INTRODUCTION TO TREE SEED PROPAGATION

1. Introduction to tree seed and tree seedling propagation

Tree seed propagation involves careful management of germination conditions and facilities and a knowledge of the requirements of individual types of seeds.

Seed must be viable and capable of germination . It should germinate rapidly and grow vigorously.

Dormancy is a process which inhibits germination, must be overcome by applying any necessary pre-germination treatments. The propagator should know the specific requirements of the tree seed being grown.

With good-quality tree seed that is genetically pure, capable of high germination, free from disease and insects, success will depend on providing the proper environment. The optimal moisture, temperature, light level required by the type of tree seedling will assure good growth assuming diseases and insects are controlled.

a. What is a seed ?

A seed is defined as a fertilized, mature plant ovule containing an embryo that can form a new plant.

An ovule is a small body in the ovary which contains the female gamete.

b. Parts of the seed: The seed has three primary parts

1. Embryo: the young plant contained in the seed having growing points for root, shoot, and leaves.

2. Food storage tissues is located in the cotyledons (leaves) for non-endosperm seeds such as *A. koa* and eucalyptus species;

For endospermatic seeds the storage material occurs in the endosperm in some species such as (*Fraxinis*) tropical ash.

For the gymnosperms (pines), the storage material is in the haploid female gametophyte

