804, Canning Bridge, WA 6153) sell "Seed Starter" granules that may be similar to smoked vermiculite (the granules are mixed with hot water and the seeds soaked for for 2-3 hours).

Smoked Paper Disks: These apparently originated in South Africa. The seeds are soaked in a container containing one of the disks for 24 hours prior to sowing. These disks are also available from Nindethana Seed Service.

Smoke Responsive Species. In some cases germination has been achieved with species that have proved very difficult or impossible to germinate in the past (eg. Calytrix, Conostylis, Dianella,

Eriostemon, Geleznowia, Lechenaultia, Philotheca, Pimelea, Stylidium and Verticordia. For a listing of smoke responsive species, see the Regen 2000 web site.

Leaching

With some seeds there is a chemical inhibitor present which prevents or delays germination. In some cases it is possible to remove the chemical by leaching with various solutions. For example, it has been found that suspending seeds of Eriostemon and some Correa species in a muslin bag in running water for 1-2 weeks improves germination substantially. Unfortunately this is not particularly practical for the home gardener although it has been suggested that leaching could be achieved by suspending the bag in the cistern of a flushing toilet! Other leaching solutions that have been used include alkaline solutions.

Seed sowing procedure

1. Sterilise trays /containers
2. Fill with media and water in thoroughly
3. Top up with media as required
4. Complete any seed pre treatments required
5. Prepare labels and record in propagation book
6. Sow seed as directed by hand or using sand as a guide – you will be shown the correct technique for small and larger seeds
7. Cover seed with a layer of vermiculite that is about twice the diameter of the seed thick. Seed needs to be well covered to retain moisture during germinations
8. Label
9. Place trays in propagation area and water thoroughly.

Why seed may not germinate

Why seed may not germinate

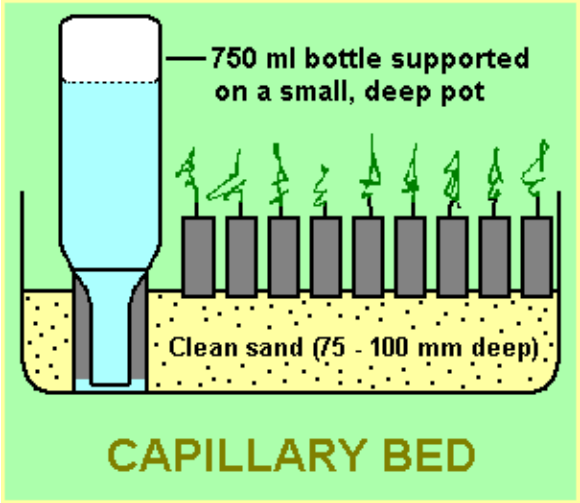
- Seed not viable
- Drying out
- Media remaining too wet
- Wrong temperature
- Pre germination treatments not used
- Seed sown to deeply or shallowly

Post germination care and transplanting

Care and attention

After sowing, the seed bed needs to be kept moist and sheltered from drying winds and from rain. Some sunlight is an advantage.

With overhead watering, a fine spray is necessary to avoid damage to small seedlings. A good method of watering for small quantities of seed is the use of a capillary bed (as shown in the diagram). With this arrangement, overhead watering is not needed and the seed and seedlings can be left unattended for 2 or 3 days (up to a week or more in cooler weather). The seed mix in the containers needs to be fairly moist before the containers are placed in the capillary bed otherwise the capillary action may not occur.



A similar method is the so-called "bog method" where the pot containing the seed is placed into a saucer of water until germination occurs.

Post germination care

After the seedlings have emerged fertiliser should be added if it has not been incorporated in the media prior to sowing. Some nurseries use a liquid fertiliser program others top dress with a slow release fertiliser such as Mini-Osmocote®. Depending on season and on variety these seedlings are then usually hardened off by removal to a shadehouse or growing on greenhouse. The sooner the plants are removed from the softer conditions of a propagation house the sooner they will become acclimatised to the outside environment.

Pricking out seedlings

Seedlings of plants required to be sold in individual containers are pricked out into individual tubes or cell trays when they have developed at least 1 set of true leaves.

Procedure

1. Fill tubes with mix and water thoroughly.
2. Make a deep hole in centre of each tube with a dibbler such as a plant tag or bamboo stake.
3. Remove seedling from punnet or tray.
4. Hold by leaf NOT stem as this can be easily crushed.
5. Gently lower the seedling's roots into the hole. Ensure that the roots are kept pointing straight down. This is very important for the future of the plant especially in the case of long term trees and shrubs.
6. Plant at the same level as in the punnet to tray and firm gently.
7. Water and place seedlings in shade house or similar.
8. Some nurseries will water with a systemic fungicide such as Previcur® at this stage.

The J root story

The nursery industry is full of tree killers!

The most common problem for transplanted trees that have been grown from seed is caused at the transplanting stage. Deformed roots are caused by operator error in one of 2 ways.

1. Bending the roots if the roots are not carefully lowered in at the transplanting stage
2. Firming the roots with fingers after backfilling the tubes causing a J shape to form in the tap root

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Note the bent tap root – image SQIT Horticulture