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Propagation of Herbaceous Native Perennials

as presented to the International Plant Propagators Society, September 27, 2004

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Herbaceous native perennials include wildflowers, grasses, sedges, and rushes. Most of these plants can be readily propagated from seed; some exhibit complex seed dormancies and are more easily propagated by root division or stem cuttings. This article will focus on propagation of wildflowers and grasses using seed, as this is the commonly used, but often misunderstood, method of producing native herbaceous perennials. The methods described herein are based upon our 30 years of experience at Prairie Nursery in propagating a wide variety of native plants from seed.

Most native perennials require that their seed be pre-treated to break dormancy prior to seeding. There are four basic types of seed treatments or planting methods that we use to overcome seed dormancy:

Dry Stratification: Seed is exposed to freezing temperatures for 30 or more days.

Moist Stratification: Seed is mixed with a damp inert substrate and stored in a refrigerated environment at 34-36 degrees Fahrenheit (1-2 degrees Celsius). The seed should not be frozen, as this may damage the cell walls and destroy the seed.

Scarification: Seed with hard seed-coats are scratched with sandpaper to allow moisture to penetrate into the seed and initiate the germination process.

Hot Water: Seeds that are stimulated to germinate by wildfires are treated with near-boiling water.

1) Dry Stratification

Many native seeds require exposure to cold temperatures as a protective mechanism, so that they do not germinate in fall and have their tiny seedlings killed over winter. The term "seed stratification" originated many years ago when wildflower seeds were originally pre-treated by planting them in layers of damp, clean sand and refrigerating them to mimic the effects of winter. Many native seeds require exposure only to cold temperatures without the addition of moisture to break dormancy. The process of treating seeds to freezing temperatures to break dormancy is referred to as "Dry Stratification."

Most of the prairie grasses and many prairie flowers require simple dry stratification. Seed can be dry stratified by placing it in a refrigerator or freezer for 30 to 90 days prior to seeding. Large quantities of seed can be stored in an unheated building over winter in rodent-proof metal containers.

2) Moist Stratification

Many of the prairie flowers and most woodland wildflowers require moist stratification to break dormancy and yield high rates of germination. For example, Shootingstar (*Dodecatheon meadia*) has a zero rate of germination when dry stratified, but after 30 days of moist stratification it will germinate close to a 100 percent rate.

Different species require varying lengths of moist stratification to break dormancy. Lupine (*Lupinus perennis*) requires only 10 days. After two

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weeks of treatment, it will often begin to germinate while still in the refrigerator. Members of the genus *Iris* require 90 days of moist stratification to yield good germination. Dormancy in most species can be broken with 30 days with this treatment. Some prairie species that benefit from moist stratification of their seeds include:

Wildflowers

Latin Name	Common Name	Stratification Time
<i>Allium cernuum</i>	Nodding Pink Onion	30 days
<i>Asclepias incarnata</i>	Red Milkweed	10 days
<i>Baptisia</i> species	False Indigos	90 days
<i>Callirhoe triangulata</i>	Poppy Mallow	30 days
<i>Camassia scilloides</i>	Wild Hyacinth	30 days
<i>Cassia hebecarpa</i>	Wild Senna	30 days
<i>Dodecatheon meadia</i>	Shootingstar	30 days
<i>Echinacea pallida</i>	Pale Purple Coneflower	30 days
<i>Eryngium yuccifolium</i>	Rattlesnake Master	30 days
<i>Eupatorium</i> species	Joe Pye Weeds, Boneset	30 days
<i>Helianthus</i> species	Sunflowers	30 days
<i>Iris</i> species	Wild Iris, Blue Flag	90 days
<i>Liatris</i> species	Blazingstars	30 days
<i>Lobelia</i> species	Cardinal Flower, Blue Lobelia	30 days
<i>Lupinus perennis</i>	Wild Lupine	10 days
<i>Parthenium integrifolium</i>	Wild Quinine	30 days
<i>Penstemon</i> species	Penstemon, Beardtongues	30 days
<i>Ruellia humilis</i>	Wild Petunia	30 days
<i>Silphium</i> species	Compass-plant, Prairie Dock, etc.	30 days
<i>Tradescantia</i> species	Spiderworts	30 days
<i>Verbena</i> species	Blue & Hoary Vervain	30 days
<i>Vernonia</i> species	Ironweeds	30 days
<i>Veronicastrum virginicum</i>	Culver's Root	30 days
<i>Zizia</i> species	Golden Alexander species	30 days

