

Professional Seed Collection

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Abstract

This paper deals with some activities of the commercial native plant seedsmen in Australia. Within the limitations of the allowed space, the more common methods of seed harvesting, collecting and cleaning of seeds are dealt with.

The selection of parent plants and need to collect from prescribed provenances, are discussed, as are methods of extraction and cleaning of seeds.

The need for records of stored seed and the statutory obligations and ethical responsibilities of those involved in the commercial seed industry are also discussed.

Introduction

Native plant seed has been collected and marketed in Australia since the early days of European settlement. Most Forest Departments have at some time sold seed to growers both within Australia and for export. The C.S.I.R.O. in Canberra have been leaders in this field in recent times.

There have also been a number of private companies, some with international connections, who have traded in native plant seed. While a few of the companies collect a portion of the seed they sell, most depend upon a network of amateur or semi-professional collectors throughout Australia.

In more recent times, as a result of demand for local seed and seed of special provenance, a number of small family companies have commenced collecting and marketing seed. In South Australia where only agents for large companies sold seed 10 years ago, there are now three small local companies operating.

Some of the small collecting firms collect mainly for the large national and international companies, while others rely upon sales to a local market.

Traditionally the two largest users of seed were nurserymen and forestry organisations, however, with the advent of a much wider interest in revegetation projects, many other groups are now seed buyers. These include mining companies, road builders, farmers, conservationist groups, to mention only a few. While most of the seed was being supplied to container growers the volume of seeds required was quite small. It has been the renewal of interest in direct seeding that has increased demand.

It is estimated in South Australia, one of the small seed using States, only about 50 kg of tree seeds per annum would be required to service the container grower industry, while a figure of around 500 kg of seed would be required each year to supply direct seeders. This figure is increasing steadily each year while the demand from nurserymen is nearly static.

It is intended in this paper to deal with collection of seeds, with special attention to seed quality, selection of parent plants, collecting methods, cleaning and storage, ethic and laws governing collecting.

Seed Harvesting

Selection of Mother Trees

Where possible it is desirable to collect from a large number of individuals that are remote enough from each other to reduce the chance of inbreeding. It has been suggested that 100 m between mother trees is desirable. Other authorities suggest twice the height of the plant as a suitable distance to avoid inbreeding. Experience both within Australia and overseas has shown that trees produced from a single specimen, or several closely related trees, show signs of stunting and poor survival after several generations.

Collectors need to select healthy, well-grown plants with a suitable form. In the case of seeds required for horticulture, flower colour and other special ornamental features need to be taken into consideration. Other special features will be important for re-vegetation projects such as salt and/or lime tolerance, drought resistant, tolerance of wet soils, wind resistance and special soil types.

Trees for forestry purposes would be selected for disease resistance, growth rate, and quality of timber, soil, rainfall and altitude.

Seed Viability

The most important factor in relation to collecting viable seed is ripeness. The period from flowering to ripening of seeds varies widely from a few weeks to many months. Even in our most import genus *Eucalyptus*, the time taken for seeds to ripen varies widely from species to species. Red Gum (*E. camaldulensis*) flowers between December and February and fruits ripen during a period between March and August. That is, about 3-6 months. Sugar Gum (*E. cladocalyx*) fruits take almost one year to ripen. Some species of *Eucalyptus* retain fruits from several years flowering and it becomes important to time collecting to avoid contamination of a seed batch with any young fruit which may be immature.

Trial batches should be collected to establish ripeness of seeds. The C.S.I.R.O. publication 'Eucalyptus Seeds' (Boland, Brooker, Turnbull and Kleing) is a valuable publication giving much information on *Eucalyptus* seeds including times for seed collecting.

Some genera, such as *Acacia*, *Grevillea* and *Cassia*, eject seeds as soon as they ripen. It is important to delay collecting until seeds are ripened, but before they drop. Seeds picked too green may not germinate. While collecting seeds that have dropped is sometimes practised, this can result in seeds that are contaminated with soil born pathogens.

