Seed Propagation of Woody Ornamentals

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For many years seed propagation was the principal method of producing new plants of many woody ornamentals. It was the least expensive means of propagation to produce a large number of new plants from a minimum of stock material. Seed propagation is still used frequently to grow many plants which cannot be propagated asexually. The main disadvantages of seed or sexual propagation are failure to produce plants true to variety and the longer time required to produce a salable plant.

When propagating woody ornamentals from seed, it is important to collect fruit as soon as ripe and before seeds have been dispersed. Seed of some plants will germinate readily if harvested immediately after fruit ripens, but if harvested after seeds have dried on the tree, pretreatments may be necessary.

Signs of Maturity Vary

There are no set rules to determine when seeds of selected species are mature and ready for collection. Changes in physical appearance of fruits such as size, shape, weight and color can serve as visual guides to seed maturation. As an example, fruits of southern magnolia are a brilliant red when mature and fruits of most junipers change to a deep blue at maturity.

Viable seeds of many ornamentals fail to germinate immediately when placed under conditions considered optimum for germination. Such seeds are said to be dormant. However, dormancy is relative because conditions restricting germination vary widely by species.

Dormancy is normally the result of the interaction of environmental conditions and hereditary properties of plants. Under various conditions, either the hereditary properties or environmental conditions can predominate and prevent germination.

Many woody ornamental plants grown in Florida produce seed that exhibit no dormancy and will germinate readily as soon as fruit are mature and harvested. However, viability of many seed is often very short, sometimes only 3 to 10 days. This situation is especially true for seed coming from pulpy or fleshy fruit. Such seed should be planted immediately after harvest because they lose their viability if stored.

Handling Seed from Fleshy Fruits

Fleshy fruits include most palm species, southern magnolia, ardisia, podocarpus, ochrosia sea grape and carissa. When storage cannot be avoided, seeds should be separated from pulp as soon after collection as possible to avoid damaging fermentation. Seeds of species with thin flesh, such as magnolia, can be air-dried and planted with seed coats intact. After an initial cleaning or washing such fruits should be spread out in thin layers and dried in the sun or a warm room. An occasional stirring is helpful.

Flesh from fruits of palms, sea grape and carissa can be removed by hand or by any of several macerating machines. Residue and seeds may then be separated effectively by flotation in water. Empty or nonviable seed, pulp and other debris will either float or sink more slowly than sound, viable seeds. This can be accomplished by putting macerated material in a slightly tilted container.

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Direct a stream of water from a hose at an angle to create a rotary swirl and lifting effect. Debris will float to the surface and spill over the edge of the container as the water overflows. Slight stirring of material in the bottom of the container is required.

Similar floatation methods are used to separate poor from good seeds that have no flesh such as oaks (Quercus spp.)

After separation, wet seeds should be surface dried or fully dried in the sun or indoors if they are to be stored. A sieve can be used for final cleaning to screen or blow away remaining debris.

Seeds from dry fruits such as redbud, pines and junipers require only cleaning before planting or storage. Cleaning is simply separation of dry seeds from pods, capsules, or cones, and removal of wings and other appendages.

Whether seed are planted immediately after harvest or stored, they should not be treated harshly because they are live plant material. Handle bags or containers of fruits and seeds gently and avoid rough cleaning procedures. Leave seed to dry in heated air only the minimum length of time. Use the lowest possible air temperature to accomplish this job because excessive heat can injure seeds and reduce viability.

Factors Influencing Storage

Many factors influence longevity of seed in storage including type of seed, stage of maturity, viability and maturity, viability and moisture content when stored and air temperature. However, a few generalizations can be made about storage.

1) Fully-ripened seeds remain viable longer than seeds collected when immature.

2) Seeds with hard impermeable seed coats store better than those with fleshy coverings.

3) Fluctuations in temperature and moisture are less favorable than constant conditions.

Recommended storage temperature and moisture requirements vary for seeds of woody ornamentals. A rule of thumb applied to agriculture seeds states that conditions for long-term storage are good if the sum of degrees F and percent of relative humidity equals 100 or less. This should serve as a rule for storing tree and shrub seeds.

At the National Seed Storage Laboratory, seeds of many different plants are stored in airtight containers at 40° F or 5° C and 32 percent relative humidity. Oak (Quercus) seeds have remained viable for 2 1/2 years stored in polyethylene bags at 5° C. Seeds can be stored satisfactorily in metal cans, plastic bags, and paper or aluminum-foil lined envelopes.

A few plants grown from seed by nurserymen in Florida are dormant because of a hard seed coat. Seed coats may be impermeable to water, air or both. Seeds which have hard and impermeable seed coats include Jerusalem-thorn (Parkinsonia aculeata), redbud (Cercis canadensis), sweet acacia (Acacia farnesiana), Poinciana spp. and other legumes. The usual method of overcoming this is by mechanical or acid scarification and soaking in hot water. Scarification is any process to break, scratch or alter the seed coat and make it permeable to water and air.

