

Native Wildflower and Grass Propagation Information®

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SEED TREATMENTS

Herbaceous native perennials include wildflowers, grasses, sedges, and rushes. Most can be readily propagated from seed. Some exhibit complex seed dormancies and are best propagated by root division or stem cuttings. This paper 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 pretreated to break dormancy prior to seeding. Seed treatments or planting methods that we use to overcome seed dormancy and improve seed germination and growth include:

- 1) **Dry Stratification.** Seed is exposed to freezing temperatures for 30 or more days.
- 2) **Moist Stratification.** Seed is mixed with a damp inert substrate and stored in a refrigerated environment at 34–36 °F (1–2 °C). The seed should not be frozen, as this may damage the cell walls and destroy the seed.
- 3) **Scarification.** Seed with hard seed coats are scratched with sandpaper to allow moisture to penetrate into the seed and initiate the germination process.
- 4) **Double Dormant.** These are species that have seeds, which must spend two consecutive winters in the ground to break dormancy. These seeds are best planted in the fall, although they typically will germinate 2 years after being seeded in the spring.
- 5) **Hot Water.** Seeds that are stimulated to germinate by wildfires are treated with near-boiling water.
- 6) ***Rhizobium inoculum.*** This inoculum is beneficial with all legume seeds (members of the pea family).

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 wildflowers seeds were originally pretreated 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 exposing the 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.

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 at close to 100% rate.

Different species require varying lengths of moist stratification to break dormancy. Lupine (*Lupinus perennis*) requires only 10 days. After 2 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 of this treatment.

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 most 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 drains down to bottom. Mix the seed and inert matter together thoroughly, place in a zip-top plastic bag labeled with the species and date, and place 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 over the winter.

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.

Hot Water. A few species are known to benefit from treatment with hot water. 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 1–2 minutes. Pour 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 1 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 their seeds in fleshy fruits. The flesh 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:

- *Actaea* spp. (red baneberry, white doll's eyes)
- *Aralia* spp. (spikenard, wild sarsaparilla)
- *Arisaema* spp. (Jack in the pulpit, green dragon)
- *Caulophyllum thalictroides* (blue cohosh)
- *Cornus canadensis* (bunchberry)
- *Hydrastis canadensis* (goldenseal)
- *Maianthemum canadense* (Canada mayflower)
- *Panax* spp. (ginseng)
- *Polygonatum* spp. (Solomon's seal)
- *Smilacina* spp. (Solomon's plume)

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 and 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 1-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 1–2 months 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 8 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.

Rhizobium inoculum. The *Rhizobium* bacterium is a microorganism that forms beneficial relationships with the roots of leguminous plants. The *Rhizobium* bacterium forms “nodules” on the roots of legume plants, so that they can obtain nitrogen, an important plant nutrient, from the air. The inoculum should be applied to the seed just before planting. Place the seed in a bowl, and dampen it very lightly with a fine spray mist of water. Do not saturate the seed. Add the inoculum to the slightly dampened seed and stir thoroughly to mix it in. Plant the inoculated seed immediately.

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 germinated best at temperatures around 80 °F. (27 °C.). Spring-blooming prairie and woodland flowers are “cool season” plants, and typically germinate in early spring at cool temperatures in the 60 and 70s °F. (15 to 21 °C.).

The following prairie grass genera germinate well at warm temperatures:

- *Andropogon* spp. (bluestems)
- *Bouteloua* spp. (grama grasses)
- *Elymus* spp. (wild ryes)
- *Panicum* spp. (switchgrass, panic grasses)
- *Schizachyrium scoparium* (little bluestem)
- *Sorghastrum nutans* (Indiangrass)
- *Spartina pectinata* (cordgrass)

Cool season prairie grasses (see below) typically germinate best when sown in early to mid-spring when temperatures are cool:

- *Calamagrostis canadensis* (bluejoint grass)
- *Koeleria macrantha* (Junegrass)
- *Hierochloa odorata* (vanilla sweet grass)
- *Sporobolus heterolepis* (prairie dropseed)

Planting Freshly Collected Seed.