Some trees rarely or never produce viable seeds. A simple rough field test is to dissect seeds to establish whether or not an embryo has developed. The presence of sibilings around a tree will also indicate that it bears viable seeds.

Seed viability can be seriously effected by insects before the seed is shed. Trees in the *Protea* family are particularly prone to this problem. In some Western Australian districts *Banksias* are so badly effected that collecting is not economically practical. Where insect attack is suspected it is wise to prise open fruit in the field before a large quantity is collected to ensure seeds are viable.

Other seeds, particularly those belonging to the genera *Acacia* are prone to weevil attack both in the pod and later during drying and storage. Little can be done to avoid attack in the pod, but treatment with an effective insecticide immediately after collecting can subsequently eliminate weevil damage. A few grains of PARADICHLOROBENZENE in the storage container is an effective insecticide.

Provenance

It is common for growers to nominate a specific seed provenance, especially when regeneration of a particular ecosystem is to be undertaken. It is important to establish the limits of the provenance before collecting begins. Some seed provenances are selected for the proven high performances of the resulting seedlings. Sometimes the location of these provenances may be very remote from the collector's base, or the amount of naturally occurring seed may be limited. In such cases it would be desirable to plant a seed orchard. However, many tree species take up to fifteen years to come into full production so that seed orchards are usually a long term project.

Economic factors such as land, establishment and maintenance costs need to be balanced against estimated returns. The establishment of orchards for the production of shrubs and annuals is now commonly practised among seed merchants. Tree seed orchards are more a function of forestry organisations.

Viability Testing

While Government-operated seed certification laboratories exist for the testing of agricultural and horticultural seeds to the author's knowledge, the only testing facilities for notice plant seeds are conducted by the C.S.I.R.O. in Canberra and their work is mainly limited to *Eucalyptus* species.

The germination of many native species is not just a matter of providing optimum temperature, air and water as it is with most agricultural seeds. Seed dormancy can be caused by many factors, many of which are not yet understood. It is for this reason and also because many batches of seeds collected are very small (less than 1 kg) that seed testing and certification is unlikely

to become common practice among native seed merchants for some time. The cost of testing would make seed prices unreasonably high.

Collecting Schedule

Many seed collectors would harvest several hundred batches of seeds each year and may regularly handle up to one thousand species or more. In most cases there is an optimum time for collecting but a margin of several weeks or even months will be allowable. Most members of the Myrtle family fall into this category. Other species including *Acacia* spp and *Grevillea* spp ripen and shed seeds within a few days during summer. There is to the author no knowledge of detailed documented information available that covers a wide range of seed ripening times for other than the genus *Eucalyptus*.

It is therefore necessary for each collector to build up records of collecting times over a period of years. From these records a monthly seed-collecting schedule can be drawn up. However, even the most detailed records will only give an indication when seeds are likely to ripen, as seasonal factors will vary ripening times.

Collecting Techniques

Tall Trees

Harvesting seeds from tall trees presents the most hazardous and laborious aspect of seed collecting. Falling limbs and even heavy fruit can cause serious injury and safety glasses and a hard hat should be worn.

Collecting of seeds from forest trees is most easily carried out during felling operations but as clearing of natural stands has become less common and even non-existent in South Australia, other methods have to be employed.

Where small batches of seeds are to be collected and where necessary permits can be obtained, a rifle with a telescopic site can be used. Selected branches can be removed by a competent marksman using a .308 calibre rifle firing soft nosed ammunition. For this method to be employed other than for research purposes, trees must be bearing heavily and the seeds harvested should be of high value. Branches can often be removed by climbing and using a bow saw or small chain saw.

For this to be economically viable it may be necessary to have a permit that covers removal of branches of say 10 cm in diameter. Twigs bearing fruit can be removed from the branches on the ground. The flexible saw, which is often just a chain saw blade with lengths of rope attached to each end, is also a useful tool for removing small branches.

