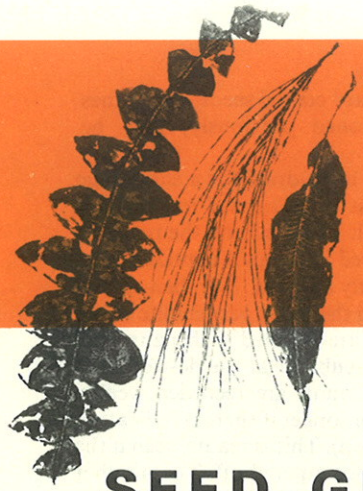

INFORMATION SHEET 19

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SEED GERMINATION AND TESTING

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The Forests Department, under its policy of management, protection and utilisation of the forest, is responsible for large-scale plantings of pines to ensure the anticipated future demands for timber, the reforestation of areas denuded by mining and dieback, the encouragement of tree planting by farmers and shires, and the supply of quality native tree seed much in demand both interstate and overseas. To achieve these objectives large quantities of selected seed are required.

The seed is harvested from seed orchards or plantations where breeding and selection has developed to a stage where the seed collected will produce a tree with the most desirable characteristics. Seeds from eucalypts and other native trees are harvested in their natural habitats from superior trees. The seed is extracted, given a serial number and stored until required. All seed collected or held in storage is subjected to regular tests to ensure that the seed is still able to germinate.

Sampling for germination

A germination test is a confident statement of the number of plants that will grow from a large bulk of seed, obtained by using a very small sample of the bulk. Care must be taken to be sure the sample is truly representative and this can be done in two ways.

(1) If the bulk is not large it can be placed on a clean level surface and divided into quarters. Two diagonal quarters are removed and quartered again. The same procedure is followed until the required sample size is obtained.

(2) When the bulk is large, random samples are taken by using a special sampling tool. Each sample being taken at varying depths within the bulk.

The final requirement is six samples of 100 seeds each.

Eucalypt seed contains a large number of unfertilised ovules referred to as chaff. With some eucalypt species chaff and seed are inseparable, making the counting of seed impossible. To overcome this difficulty a squash test is used.

The eucalypt seed plus chaff is sampled as mentioned previously to give six samples each of which it is estimated will contain in the vicinity of 25 seeds, and the weight of each sample recorded. All material in each sample is then squashed by a spatula or other suitable object, under a microscope or powerful magnifying glass, and each particle which contains oil is counted as seed, the rest is chaff. By dividing the number of seed into the weight of the samples a reliable estimate of weight for one seed is obtained. This can be multiplied by whatever number of seeds is required per test. Instead of counting 100 seeds it is then known that a certain weight will give 100 seeds.

Aids in germination

Nature has given to some seeds from harsh climates a protection against the natural environment. In Australia this protection can be in the form of a hard coat which requires the heat of a bushfire to crack the outer skin before moisture can penetrate. Again the seed can be enclosed in a woody fruit or shell which is encouraged to open under extremes of heat. After a bushfire has passed the fruit opens, depositing the seed on the clean ashbed which provides an ideal seed bed. In a cold climate freezing and thawing can produce the same effect. The passing of seed through the digestive system of animals and birds can also assist germination, the hard shell being softened by the stomach juices. It is therefore understandable that when seeds are germinated artificially some help is needed to allow moisture to penetrate the testa (outer shell) and to hasten germination.

To know what pre-treatment should be given the natural habitat of the tree should be known and the hardness of the testa examined. Most cold climate seeds are assisted by stratification. This means the storing of seed which has been soaked for 24 hours or longer, at about 5°C, under moist conditions, for a period of four to six weeks. Hard shelled seeds can be cracked, filed, chipped, treated with acid, or have boiling water poured over them. Soft seeds from tropical or temperate climates generally do not require pre-treatment, but should be sown as soon as collected. This applies particularly to winged or plumed seeds.

Seed testing

When a genus or species which has not been tested before requires germination tests, the following procedure is adopted. The seed is given pre-treatments which may help in germination, and is then germinated at a range of temperatures. An untreated sample is also used for comparative purposes. Results are analysed and the best treatment recorded and used in further tests. When this test is being done the number of seed in each sample can be reduced to a minimum of 25, to save seed and to stop the test from being too cumbersome.

Equipment

The essential requirements for germination are moisture, warmth, oxygen and eventually light. The last is not necessary (except in rare cases) in germination testing as counts are done when the radicle (root) is the length of the shortest axis. Light is necessary for the development of chlorophyll (the green colouring of plants) contained in the above ground section of a plant, which develops after the radicle.

The following equipment is necessary for germination testing.

Germination cabinets. These are of similar design to a refrigerator and are fitted with heating and cooling controls which can be adjusted to maintain a constant temperature. The main temperatures used in testing are 15°, 20°, 25°, 30°C.

Petri dishes are clear plastic circular dishes complete with loose fitting lids, approximately 9 cm in diameter and 13 mm deep. Two notches 3 mm deep are filed in the bottom dish to allow air circulation as sometimes moisture may seal the two together.

Vermiculite is a sterile, neutral, moisture holding medium, placed in the bottom of the petri dish to maintain an even moisture, the depth depends largely on seed size but is not more than 6 mm.

Filter paper. A fine, absorbent, sterile paper which is placed over the vermiculite to facilitate counting.

Fungicide. Used for dusting the seed to prevent fungal contamination. It can be applied as a wash or by dry dusting at not more than 5 per cent of seed weight.

Water bottle. Used for maintaining moisture requirements. Seed must not stand in water nor must it be allowed to dry out.

Method

Depending on the seed to be tested it may have any or all of the following four pre-treatments.

1. Overnight soak. Used for soft coated seeds which require no mechanical assistance.
2. 24 hour soak. Used for larger, slightly harder coated seeds which require no mechanical assistance.
3. Stratification. Mainly for cold climate species.
4. Boiling water. Used for hard coated seeds, sometimes chipping etc. (as mentioned previously) may be necessary.

After treatment, the seed is air dried for a short time to allow fungicide treatment to be carried out and for even distribution of the seed. The seed and the required amount of fungicide is placed in a small container and shaken until the seed is lightly covered. It is then spread over the filter paper covering the moist vermiculite in the petri dish. The six samples are labelled with name and number and placed in the incubator at the desired temperature or temperatures. Counts are recorded weekly for a period of one month (or longer if there is indication of the germination carrying on). This is readily seen if the number of germinants has not tapered off. The number of germinants per replicate is then totalled and statistically analysed.

Data extraction

The International Seed Testing Association has compiled a set of rules governing the requirements for the international exchange of seed. To obtain the necessary information the following data is extracted from a test.

1. *Weight per 1000 viable seeds.* This is obtained by dividing the total weight of seed (or seed and chaff with eucalypts) in a trial by the total number of germinants and multiplying by 1 000.
2. *The germinative capacity* is the total number of germinants over a fixed period of time, usually one month.
3. *Germinative energy* refers to the strength of the seed and is equal to the germination at 14 days over the total germination at 28 days by 100.
4. *Seed purity* is the weight of sound seed in the total weight of material by 100.