3. Seed covering (testa) Varies widely by seed type.

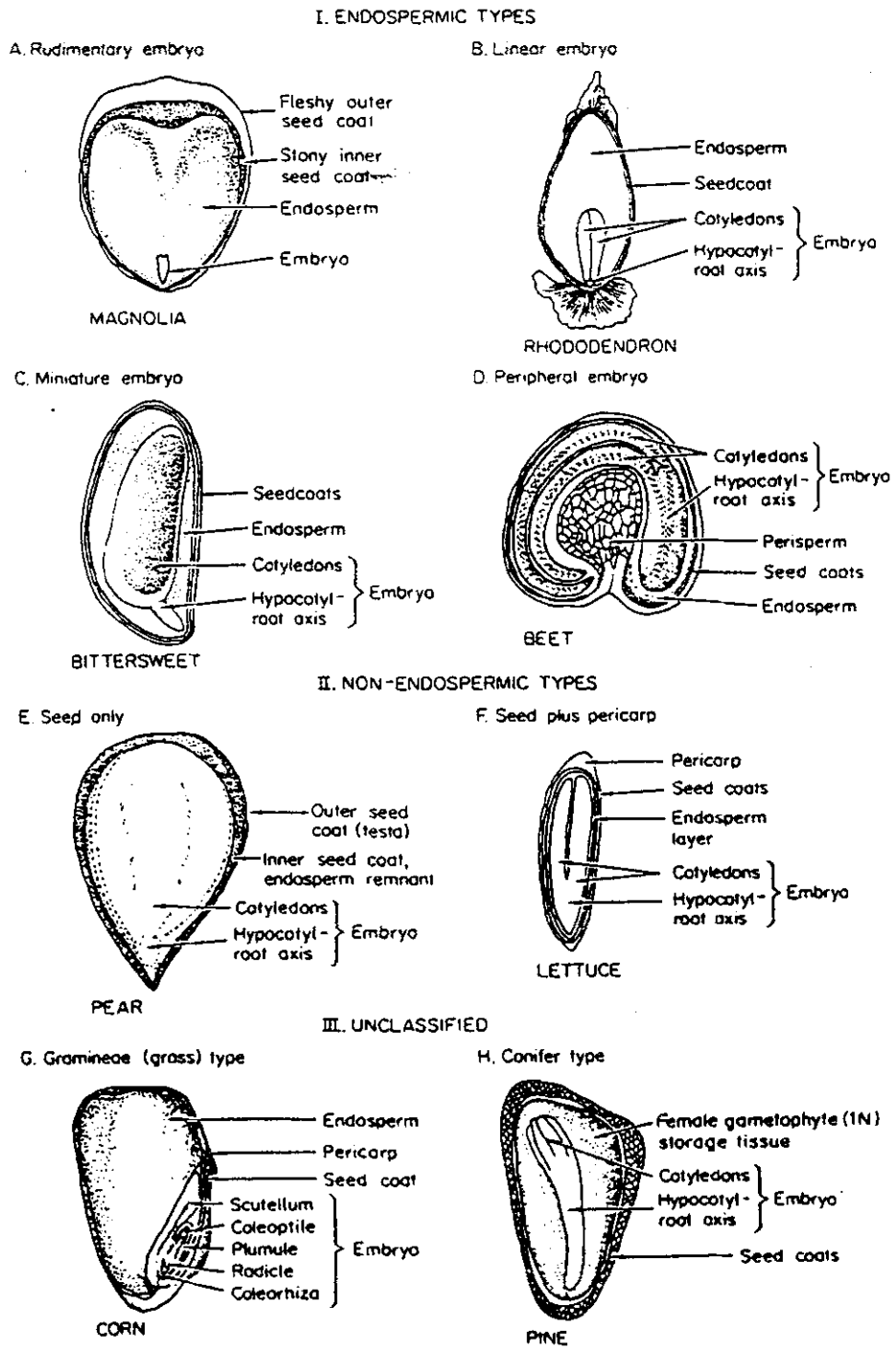

Figure 3–8 Morphological types of seeds as described in text. *Rhododendron* and *Celastris* Redrawn from (*46*).

What is a tree?

Tree are woody perennial plants which continue to increase in size each year by growth of the shoot and root tips or by lateral cambium growth, or both.

b: Classification

Example: taxonomy

KINGDOM:	*PLANTE*	*PLANTE*
DIVISION:	*SPERMATOPHYTA*	*SPERMATOPHYTA*
SUBDIVISION:	*ANGIOSPERMAE*	*ANGIOSPERMAE*
CLASS:	*DICOTYLEDONES*	*DICOTYLEDONES*
ORDER:	*MYRTIFLORAE*	*ROSALES*
FAMILY:	*MYRTACEAE*	*LEGUMINOSAE*
GENUS:	*EUCALYPTUS*	*ACACIA*
SPECIES:	*GRANDIS*	*KOA*

Species tend to be relatively uniform phenotically

2. Seed Propagation

a. Advantages

1. A primary method for raising large number of plants, because large amounts of seed are easily obtained.
2. Seed is generally a low cost method of plant production.
3. There is far less risk of virus transmission from one generation to next with seed propagation.
4. Rate of growth and ability to establish following transplanting is often faster with seed then vegetativly propagated trees.
5. Seed can be stored for lang periods under proper conditions.

b. Disadvantages

1. Difficulties in germination are oftendue to a lack of viability and seed dormancy problems.
2. Seed crops can be unreliable and result in inadequate seed quantities.
3. Genetic variation can be so extreme that a high percentage of the seedlings are of low quality.
4. Many tree species have special processing requirements.

3. Sources of Seed

Seed of high quality and known sources are vital to the successful of a forest nursery.

a. Wild collected / Produced sources

1. Seed from individually good trees (phenotypes)

The very best individuals from natural stands are well adapted to the areas where they are growing. Improved adaptability alone usually makes collection from individual trees worthwhile.

2. Seed from good stands / Naturalized populations

The method of collecting from plus stands is a worthwhile practice to follow when the individual tree methods cannot be used. , but will yield seedlots with higher degree of relatedness than seedlots collected from individual trees growing in many different stands.

3. Seed production areas

The poor trees are rouged and the good trees are left. This will generally yield growth improvements. Seed production areas are generally used as interim sources of seed and are phased out as better materials comes on line from seed orchards.