An arrow with a fine line attached can be fired from a bow over branches and the saw rope is then drawn over. This is a two-man operation and can be dangerous as branches fall close to the operators.

While 'cherry pickers' have been used for removal of fruits from tall trees, these machines are expensive to operate and can rarely be justified for commercial collecting. Some useful batches of seed can be collected after a heavy windstorm when branches are broken. In addition some advantage can be gained by removing fruit from limbs where Council or State authorities have been pruning.

Medium Sized Trees

The most effective method of removing fruiting branches from medium size trees about 10m high is the use of long handled secateurs and a high (45m) three- legged fruit picking ladder. More height can be gained by using telescopic pole pruners, however, there is some risk and much hard work associated with using pole pruners on a ladder. Pole pruners can be used with more safety from the ground but pole lengths of more than 5m are difficult to handle.

Small Trees and Shrubs

In the case of species like some *acacia* spp that drop pods with seeds enclosed as soon as they ripen, collecting can be as simple as placing a drop sheet under the tree and beating the branches with a light pole to remove the pods. However, in most cases, fruiting branches are removed with long handled secateurs or ordinary secateurs. In some cases it is necessary, particularly those that flower over a long period, to remove fruit individually by hand. Also cones like those of *Banksia* would be removed individually. For such collecting a fruit pickers bag is useful.

Collectors Plant

Useful plant required for collecting would include the following:

4 wheel drive vehicle
Extension ladder
Fruit pickers ladder (4-5m)
Trailer with high wire mesh sides
Commando Saw (flexible saw)
Long handled secateurs
Fruit pickers bags
Secateurs
Bow Saw
Chain Saw
Drop sheets
Telescopic pole pruner
Vacuum cleaner & generator (for Chenopods etc)
Hard Hats
Safety Glasses
Gloves
Aluminium pole (fruit knocker)
Rifle

Seed Extraction

There are many and varied methods of seed extraction, too many to discuss in any detail here. However, the most common method involves drying fruit followed by tumbling or thrashing, winnowing and screening.

Drying

In cool humid climates it is common to use drying kilns. These, which can be expensive to operate, are usually large rotating drums with a dry heat source. Solar extractors are also used in cooler climates. These are usually a structure similar to a nursery glass frame. It is important that they are orientated east and west to capture maximum sun during the winter. More commonly much drying is carried out during warmer months when seed is sun dried in the open on drop sheets. Special attention needs to be taken to avoid loss of seed by mice, ants and birds. Also seed can be lost during a windstorm when drop sheets can be overturned.

Fire

Banksia and some other species need to be fired to extract seeds. Cones can be placed on a 40-50 mm screen over hot coals. When the valves begin to open the cones are immersed in water, then sun dried. The seeds will usually fall from the cone after this treatment. However excessive heat will damage or destroy seeds. Trial and error will be necessary to become proficient in the use of this treatment.

Water

Seeds can be extracted from fleshy fruits by mashing the flesh and washing it away from the seed with running water. *Acmena* and *Nitraria* are two of many genera that are handled in this way. With some kinds of fruit such as *Santalum* spp the flesh cannot be easily mashed, but by soaking the fruit for several days the flesh can be removed more readily after fermentation is well advanced.

Thrashing

Cassia, some *Acacia* and *Dodonaea* are among a group of plants which bear seeds that do not readily fall from the pod after drying. It will be necessary to vigorously rub such pods through a screen or alternatively where large batches of seed are to be processed, a mechanical thrasher can be employed. Care should be taken to ensure that seeds are not bruised or otherwise damaged during thrashing. Roughly treated seed can have a reduced germination rate and sometimes reduced longevity.

Seed Cleaning

As is the case with seed extraction the methods used to clean seed are many and viable and each collector will develop methods to suit his or her operation.

