Technical Aspects of Seed Collection, Storage and Handling

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Overview of the Subject

A number of recent publications in the list at the end of this article provide detailed information on the subjects of seed collection, storage and handling. Most of the listed references are books or review articles which provide many other original references on these subjects.

Rather than paraphrasing these references, most of which are readily available, I have listed below in point form the areas that should be considered, and indicated which references relate to each area. The remainder of this paper concentrates on certain issues that may be of particular interest to this conference. Attention is focussed on orthodox seeds, which tolerate desiccation and freezing temperatures, and retain their viability on drying below 12 % moisture content, and can be stored alive for several months or years.

Aspects of collection, storage and handling of tree and shrub seed, with key references indicated (numbers correspond to numbered references in the reference list).

Collection (2, 4, 5, 7, 8, l0, ll, 12)
Permission to collect (see Appendix l)
Selection of trees for collection, and collection standards (2, 4, 7, 8, 12)
Collection methods (2, 4, 7, 8, 12)
Extraction of seed from fruits (2, 4, 7, 8, 12)
Documentation (2, 4, 7, 8, 12)

Storage (2, 4, 7, 8, ll, 12)
Cleaning (2, 4, 5, 7, 8, 12)
Fumigation (2, 4, 7)
Moisture and temperature conditions for storage (2, 4, 7, 8, 12)
Germination testing (l, 2, 3, 4, 7)

Handling (2, 4, 6, 7, 8,)
Pretreatments to promote germination treatments for leguminous seeds (4, 7, l0)
stratification (2, 8)
Coating treatments for direct seeding (2, 7)

Yields of tree seed in relation to sowing requirements for direct seeding.

The size of the seed crop varies from year to year in many Australian tree species. For example, Eucalyptus camaldulensis (river red gum), E. grandis (flooded gum) and E. saligna (Sydney bluegum) usually bear heavy seed crops once every 2-3 years, while E. regnans (mountain ash) does so every 2-4 years. In the case of heavy seeding eucalypts such as Eucalyptus camaldulensis and E. globulus (Tasmanian blue gum), yields of 5-l0 kg per mature dominant tree can be obtained by nondestructive collecting in good seeding years. Corresponding figures for temperate zone acacias are 2 kg per tree (L.A.J. Thomson, personal communication l990). The yield figures from stands of closely spaced younger-aged eucalypts are much lower. Cremer et al. (1984) note that many such stands, harvested at age 30-80 years, may carry insufficient seed for their own natural regeneration. It should be noted that intensive collection, in which branches are cut off so that buds as well as mature fruit are removed, will depress seed yields from a tree for several subsequent years.

Some species never carry heavy crops, and the shortage of seed is likely to rule them out as choices for direct seeding, especially when, like Eucalyptus nitens (shining gum) and E. dunnii (Dunn's white gum), their seed is in heavy demand for plantation projects which can afford to pay a much higher price for seed.

It would not be good practice to take seed from all the trees in an area, unless the trees were being felled in the course of timber harvesting or land clearing. Where trees are being felled, it may be possible to time felling to coincide with a heavy seed crop, which could be of comparable value to the timber for certain species and provenances for which there is strong commercial demand.

The yield figures quoted above give some indication of the effort that will be needed to collect the amounts of seed needed for large scale direct seeding projects. Collections are best made during years of heavy flowering and seeding, because costs will be lower and the seed will tend to be of better genetic quality. Storage is necessary for use in subsequent years when further seed may be harder to obtain.

Code of practice for seed collection

As the demand for seed of Australian native plants increases, it is important that collectors follow sensible standards for collecting from natural stands. Problems caused by seed collectors could alienate land managers and landowners, making future access to important collecting areas more difficult. The current code of practice followed in seed collections for the Australian Tree Seed Centre is shown in Appendix l as a possible guide for other collectors.

The need for viability testing

There is of course tremendous variation between tree species in the number of viable seeds per unit weight of a seedlot, as illustrated by the following examples.

Eucalyptus camaldulensis (river red gum) mean 698,000/kg

E. globulus ssp. globulus (Tasmanian blugum) mean 78000/kg

Acacia stenophylla (river cooba) l2-25,000/kg

A. holosericea 95-175,000/kg
B.
Allocasuarina decaisneana (desert oak) about 85,000/kg

Casuarina cunninghamiana (river she-oak) about 1,800,000/kg

There is also great variability within a species, arising from genetic variation and differences arising from factors such as year-to-year variation in the physiological status of the trees, and timing of the collection in relation to seed crop maturity. As an example, the 73 provenances of Acacia mearnsii (black wattle) currently in store at the Australian Tree Seed Centre range from about 35,000 to 110,000 viable seeds per kilogram. In some cases there are regional differences in seed size within a species - for example Eucalyptus cloeziana (Gympie messmate) seeds from moist coastal forests average 100,000-400,000 seeds per kg whereas seeds from drier inland woodlands average only 35,00-65,000 seeds per kg (Langkamp 1987, p 53).

Viability tests should therefore be carried out on any batch of seed to be used in direct seeding, to establish the optimum sowing rate. Applying an average figure for the species in question is not sufficient and would lead to undersowing or waste of seed in many cases.

Viability and germination energy, and their maintenance in storage

Performance of a seedlot can be summarised in terms of its viability and germination energy. Viability can be defined as the percentage of seeds in a seedlot which germinate under the test conditions, or the number of seeds that germinate per unit weight of the seedlot. The latter measure is easier to determine for species such as eucalypts in which the seedlot is a mixture of seed and chaff which is difficult to separate. It is also more useful for calculating sowing rates. Germination energy is a measure of the rapidity of germination, and can be expressed as the percentage of the viable seeds in the sample which generate within a given time, or as the number of days required for (e.g.) 50 % of the viable seeds to germinate. A seedlot with higher germination energy is likely to be more valuable for direct seeding.

Seed for direct seeding projects will often need to be stored for more than a year, because of variations in seed crops referred to above. Fumigation to kill seed-eating insects is necessary. The Australian Tree Seed Centre fumigates by placing seedlots in an atmosphere of l00 % carbon dioxide for a minimum of 2 weeks.

It is of particular importance in direct seeding projects that seed germinate rapidly and early seedling growth is vigorous. As a seedlot ages, its viability and germination energy will decline, making it less suitable for use in direct seeding. Most eucalyptus, acacia and casuarina species can be stored at a low moisture content (less than about l0 %) at room temperature for several years (Boland et al. 1980; Doran et al. 1983; Turnbull and Martenz 1981), but viability declines to a low level after 10-15 years or so. Certain species such as Eucalyptus microtheca (coolabah) and Acacia harpophylla (brigalow) lose viability more quickly under normal conditions and should be stored at low temperature (Boland et al. 1980; Doran et al. 1983). In general, most orthodox seeds will retain their viability and vigour longer if stored at low moisture content (4-7 %) in moisture-proof containers at 3-5 °C or lower (e.g. -18 °C). The timing of collection can affect storage life: seed that is not fully ripe at the time of collection will have a lower initial viability and will not remain viable for as long.

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