Woodland Wildflowers. Certain wildflowers of both prairies and woodlands are known best when the seed is sown fresh, immediately after collecting in summer. This is particularly true of woodland wildflowers that possess lysosomes, a fleshy, strap-like appendage that is attached to the exterior of the seed. If the lysosome is allowed to dry out, the seed often will enter into a deep dormancy condition. Deep dormancy typically requires extended exposure of the seed to cool, moist conditions in order to overcome it. Planting the seed fresh, immediately after harvest is recommended for the following species and genera of woodland wildflowers:

- *Asarum canadense* (wild ginger)
- *Caulophyllum thalictroides* (blue cohosh)
- *Hydrastis canadensis* (goldenseal)
- *Jeffersonia diphylla* (twingle)
- *Sanguinaria canadensis* (bloodroot)
- *Trillium* spp. (trilliums)
- *Actaea* (red baneberry, white doll's eyes)
- *Claytonia* (spring beauty)
- *Hepatica* (hepatica)
- *Mertensia* (Virginia bluebell)
- *Tiarella* (foamflower)
- *Uvularia* (bellwort)

These seeds typically will not germinate until the following spring. Planting the seed immediately prevents it from drying out, and allows other internal seed after-ripening processes to occur under conditions similar to those in nature. Keep the seeded flats in a cool shade house, and avoid exposure to high temperatures and dry conditions.

“General Rule of Thumb for Seeding Woodland Wildflowers: When in doubt, plant the seed fresh and allow it to experience natural temperature cycles.”

Prairie Wildflowers. 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:

- *Anemone patens* (pasque flower)
- *Delphinium* spp. (larkspur)
- *Geum triflorum* (prairie smoke)
- *Lupinus perennis* (lupine)
- *Ranunculus* spp. (buttercup)
- *Tradescantia* spp. (spiderwort)

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 70's or low 80's °F.

The specific seed treatment requirements for many native prairie flowers and grasses are provided in Table 1. 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 experience, reliable results can be achieved in growing our beautiful native wildflowers and grasses.

Table 1. Propagation information for selected prairie plants.

Wildflowers	Latin Name	Greenhouse propagation methods				Seed scarification required (3)	Direct seeding in field Optimal planting times
		Dry stratify (1) ^y	Moist stratify (2)	Days to Moist stratify (1) to improve germination	double dormant(4)		
Red baneberry	<i>Actaea rubra</i>		x				fall, early spring
Lavender hyssop	<i>Agastache foeniculum</i>	x					fall, spring
Nodding pink onion	<i>Allium cernuum</i>		x	30			fall
Leadplant (6)	<i>Amorpha canescens</i>	x				x	spring, early summer
Thimbleweed	<i>Anemone cylindrica</i>	x					fall, spring
Angelica	<i>Angelica atropurpurea</i>		x	30			fall
Columbine	<i>Aquilegia canadensis</i>	x					fall, early spring
Jack in the pulpit	<i>Arisaema triphyllum</i>	x					fall, early spring
Red milkweed	<i>Asclepias incarnata</i>		x	10			fall, spring, early summer
Common milkweed	<i>Asclepias syriaca</i>		x	10			fall, spring, early summer
Butterflyweed	<i>Asclepias tuberosa</i>	x					fall, spring, early summer
Butterflyweed for clay	<i>Asclepias tuberosa</i> 'Clay'	x					fall, spring, early summer
Sky blue aster	<i>Aster azureus</i>	x					fall, early spring
White woodland aster	<i>Aster divaricatus</i>	x					fall, early spring
Smooth aster	<i>Aster laevis</i>	x					fall, early spring
New England aster	<i>Aster novae-angliae</i>	x					fall, early spring
Frost aster	<i>Aster pilosus</i>	x					fall, early spring
White aster	<i>Aster ptarmicoides</i>	x					fall, early spring
Arrow leaved aster	<i>Aster sagitifolius</i>	x					fall, early spring