MECHANICAL SCARIFICATION

Mechanical scarification is accomplished by tumbling seeds in containers lined with sandpaper or other abrasive materials or seeds can be mixed with coarse sand or gravel in a revolving container. Small lots of seed can be scarified by rolling them on a cement floor using a brick or board.

To determine if seeds are properly scarified, a test lot can be germinated. The seeds may be soaked to observe swelling or the seed coats may be examined with a hand lens. Seed coats generally should be dull but not deeply pitted or cracked enough to expose the inner parts of the seed. Scarified seed will not store as well as comparable nonscarified seed and should be germinated as soon as possible.

Chief advantages of mechanical scarification are as follows:

1) It requires no temperature controls.
2) It involves no safety hazards to workmen.
3) Seeds remain dry and can be planted immediately.

Disadvantages are as follows:

1) Special equipment may be necessary.
2) Seeds must be free of pulp flesh.
3) Damage from overtreatment is extremely possible.
4) Seeds mechanically scarified do not store as well as those scarified with acid or water.

**SOAKING SEEDS IN WATER**

Soaking seeds in water may overcome seed coat dormancy and stimulate germination in some cases. Impermeable seed coats can be softened by dropping seeds into 4 to 5 times their volume of hot water (80-100° C or 190-210° F). Heat should be removed immediately and seeds allowed to soak in the gradually cooling water for 12 to 24 hours. Unsown seeds can be retreated or subjected to some other method of treatment. Seeds should be planted immediately after the hot water treatment. Boiling seeds or over-exposure to high temperatures is likely to result in injury.

**ACID SCARIFICATION**

One of the most common methods of pretreating seeds with hard and impermeable seed coats is to soak them in concentrated sulfuric acid. This treatment is highly effective with many species.

Special materials and equipment required include: (1) concentrated sulfuric acid to cover the seeds, commercial grade- 95 percent pure; (2) acid-resistant containers of thick plastic or glass are preferred; (3) wire containers and screens for handling, draining and washing the seeds; (4) a supply of running water; (5) a safe place to drain away the dilute acid after rinsing the seeds; and (6) facilities for drying the seed if they are to be stored.

**Steps in Acid Treatment**

Steps in acid treatment are as follows:

1) Allow seeds to come to air or room temperature, especially if they have been in cold storage.

2) Thoroughly mix seeds to be treated as one lot.

3) Determine the optimum period for immersion in the acid. Time of treatment may vary from as little as 10 minutes for some species to as much as 6 hours for other species. Time can be determined on small lots of seeds in preliminary tests by removing samples at set intervals and visually checking thickness of seed coats. When coats become paper thin, treatment should be terminated immediately.

4) Immerse dry seeds in acid for the required period, making sure that all are covered. Usually one part seed to two parts of acid will be adequate. Seed should be GENTLY stirred during the immersion period. Treatment should be carried out at 18-27° C or 65-80° F. If temperatures are lower the seeds must be soaked longer; if higher they must be soaked less time.

5) Remove seeds from the acid and wash promptly and thoroughly over a wire screen in cool, running water for 5 to 10 minutes to remove acid residue. Apply plenty of water at the start and stir carefully during rinsing.

6) Seed can be planted immediately while wet.

**Precautions to Follow in Using Acid**

**PRECAUTIONS** to take in use of acid are as follows:

1) Concentrated sulfuric acid is very caustic to skin and to clothing and should be handled with great care.

2) Never pour water into concentrated sulfuric acid. It will react violently by heating, boiling and splattering.

Several advantages of the acid treatment over mechanical scarification are:

1) It is effective for many species.
2) It requires little special equipment.
3) Cost is reasonable. Acid can be reused.

There are also disadvantages. They are:

1) Length of treatment must be carefully determined.
2) Temperature must be controlled.
3) Workmen face a safety hazard.

**COLD STRATIFICATION**

Seeds of many other species of woody ornamentals such as holly (Ilex spp.), southern magnolia (Magnolia grandiflora), nandina (Nandina domestica), and sweet gum (Liquidambar styraciflua) have embryos or endosperms that are nonfunctional, or contain inhibitors at the time of seed maturity, and require a period of cold stratification. Cold stratification is the subject of moist
seeds to low temperatures for a specified length of time before germination.

Steps in cold stratification are:

1) Soak seeds overnight or from 12 to 24 hours in water at room temperature immediately prior to stratification.

2) Moist seeds are then mixed with the moistened but sterile medium. Suitable media include well-washed sand, peat moss, shredded sphagnum and vermiculite. The medium must retain moisture. Seed should be mixed with 1 to 3 times their volume of the medium or placed in layers 1/2 to 3 inches thick alternating with equally thick layers of the stratification medium. Layers of cheesecloth may be used to separate the seeds and the medium. This eliminates the need for cleaning resulting from mixing of the seed and medium. Suitable containers for stratification are flats, trays, boxes or cans which provide aeration, prevent drying and allow drainage. Polyethylene bags no more than 0.004 inch thick have also been used successfully. During stratification seeds should be examined periodically; if dry, the medium should be remoistened.

