Plant Propagation Lab Exercise Module 2

PROPAGATION OF PLANTS FROM SEED SEED COLLECTION, CLEANING, GRADING AND STORAGE
An introduction to plant propagation laboratory exercises by:
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In this lab students will be introduced to procedures for collection, cleaning, grading and storing seed.

The objectives of this lab are to: Review criteria for determining what a mature fruit looks like on an unfamiliar plant species Review steps for collection of ripe fruits Describe processes for cleaning seeds Demonstrate how to determine storage potential and describe steps for placing seeds in storage

The first class of seed types are **Dry fruits that do not dehisce at maturity** such as beans, corn, grains & nuts are thrashed or tumbled to separate or remove unwanted parts of the fruit. For eans, corn, grains (and some composites with achenes) thrashing is used to separate the seed. Nut crops often do not separate from outer coatings and outer hulls may need to be removed – Floatation in water often used to separate viable and nonviable seeds. Nonviable seeds will usually float.

Next we have Dry Fruits that dehisce at maturity. Examples are follicles, pods, capsules & siliques Often these fruits are harvested prior to full maturity. Generally inflorescences (fruits) or whole plants are harvested and dried. To extract the seed, dried fruits thrashed, flailed, or rolled and seed separated from chaff and fruit parts. Seed cleaning (conditioning) methods are usually used to further clean the seeds from debris.

Another type of Dry fruits that dehisce at maturity –are conifer cones Handled similarly to dry dehiscent fruits Cones are dried which assists opening and dispersal of seed Cones may be tumbled to dislodge seeds Seeds are collected and dewinged Seeds are further cleaned (conditioned)

Plants with fleshy fruits –are handled quite differently. These are Berries, pomes and drupes Small lots -cut fruit and scoop out seeds, collect in tubs, rub through screens or wash with high pressure water streams in wire baskets (mixer or blender) Larger lots – separate by maceration, fermentation, mechanical means or washing through screens. Maceration – crushes fruit and mixes it with water Fermentation – macerated fruit sometimes benefit from a fermentation step. Chemical treatment – acid treatments or pectinase Floatation -heavier good seeds sink while pulp and underdeveloped seed float.

Here we will discuss how to collect fruits containing seeds of an unfamiliar plant for use in seed propagation. This case study describes a process used to develop seed production protocols for *Crocanthemum arenicola*, common name coastal sandfrostweed (1A). Wild collected plants were grown in gallon containers in a greenhouse and the presence of flowers with pistils confirmed (1B) these flowers will produce the fruits (1C) which are capsules. The dry, brown capsule below the red arrow is ready for collection. Compare the mature brown capsule to the adjacent immature green fruit below the thin black arrow. When plants were gently shaken these dry capsules fell off and this was used as a test of maturity and was the field technique used for harvesting fruits in the field. Fruits were then air dried as is shown in Figure 2. Fruits were then covered with a thick paper plate and hand pressure used to rub and crush fruits creating a mix of dark brown seed aggregates within light brown fruiting tissue.

Seeds are air separated from the dry capsule tissues. The heavier seed remain in the paper plate and the capsules are carried out of the plate in the wind stream.

When seed are in the capsule they are aggregated into a single unit, these aggregates separate with minimal pressure. What remains in the plate during air separation is the aggregate of seeds and individual seeds.

Once seeds are clean of unwanted debris, they may be further graded to remove abnormal seeds. Abnormal seeds are defined as seeds which are discolored or deformed. Here we see seeds of *Crocanthemum arenicola* with normal seeds on the top and abnormal seeds on the bottom. Normal seeds are full, dark in color and appear larger than abnormal seeds.

Seed grading is an important step in the seed cleaning process. These images represent seeds of Chrysopsis, a member of the Asteraceae. Class 1 seed (normal seeds) are on the left and class 2 seed (abnormal seeds) on the right. The two classes were defined by researchers working on this species. Normal seeds (class 1) were full with a consistent shape, color, and size and were intact with no signs of herbivory. Abnormal seeds (class 2) had irregular shapes, were either dark or light in color, under-sized or had signs of herbivory. Germination tests conducted on these two classes of seeds confirmed the abnormal seeds were not viable or resulted in failed germination.

In this slide you see 6 examples of seeds from *Lupinus difussus*. Grading of these seeds is more difficult and requires a period of training and the use of clear descriptions to assist the grader in understanding the different grades. In some instances, technicians in seed laboratories may use photographs and descriptions to aid is seed grading. Without any guidance – can you identify the normal and abnormal seeds in this image?

In this slide you see 6 examples of seeds from *Lupinus difussus*. Yellow arrows identify Hyphae of a fungus on the outside of the seeds. Irregular shapes, undersized, or with cracks in the seed coat.

Physalis angustifolia Ground Cherry Solanaceae Which of the following seed or seeds appears abnormal?
The abnormal seed is identified by the arrow and is characterized by a sunken seed coat. This suggests an empty, non-viable seed. The plump seeds with the darker color are normal seed and should also be viable.

Review of Seed processing steps:

1 Identify the plant species to understand the type of fruit/seed it will produce and potential time of harvest
2 Collect fruits based on fruit type (dry/fleshy and dehiscence)
3 Determine what is fruit tissue and what is seed
4 Remove fruit tissue
5 Process (clean) seeds
6 Grade seeds
7 Review literature to understand storage potential and drying sensitivity or requirements.

Seeds can be separated as recalcitrant or orthodox based on their genetic potential to tolerate storage

Recalcitrant seed

Do not tolerate significant drying after seed development.
Most recalcitrant seeds begin to loose viability at seed moistures below 25%

Orthodox seed

Do tolerate drying after seed development and can be stored in a dry state (4 to 10% moisture) for extended periods of time.
Seed longevity will be considerably longer under controlled low temperature and humidity storage.

A relative storability Index indicates the storage time where 50% or more of the seeds can be expected to germinate under ambient storage conditions.

Seed storage

Recalcitrant seed Do not tolerate significant drying after seed development. Most recalcitrant seeds begin to lose viability at seed moistures below 25%

Orthodox seed Do tolerate drying after seed development and can be stored in a dry state (4 to 10% moisture) for extended periods of time. Seed longevity will be considerably longer under controlled low temperature and humidity storage.

Species of each seed type Recalcitrant seed avocado, cacao, coconut, jackfruit, lychee, mango, rubber, tea

Orthodox seed *Citrus aurantifolia*, *Capsicum annum*, *Hamelia patens, Lantana camera*, guava (*Psidium guajava*), Cashew (*Anacardium occidentale*) and most grains and legume types

Lab exercise: Locate a plant from a garden or natural area and determine the type of fruit it produces. Collect fruit or harvest inflorescences as appropriate for the species. Separate seeds from fruit using the most appropriate method. Process (clean) seeds Grade seeds as normal and **abnormal (photograph examples of each) Count normal and abnormal seeds**

Lab Report Provide a descriptive summary report with supporting photographs of your subject plant and fruits. Include a description of your steps for collection, separation, cleaning and grading and include supporting photographs. Your descriptive report should conclude with an assessment of your choices for achieving each step and it should indicate the number of seeds in your abnormal and normal seed lots. Retain both lots of seeds and bring them to your next lab for use in Seed Testing experiments.