Stratification Requirements for Breaking Dormancy of Tree seed

Dormancy

Tree shrub seed does not normally germinate and grow until dormancy of the seed is broken. Embryo dormancy is usually broken by a period of cold/moist stratification in which enzyme changes take place in the embryo, allowing the embryo to start developing. This is similar to the treatment of a seed under snow cover, which is usually slightly above freezing. Some seed has a double dormancy in which case there is a seed coat dormancy as well as an embryo dormancy. With a seed coat dormancy, the seed coat must be altered by some additional treatment before the seed will absorb water and the embryo start to develop. This treatment may be acidic, mimicking the acid treatment in the stomach of a bird or animal, or alternately, a simple abrasion of the seed coat mimicking mechanical damage, or the gnawing of a rodent or insect.

Collection

Hardwood seed is a perishable commodity and should not be allowed to dry out during storage, prior to stratification. Store in moist sand or sawdust.

Conifer cones, if piled with little air circulation, will heat, and damage the seed. These can be stored on racks to dry, then the seed tapped out of them. Cleaned conifer seed can be stored for several years, if stored in a cool, dry environment.

Silver and red maple seed, as well elm, mature and fall in the late spring or early summer. Most others mature in the fall. Some species like red oak, and white pine require two years for seed to mature on the tree before it is ripe and falls. Many trees have a seed cycle of one to five years for good seed crops. A bumper seed crop is the best time to collect seed as better quality seed, with less insect damage, is readily available. Some seed should be collected and cut open to test and see whether seed is insect damaged, and whether a large percentage of seed is "filled", indicating good pollination and seed development.

Nuts must be floated – nuts that float are usually wormy, nuts that sink are usually sound. Nuts and other seed that drops prematurely are usually not sound. This can be confirmed by cutting a few in half. Do not store nuts in piles or tubs for an extended period of time, as they will heat up and damage the embryos. Temperatures from 50^0 C. (120^0 F.) to 61^0 C. (140^0 F.) are lethal to nuts. Piling also leads to lack of oxygen, and high carbon dioxide levels, which are also lethal. Husks can be removed by laying nuts in a driveway and driven over them with a small vehicle. Tumbling in a cement mixer along with a few sharp fist-sized rocks will also do the trick.

No stratification required:

Silver maple *Acer saccharinum*, Red maple, *Acer rubrum*, White oak *Quercus alba*, Catalpa *Catalpa speciosa*, Privet *Ligustrum vulage* (seeds cannot be allowed to dry out)

Require soaking in water for 1 - 2 days:

Spruce, *Picea spp.* Pine - Red, *Pinus resinosa* Austrian *Pinus nigra* and Scots *Pinus sylvestris*

Stratification in moist sand, peat, or plastic bags: Small quantities of seed can be placed in a butter container half filled with moist sand. Place a damp paper towel on top of the sand to separate the seed from the sand, and place the seed on top of the paper towel. Put the cover on, and place in the back of a refrigerator, NOT A FREEZER, for the required period.

Cold Stratification:

During cold stratification, inspect seed periodically to see if germination has begun. If so, remove seed and sow. Some seed can be damaged by prolonged stratification after germination has begun, or can result in damage to the plant when subsequently handled.

Sugar maple *Acer saccharum*	33-41^{0}F	40 - 90 days
Hickory *Carya spp.*	33-41^{0}F	90 - 150 days
(prior to cold treatment, hickory nuts should be soaked in water at room temperature for 2 - 4 days with 1 or 2 water changes per day)		
Walnut *Juglans nigra*	33-41^{0}F	90 - 120 days
Larch, tamarack *Larix spp*	"	21 - 60 days
White Pine *Pinus sylvestris*	"	60 days
Red oak *Quercus rubra*	"	30 - 45 days
Black oak *Quercus velutina*	"	30 - 60 days
Bur oak *Quercus macrocarpa*	"	30 - 60 days
Serviceberry *Amelanchier spp.*	"	2 - 6 months
Birch *Betula spp.*	"	60 - 75 days
Beech *Fagus spp.*	"	90 days (after germination has started at the low temperature, temperature should be raised to 68^{0}F for 60 days
Magnolia *Magnolia spp.*	"	3 - 6 months
Mulberry *Morus spp.*	"	30 - 90 days (fall sowing benefitted by allowing fruit to ferment, or soaking in cold water for 100 hours)
Mountain Ash *Sorbus spp.*	"	60 - 120 days
Hemlock *Tsuga spp.*	"	30 - 120 days
Horse Chestnut *Aesculus hippocastanum*	41^0	120 days
Caragana *Caragana spp.*	"	12 days
Norway maple *Acer platanoides*	"	90 - 120 days
Hackberry *Celtis occidentalis*	"	60 - 90 days
Filbert/ Hazel *Corylus Sp.p*	"	2 - 6 months
Juniper *Juniperus spp.*	"	60 - 90 days (not to be stratified below freezing)
Honeysuckle *Lonicera spp.*	"	30 - 60 days

