Seed ecology

Dormant seeds are unable to germinate even when the conditions for germination are favorable. There are ecological advantages for plants with seed dormancy.

These include:

1. Delaying seed germination until the conditions for seedling survival are most favorable. For example, seeds may be shed from the plant in late summer or early fall. The germination conditions are favorable for germination, but because winter conditions will occur soon, it may not be the best conditions for seedling survival. By requiring seeds to receive several months of moist, chilling conditions to satisfy dormancy, these seeds will not be able to germinate until spring when conditions for seedling survival are higher.
2. To create a seed bank. A seed bank includes the seeds that are shed from the plant that do not germinate for years due to dormancy. A seed bank ensures that not all seeds of a species germinate in a single year. This is insurance against seedlings being exposed to catastrophic conditions (like drought or cold) that kill the entire next generation of a species. It also allows seedlings to grow during favorable years even if the mother plants failed to flower and make seeds.

Types of dormancy

Seeds with primary dormancy can display exogenous, endogenous, or combinational dormancy.

1. Exogenous dormancy
    a. physical
2. Endogenous dormancy
    a. physiological
    b. morphophysiological
3. Combinational dormancy
    a. physical plus physiological

<u>Exogenous dormancy</u>

The major type of exogenous dormancy is called *physical dormancy* and these are often called hard seeds. Physical dormancy is caused by the outer seed coverings preventing the seed from taking up water. In nature, physical dormancy is most often satisfied by exposing the seed to high temperature conditions. Since this can take many years, gardeners treat seeds with physical dormancy by scarification. The three most common ways to scarify seeds include hot water, acid, or scratching the seed surface.

Hot water treatment can be accomplished by dropping seeds in water that has just begun to boil. Remove the boiling water container from the heat source and allow the seeds to soak for 1 to 10 minutes depending on the seed type. Too long an exposure to the hot water can kill the seed. This works for many seeds with physical dormancy, but usually only a small percentage of seeds become able to absorb water.

Acid treatment involves soaking the seeds in concentrated sulfuric acid for 30 to 120 minutes. Following treatment, the acid is drained from the seeds and the seeds quickly rinsed to remove the remaining acid. Since sulfuric acid and water react together to generate heat, improper rinsing can kill the seeds. This is a very effective way to treat seeds with physical dormancy. However, working with acid can be dangerous. It is only recommended for professional nursery workers where proper safety equipment is available.

Scratching the seed surface with a small file is the recommended method for scarifying small batches of seeds. The outer few layers of the seed covering should be scratched through with the corner of the file. The seed only needs to be scratched at one location. This allows water to penetrate the seed.

Endogenous dormancy

Physiological and morphophysiological are the two major types of endogenous dormancy found in tree species. Morphological dormancy is a third type of endogenous dormancy, but it is most often seen in herbaceous plants.

Seeds with *physiological dormancy* require a period of moist, chilling to satisfy dormancy. A moist, chilling period is called stratification.
In nature, physiological dormancy is satisfied by having the seeds in moist soil over the winter. The same conditions can be simulated by keeping the seeds in a plastic bag containing a moist substrate (sand or vermiculite) in the refrigerator for several months. The optimum temperature for stratification is between 1 and 5^{o}C (35 and 50^{o}F), which is about the temperature of most refrigerators.

Seeds with *morphophysiological dormancy* have an embryo that is less than one-third the size of the seed. It has not fully completed development when it is shed from the plant. In most cases, the seeds require a period of moist, warm stratification to allow the embryo to continue development. However, once the embryo completes development, it still has physiological dormancy that requires a period of moist, chilling stratification.
In nature, seeds with morphophysiological dormancy can take several years to germinate because they need to be exposed to summer and winter conditions. To get quicker germination, these seeds can be placed moist in a warm place (about 21^{o}C, 75^{o}F) for several months before being moved to the refrigerator for several months more. Because of this complicated dormancy treatment, seeds with morphophysiological dormancy can be difficult to germinate for beginning gardeners.

Combinational dormancy

Combinational dormancy occurs in seeds that have both exogenous (physical) and endogenous (physiological) dormancy. This is not a common form of dormancy, but eastern redbud (*Cercis canadensis*) is a good example of a plant with combinational dormancy. In this case, the physical dormancy must be satisfied before the physiological dormancy can be relieved. These seeds are first scarified (by scratching the seed coat with a file) to allow seeds to absorb water. This is followed by moist, chilling stratification for about three months.