Screens

Screens, mechanical or hand, are the most important tools used for cleaning seeds. Screen sizes need to vary from as small as 150 micron to 40 mm and a range of aperture shapes from oblong to round and square are useful. To handle a wide range of seed it may be necessary to have 30 or more screens. Two screens are usually used together, one to retain oversize material and the other for the undersize material to pass through.

Winnower

The simplest method of winnowing is carried out using wind to remove light matter from seed. An effective cheap machine can be made using a vacuum cleaner for power. Seed can also be winnowed using an ordinary electric fan. Most commercial collectors will use a seed cleaning machine that will include a winnower as well as screens.

Specific Gravity Separator

A specific gravity separator is a variably inclined vibrating table with variable surface textures. It is used when screening and winnowing is not effective and when seed of high purity is required.

Water

Some batches of seed can be cleaned by floating dross off in water. It is important that seed is well dried after treatment.

Seed Storage

While little is known about longevity of many native tree seeds, it is well accepted that seeds should be stored in a cool dry environment. In most cases seed will remain viable for at least 5 years if well dried and stored in sealed containers at room temperature. Eucalyptus seeds have been known to stay viable for 20 years if stored at low temperature (3-5° c). It is however, good commercial practice to turn over seed within 5 years. It is doubtful if it is commercially viable or ethically should, to keep seeds in storage for more than a few years.

There are a few species that bear seeds with a very short life. These are often rainforest kinds such as *Acmena*. But also surprisingly some desert species also bear seeds of short life. In 'Plants of Western N.S.W.' (Cunningham, Mulham, Milthorpe and Leigh) it is reported that *Maireana pyramidata* seed remains viable for a few months only. There may be many other kinds of seed in this class.

Records

Comprehensive records are required for efficient operation of a commercial seed store. The following information about stored seed is the minimum:

Scientific name

Date collected

Origin

Height

Form

Special features

Number of seeds to given volume

Quantity in stock

Serial number

Collector's Name

Purchaser

Viability (if known)

Ethics

Seed Collectors bear a responsibility to ensure that the material they collect is true to label This is not as simple as it might appear. With the current rate of change of plant names it is difficult to be sure of the latest name. It is also uncertain that the buyer will know the latest name. It is certain that seed merchants cannot use all the synonyms in their price list as these are often too numerous. Some genera have been revised three times during the last 20 year. The dilemma is to use the latest nomenclature and to confuse the customer, or to use the old name and be accused of being unscientific and outdated. Perhaps the best course is to follow a few years behind name changes. Commercial seed collectors also bear a responsibility to ensure that seed they sell comes from plants that are selected for good form, health and genotype. Collectors need some background training to be able to meet these responsibilities effectively.

Because by far the largest amount of seed used in Australia is marketed through commercial companies, it might be reasonable to claim that the future physical and genetic health of our revegetation projects depends upon high ethical standards of seedsmen.

Statutory Responsibility of the Seed Collector

There seems to be some lack of understanding by legislators and bureaucrats about the importance of the seed industry to the re-vegetation of Australia. In addition authorities do not seem to be aware that responsible seed collecting has no negative effect upon the environment. It also does not seem to be fully appreciated that most seed used is collected and marketed by commercial operators and because the industry is labour intensive this is likely to be so in the future. This lack of understanding is partly because commercial collectors have not put their case to the appropriate authorities.

Each State has its own regulations. In South Australia regulations governing collecting on public and private land (even when the collector and the owner are the same person) are so draconian that in many cases by the time a permit was granted, seed would often have fallen. All the large collectors in this State collect without permits (illegally). These regulations cover Government bodies and amateur collectors too. The good news is that the author has been advised that new regulations will soon put forward to improve this situation. In other States the position of collectors varies. Collecting in National Parks is usually prohibited or strictly limited for commercial purposes. In all States other than South Australia, collecting on private land is a matter between collector and landholder. Collectors should approach their State Environment Department for information about permits and regulations governing seed collection.

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