Grasses, Sedges, & Rushes

Latin Name	Common Name	Stratification Time
<i>Carex</i> species	Sedges	30 days
<i>Calamagrostis canadensis</i>	Canada Bluejoint Grass	30 days
<i>Spartina pectinata</i>	Prairie Cordgrass	30 days
<i>Scirpus</i> species	Rushes, Bulrushes	30 days

Seed can be moist stratified by mixing it with an equal or greater volume of slightly damp, inert material. We have found that oak or pine sawdust works admirably for this purpose. It is easy to work with, absorbs moisture and transfers it to the seed well – and the relatively high acidity of the sawdust limits the growth of bacteria during the stratification process. Vermiculite, perlite, and peat moss can also be used as the inert material.

The inert matter should be only lightly dampened prior to mixing with the seed. If water can be wrung out of the sawdust or peat moss by squeezing it, then it is too wet. Vermiculite and perlite should be moistened in a bowl or colander, so that excess water will drain off. Mix the seed and inert matter together thoroughly, place in a zip-top

plastic bag, labeled with the species and date, and place it in the refrigerator for the specified amount of time for the species being treated.

Another method of moist stratifying seed is to plant the seed directly into flats, cover them with plastic wrap to retain moisture in the soil, and store them in a refrigerator or walk-in cooler. If such facilities are not available, the flats can be seeded in fall, and stored over winter in an unheated building or greenhouse. Make sure that the flats are protected from damage by mice and other animals during winter storage.

Timing of Moist Stratification Pretreatment The initiation of moist stratification should be timed so that the seed will be removed from the refrigerator at the appropriate time of year for optimal germination. Cool-season plants should be started in mid-March to early April when temperatures are still cool. Warm-season plants can be started once the air temperature reaches the high 70s or low 80s F.

3) Scarification

Seeds with hard seed coats often require scarification, or scratching of the outer seed surface, to allow penetration of water into the seed itself in order to initiate the germination process. This can be accomplished by placing a single layer of seed in the bottom of a wooden box and rubbing it with sandpaper wrapped around a wooden block or sandpaper holder. Rub the seed with the sandpaper just hard enough to scratch the outer surface, being careful not to grind the seed into flour. Light pressure is usually sufficient to scarify all but the most resistant seeds.

Some genera, such as *Baptisia* and *Iris*, require scarification followed by moist stratification. Following scarification, the seed should be moist stratified as described in the directions above.

4) Hot Water

A few species are known to benefit from treatment with hot water, which mimics the effect of a wildfire. Some seeds have dormancy mechanisms that require exposure to high temperatures, signaling that a fire has recently occurred and there will be open soil available for germination and growth of new seedlings. The prairie shrub, New Jersey tea (*Ceanothus americanus*) is one that exhibits higher germination following exposure to hot water, followed by 30 days of moist stratification.

Place the seed to be treated in a bowl. Heat water in a teakettle to boiling, then turn off the heat and allow the water to cool for a minute or two. Pour *Continued on page 3.*

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the hot water over the seed and allow it cool down to room temperature. Pour off the water, and the seed can be seeded directly, or in the case of New Jersey Tea, mixed with a damp inert material and moist stratified for 30 days prior to seeding.

Other growers have reported to have good results using the hot water treatment with the genus *Baptisia*, followed by placing the seed in the freezer for a short period, until ice crystals begin to form on the wet seed (about one hour or less). One grower uses this treatment three times in succession (hot water followed by near-freezing) to obtain high rates of germination on this notoriously recalcitrant genus.