3) Place seeds in refrigerated storage. The recommended temperature is between 3-5°C or 37-40°F. For most species of seeds, the required period of low temperature is 3-4 months, but some species such as southern magnolia may require 5-6 months.

4) Seeds should be planted immediately after removal from refrigeration or they may return to a dormant state, and require additional low temperature as well as losing viability.

**COMBINATIONS OF PREGERMINATION TREATMENTS**

The purpose of combining two or more treatments is to overcome double dormancy which may result from a combination of hard seed coats, immature embryos or other factors. The combination of scarification with cold stratification is effective for many of these seeds. Also, a combination of warm and cold stratification is another suitable treatment.

The procedure to prepare seeds for warm stratification is essentially the same as for cold stratification. Planting seeds directly in a greenhouse for the desired time will suffice for the warm period. Periods of cold temperature must follow the warm temperature.

**ENVIRONMENT FOR GERMINATION**

Media used for germinating seed must have a high waterholding capacity, good drainage and good aeration. A mixture of peat moss and builder's sand in a 1:1 volume is used by many Florida nurserymen. Various other materials such as shredded sphagnum moss, vermiculite and perlite have also been used successfully in germination mixtures.

Regardless of the media that is used for germination, it should be sterile to prevent loss of seedlings by disease. A common disease problem with seedlings is damping-off, which eventually can cause death of the new plant. Damping-off is caused by certain fungi, primarily species of *Pythium* and *Rhizoctonia*. Control involves three separate procedures: (a) elimination of the organisms during propagation; (b) control of environmental conditions during propagation; and (c) keeping the propagation area sanitized at all times. Excellent control can be obtained by using sterile media, treating seeds and following good sanitation practices. Five percent solutions of commercial bleaching preparations have been used satisfactorily to treat seeds.

**Structures for Planting**

Seeds may be planted in flats, pots, greenhouse benches and similar structures. It is desirable to cover germination facilities with moisture proof plastic, glass or other material to prevent water loss from the medium and surrounding air. Plastic coverings are most desirable because they maintain high humidity without restricting movement of air or oxygen.

Optimum temperatures for germination of seeds of woody ornamentals grown in Florida is 24-35°C, or 75-95°F. Variation of 5°C between night and day temperatures often stimulates germination of many species, compared to a constant temperature. The lower temperature should be given during the dark period.

Another critical problem in seed germination is depth of planting. Generally, seed should not be planted deeper than 1 to 2 times their diameter. Very fine or small seeds should be scattered over the surface of the medium or planted thickly in rows. For small seed this means dusting them onto the medium surface without covering, or covering with a very thin layer of shredded sphagnum.

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moss. Larger seed should be planted less than their
diameter in depth since 2 to 3 inch planting depth is the
maximum for any species. Seeds such as the coconut are
an exception.

**Importance of Moisture**

The medium should be moistened prior to sowing of
seeds. After seeds are sown, the medium should be
watered with a fine mist or, particularly with small seeds,
subirrigated. Both medium and air surrounding the
germinating seed must remain moist throughout the
germination process.

Germinating seedlings should receive adequate light
to produce short, stocky plants rather than weak and
spindly ones. However, full sunlight during very early
germination should be avoided with some seedlings
because of possible injury from high temperatures.

Seedlings should be transplanted into larger
containers as soon as the first 2 to 4 true leaves appear
(not the cotyledonary leaves). During transplanting, it is
desirable to retain as much of the medium around the roots
as possible.

**PROPAGATION OF PALMS BY SEED**

Follow these eight steps in propagation of palms by seed:

1) Plant palm seed as soon as ripe. Seed of some species
are relatively short-lived and begin to lose viability in
2 to 3 weeks or less.

2) Remove fleshy coat, dry in the shade for a few days
before storage or plant immediately. Seeds that have
been previously dried should be soaked in water for 2
to 3 days before planting.

3) Before storage, dust seeds with a fungicide, such as
ferbam, ziram or chloranil (Spergon).

4) To hasten germination, scarify or cut through the thick
or hard coat of the seeds.

5) Plant the seed in sterilized media in flats or beds.
Mixtures of peat and sand 1:1 by volume or peat,
sand, and vermiculite 1:1:1 by volume have proven
satisfactory.

6) Keep seed bed moist and at a temperature of more
than 5°C until germination. Germination is
considerably better at high temperatures, 30-35 °C or
85-95°F. Heating cables may be used to raise
temperature of seedbed.

7) Germination time of palm seeds varies with species.
*Chrysalidocarpus lutescens* and *Phoenix roebelenii*
germinate in about one month, whereas *Chamaedora*
*spp.* require about seven months.

8) Seedlings should transplanted as soon as leaves are
well-developed to reduce root injury in transplanting.