Sycamore *Platanus spp.*	41^0	60 - 90 days
Hoptree *Ptelia trifoliata*	"	3 - 4 months
Sassafras *Sassafras albidium*	"	120 day
Elm: White, red *Ulmus americana/rubra* sown without stratification	"	60 - 90 days - other elms can be
Pear *Pyrus communis*	32 - 36^0F	60 - 90 days

Warm/cold Stratification:

Ash *Fraxinus spp.* - Warm period at 68^0F for 30 days for after-ripening followed by cold period at 41^0F for 60 days

Dogwood *Cornus spp.* - Warm period at 68 - 86^0F for 60 days followed by cold period at 41^0F for 60 days

Yew *Taxus spp.* - Warm period at 60^0F for 90 - 210 days followed by 36 - 41^0F for 60 to 120 days.

Moist Treatment:

White Cedar *Thuja occidentalis* - 21 days of treatment as follows:
- keeping seed on moist blotters, 86^0F for 8 hours (with light) alternating with 68^0F for 16 hours in the dark
or moist treatment for 20 days at a constant 73^0F.
or alternately 34 - 41^0F for 30 - 60 days

Treatment by soaking in concentrated sulphuric acid (usually 1-2 hours), washing the seed, then planting. **OR** Boiling in water for one minute, then allowing the seeds to soak overnight as the water cools, or soak until the seeds swell. Seed should be sown promptly after treatment:

Redbud *Cercis canadensis*, Honey locust *Gleditsia triacanthos*, Sumach *Rhus typhina* Locust *Robinia psuedoacacia* (Alternative: seed coat can be filed as with Kentucky coffeetree)

Treatment in concentrated sulphuric acid for 1-2 hours, washing the seed, then planting:

Kentucky Coffeetree *Gymnocladus dioicus* (for a few seeds, germination can be initiated by filing through the seed coat to allow water absorption and subsequent germination)

Others:

Sweet Chestnut *Castanea dentata*: **seeds are perishable** and must be sown immediately after ripening or collection. Seeds should be fall sown. Overwintering will break dormancy.

Ginkgo *Ginkgo biloga*: Seeds require after-ripening to mature the embryo. Seeds should be picked and stored warm until the fleshy seed coating is soft enough to be washed off. Seeds are then sown in late fall. An alternative is to start cold stratification for 30 to 60 days in December, after embryos have matured.

Tulip *Lirodendron tulipifera*: viability of seed of this species is usually only about 20%.

a) Storage in moist soil, sand, peat for up to 3 years
or b) Cold stratification in moist peat of sand/peat mix for 60 - 90 days
or c) Cold moist stratification in plastic bags for140 to 168 days.
Recommended cold stratification temperature: 35-36^{0}F.

Osage Orange *Maclura pomifera*: Store outdoors overwinter until they ferment. Separate seeds in spring and sow.

or Cold stratify for 30 days at 41^{0}F
or Soak in water for 48 hours

Seeds considered difficult to germinate, or complicated to stratify:

Ironwood *Carpinus caroliniana*, cherry *Prunus*, plum *Prunus*, peach *Prunus*, basswood *Tilia american*, viburnum *Viburnum spp.*

For many species, fall sowing can replace stratification providing seed is protected from rodents.

J. R. Irwin

Sources: Seeds of Woody Plants in the United States, Forest Service, U.S.D.A., Agriculture Handbook No. 450. Washington D.C., 1974.

Creasy, K.R. Guidelines for tree crop forecasting and collecting, MNR Ontario Seed Plant, 1996.