4. Seed from proven sources

One of the most common methods of obtaining large quantities of seed quickly is to collect from to the original source or provenance that has been tested earlier and has proven to be suitable for planting. Documentation is important as well as reliable collectors.

5. Seed orchards

The standard method of producing genetically improved seed in operational quantities is to use the seed orchard approach. A seed orchard is an area where seed are mass produced to obtain the greatest genetic gain as quickly and inexpensively as possible.

a. Seeding seed orchard

These are generally seed production plantations with known family identity that are managed for maximum seed production. They consist of a population of open (naturally) pollinated families of selected trees. Often they are "first -generation " orchards that are the result of species and provenance trials.

b. Vegetative seed orchards

These orchards are established from clones, cutting, grafts or other asexual methods such as micropropagation. These are generally advanced generation and the most common operational type for large scale seed production.

b. Purchased seed

Caution is the watch word. There are many unscrupulous seed dealers.

2. Chemical dormancy : Natural chemicals in the seed that act as seed germination inhibitors and must be leached for germination to begin

Example: citrus ,palms

3. Physiological dormancy: Several categories include seeds in which dormancy is internally controlled within the living tissues of the seeds. The first is the control exerted by the permiability of seed covering. The second is the dormancy present within the embryo that is overcome by exposure to light, (photodormancy) or moist-chilling. (temperature sensitive)

Example: Fall ripened temperate zone trees that must overwinter (Stratification)

c) Environmental factors: water, temperature, light.

1.Water: Water uptake (imbibition) and water content have a significant effect on germination.

Seed priming: This process involves procedures that initiate germination by imbibition prior to planting

Seed soaking: Certain tree species benefit from water soaking before planting to speed up germination and to overcome certain dormancy conditions.

2. Temperature is the most important environmental factor that regulates germination and controls seedling growth.

Germination rate is usually low at low temperature, but increases as temperatures rise. Above an optimal level , there is a rapid and steep decline.

Germination percentage remains relativily constant over a range of temperatures

Minimum: The lowest temperature for effective germination

Maximum: The highest temperature for effective germination

Optimum: The ideal temperature where the largest percentage of seedlings are produced at the highest rate. The optimum germination temperature is usually between 77 ° to 86 ° F.

3. Light.

Relatively high intensity of light is desirable to produce sturdy, vigorous tree seedlings.

Low light intensity results in etiolation and reduced growth and poor seedling survival.

4. Storage of seed

In general, seed with thin seed coats tend to lose their viability quickly. In contrast, hard seed can be stored for many years.

Examples: :Norfolk island pine(thin)
Acacia koa (hard)

a. Temperature

Lowering the temperature is essential for successful storage. The optimal temperate range is between 30-41°F

b. Moisture

The moisture content for storage normally should be in the range of 5 - 14 %. There is the exception of nutty seeds (Mac nuts). They should be stored at the moisture content present at collection.

c. Humidity

The relative humidity of the air must remain low during storage. The air absorbs water as the temperature increases, and increased humidity levels encourage the seeds to absorb moisture.

D. Eucalyptus generally retain much of their germination capacity for at least 10 years. When stored in a controlled environment can remain viable for 20 or more years. This is because most eucalyptus species have a water-impervious seed coat.

5. Seed germination process

a) Germination is the first process of seedling development. Germination begins with imbibition (uptake) of water and ends with the emergence of the first true leaves.

b) Seed viability (quality) is a term used to denote the proportion of live seed at a point in time.

1.Germination percentage (amount) and rate (fast / slow)

2 Seedling vigor(strength, robustness, vital force)

c) Types of dormancy (state of inactivity)

1. Physical dormancy: Ocurrs when the seed coats are hardened and impermeable to water.

Example *Acaia koa*

High light intensity can also negatively affect growth.

Shading is desirable for many species of trees during the early stages of seedling growth.

Combining optimal light intensity, optimal temperature, high humidity, and supplementary fertilizers is a formula for maximum tree seedling growth.