Other Considerations in Native Seed Propagation

Fleshy Fruited Seeds

Some species have a fleshy pulp on the outside of their seeds. The pulp often possesses compounds that can prevent seed germination, and therefore must be removed prior to sowing. If the seed is collected when ripe, the flesh is usually soft and can be readily removed. Wash the seed with water while rubbing the seed carefully across a screen with openings smaller than the seed (a 1/4-inch screen works for most species). The flesh will go through the screen, and the seeds will remain on top where they can be collected. If the flesh is hard, allow it to soften for a week or longer, storing the seed in a cool, damp place until soft.

Many woodland species have fleshy fruits, including (not all have elaiosomes):

Latin Name	Common Name
<i>Actaea</i> species	Red Baneberry, White Doll's Eyes
<i>Aralia</i> species	Spikenard, Wild Sarsaparilla
<i>Arisaema</i> species	Jack in the Pulpit, Green Dragon
<i>Caulophyllum thalictroides</i>	Blue Cohosh
<i>Cornus canadensis</i>	Bunchberry
<i>Hydrastis canadensis</i>	Goldenseal
<i>Maianthemum canadense</i>	Canada Mayflower
<i>Panax quinquefolium</i>	Ginseng
<i>Polygonatum</i> species	Solomon's Seal
<i>Smilacina</i> species	Solomon's Plume, Starry Solomon's Seal

Double Dormant Seeds

Some species, especially members of the Lily Family, exhibit a phenomenon known as "double dormancy." These seeds require exposure to two winters before they will emerge from the soil. Some will "germinate" in the first year, but all of their development is underground, and no leaves are produced. The seedlings emerge in the spring after the second winter, almost two years after seeding.

The seed of these species is typically sown fresh directly in beds in the ground, or allowed to overwinter in flats, either in a cooler or in a greenhouse at ambient temperature. During the growing season, the flats are kept in a cool greenhouse or shade house. They are then allowed to experience a second winter in the flat, stored in a cooler over the winter or in an unheated greenhouse. The seed will then germinate the following spring.

Some growers accelerate this process by tricking the seed to "think" that it has experienced two winters in a one year period. After the seed has been cold treated over the first winter, the flats are placed in a cooler in early to mid-summer for a month or two to mimic winter conditions. The flats are then brought out in late summer and early fall and placed back in a cool greenhouse, where the seed will then germinate. This process stimulates germination eight months earlier, and allows for the development of the seedlings in the fall of the first season, rather than in the spring of the second season. The plants that germinate in the fall can be grown until the onset of winter, at which time they are allowed to go dormant. They will re-emerge the following spring with a head start over those flats that were not treated with a summer cool period.

Some of our best known wildflowers produce seeds that are typically double-dormant:

Latin Name	Common Name
<i>Allium tricoccum</i>	Wild Leek
<i>Caulophyllum thalictroides</i>	Blue Cohosh
<i>Maianthemum canadense</i>	Canada Mayflower
<i>Polygonatum</i> species	Solomon's Seal
<i>Smilacina</i> species	Solomon's Plume, Starry Solomon's Seal
<i>Trillium</i> species	Trilliums
<i>Uvularia grandiflora</i>	Bellwort

Timing of Seed Sowing and Pretreatment

Different species germinate at different times of the year. Most summer-blooming prairie flowers and grasses are "warm season" plants, and germinate best at temperatures around 80 degrees F. (27 degrees C.). The warm season prairie grasses are best seeded in mid to late spring or early summer, and not in fall. The exceptions include the cool-season native grasses, which do best when seeded in fall or early spring. Spring-blooming prairie and woodland flowers are "cool season" plants, and typically germinate in early spring at cool temperatures in the 60s and 70s F. (15 to 21 degrees C.). The following prairie grass genera germinate well at warm temperatures:

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Latin Name	Common Name
<i>Andropogon</i> species	Bluestems
<i>Bouteloua</i> species	Gramma Grasses
<i>Elymus</i> species	Wild Ryes
<i>Panicum</i> species	Switchgrass, Panic Grasses
<i>Schizachyrium scoparium</i>	Little Bluestem
<i>Sorghastrum nutans</i>	Indiangrass
<i>Spartina pectinata</i>	Cordgrass

Cool season prairie grasses typically germinate best when sown in early to mid-spring when temperatures are cool. They also can be planted in fall as a dormant seeding, and will germinate in early spring when conditions are optimal. Prairie Cordgrass, although a warm season grass, germinates best when sown in fall because it requires an extended period of moist stratification to break dormancy.

Latin Name	Common Name
<i>Calamagrostis canadensis</i>	Bluejoint Grass
<i>Koeleria macrantha</i>	Junegrass
<i>Hierochloa odorata</i>	Vanilla Sweet Grass
<i>Sporobolus heterolepis</i>	Prairie Dropseed

Planting Freshly Collected Seed

Woodland Wildflowers

Certain wildflowers of both prairies and woodlands are known to do best when the seed is sown fresh, immediately upon collection in late spring or summer. This is particularly true of woodland wildflowers that possess *elaiosomes*, a fleshy, strap-like appendage that is attached to the exterior of the seed. Rich in lipids and proteins, elaiosomes attract ants, which harvest the seeds and take them back to their nests. After the ants have consumed the elaiosomes, they take the seeds to their waste disposal site, and “plant” them in this nutrient rich environment. This symbiotic relationship benefits both parties, and has been observed with a number of different species of ants and plants.

If the *elaiosome* is allowed to dry out, the seed will often enter a state of “deep dormancy” in which it becomes resistant to germination. Once a seed enters deep dormancy, it typically requires extended exposure to cool, moist conditions to overcome it. Planting the seed fresh, immediately upon harvest is recommended for the following species and genera of woodland wildflowers:

Latin Name	Common Name
<i>Asarum canadense</i>	Wild Ginger
<i>Caulophyllum thalictroides</i>	Blue Cohosh
<i>Hydrastis canadensis</i>	Goldenseal
<i>Jeffersonia diphylla</i>	Twinleaf
<i>Sanguinaria canadensis</i>	Bloodroot
<i>Trillium</i> species	Trilliums

Some other species that do not possess elaiosomes but appear to benefit from seeding immediately after collection include:

Latin Name	Common Name
<i>Actaea</i> species	Red Baneberry, White Doll’s Eyes
<i>Claytonia virginiana</i>	Spring Beauty
<i>Hepatica</i> species	Hepaticas
<i>Mertensia virginica</i>	Virginia Bluebells
<i>Tiarella cordifolia</i>	Foamflower
<i>Uvularia grandiflora</i>	Bellwort (double dormant)

These seeds generally will not germinate until the following spring, or the second spring if their seeds are double dormant. Planting the seed immediately after collection prevents it from drying out, and allows the process of internal seed “after-ripening” to proceed under conditions similar to those in nature. It can be seeded directly into the ground or into flats. Keep seeded flats in a cool shade house, and avoid exposure to high temperatures and dry conditions during the summer. In fall, move the flats to a secure, unheated building or cooler that is protected from rodents that might damage the flats.

General Rule of Thumb for Seeding Woodland Wildflowers

When in doubt, plant the seed fresh and allow it to experience the natural seasonal cycles.

Spring-Blooming Prairie Flowers

Certain spring-blooming prairie flowers will often germinate in late summer or early fall when their seed is planted immediately after being collected in summer. The seedlings will develop in fall, in preparation for their most active growth period early the following spring. Species and genera whose seed will often germinate shortly after sowing in summer include the following:

Latin Name	Common Name
<i>Anemone patens</i>	Pasque Flower
<i>Delphinium</i> species	Larkspurs
<i>Geum triflorum</i>	Prairie Smoke
<i>Lupinus perennis</i>	Lupine
<i>Ranunculus</i> species	Buttercups
<i>Tradescantia</i> species	Spiderworts

Summary

By following these procedures and using quality seed from a reliable supplier, the mysteries of propagation of native species from seed can be unraveled. With a little patience and experience, one can obtain reliable results when growing seeds of our beautiful native wildflowers and grasses. ▲