Short's aster	<i>Aster shortii</i>	x				fall, early spring
Canada milk vetch (6)	<i>Astragalus canadensis</i>	x			x	fall, spring, early summer
Blue false indigo (6)	<i>Baptisia australis</i>	x			x	fall
Cream false indigo (6)	<i>Baptisia bracteata</i>		x	30	x	fall
White false indigo (6)	<i>Baptisia alba</i> var. <i>macrophylla</i>		x	30	x	fall
False aster	<i>Boltonia asteroides</i>	x				fall, spring
Pale Indian plantain	<i>Cacalia atriplicifolia</i>	x				fall, early spring
Poppy mallow	<i>Callirhoe triangulata</i>		x	30	x	fall
Tall bellflower	<i>Campanula americana</i>	x				fall, early spring
New Jersey tea	<i>Ceanothus americanus</i>		x	hot water (5), 30 days	x	fall
Lanceleaf coreopsis	<i>Coreopsis lanceolata</i>	x				fall, spring, early summer
Tall coreopsis	<i>Coreopsis tripteris</i>		x	30		fall, spring, early summer
White prairie clover (6)	<i>Dalea candida</i>	x				fall, spring, early summer
Purple prairie clover (6)	<i>Dalea purpurea</i>	x				fall, spring, early summer
Canada tick-trefoil (6)	<i>Desmodium canadense</i>	x				fall, spring, early summer
Shooting star	<i>Dodecatheon meadia</i>		x	30		fall
Narrow-leaf purple coneflower	<i>Echinacea angustifolia</i>	x				fall
Pale purple coneflower	<i>Echinacea pallida</i>		x	30		fall
Purple coneflower	<i>Echinacea purpurea</i>	x				fall, spring, early summer
Rattlesnake master	<i>Eryngium yuccifolium</i>		x	30		fall
Joe Pye weed	<i>Eupatorium purpureum</i> subsp. <i>maculatum</i>	x		30		fall
Boneset	<i>Eupatorium perfoliatum</i>		x	30		fall
Sweet Joe Pye weed	<i>Eupatorium purpureum</i>		x	30		fall

Wildflowers	Latin Name	Greenhouse propagation methods				Direct seeding in field Optimal planting times
		Dry stratify (1)	Moist stratify (2) ^y	Days to Moist stratify (1) to improve germination	Seed scarification required (3)	
Bottle gentian	<i>Gentiana andrewsii</i>		x	30		fall
Prairie smoke	<i>Geum triflorum</i>	x				fall, early spring, fresh seed
Dogtooth daisy	<i>Helenium autumnale</i>	x				fall, early spring
Sawtooth sunflower	<i>Helianthus grosseserratus</i>		x	30		fall
Showy sunflower	<i>Helianthus × laetiflorus</i>		x	30		fall
Downy sunflower	<i>Helianthus mollis</i>		x	30		fall
Western sunflower	<i>Helianthus occidentalis</i>		x	30		fall, spring, early summer
Woodland sunflower	<i>Helianthus strumosus</i>		x	30		fall
Ox-eye sunflower	<i>Heliopsis helianthoides</i>		x	30		fall, spring, early summer
Alum root	<i>Heuchera richardsonii</i>	x				fall, spring, early summer
Wild iris	<i>Iris shrevei</i>		x	90	x	fall
Blue flag iris	<i>Iris versicolor</i>		x	90	x	fall
False boneset	<i>Kuhnia eupatorioides</i>	x				fall, spring, early summer
Roundheaded bushclover (6)	<i>Lespedeza capitata</i>	x				fall, spring, early summer
Rough blazingstar	<i>Liatris aspera</i>	x				fall
Northern blazingstar	<i>Liatris scariosa</i> var. <i>novae-angliae</i>	x				fall, spring
Meadow blazingstar	<i>Liatris ligulistylus</i>	x				fall
Dotted blazingstar	<i>Liatris punctata</i>	x				fall
Prairie blazingstar	<i>Liatris pyrenostachya</i>		x	30		fall, spring
Dense blazingstar	<i>Liatris spicata</i>	x				fall

Cardinal flower	<i>Lobelia cardinalis</i>	x					fall, early spring
Great blue lobelia	<i>Lobelia siphilitica</i>		x	30			fall, early spring
Lupine (6)	<i>Lupinus perennis</i>		x	10			fall
Bergamot	<i>Monarda fistulosa</i>	x					fall, spring, early summer
Dotted mint	<i>Monarda punctata</i>	x					fall, spring, early summer
Evening primrose	<i>Oenothera biennis</i>	x					fall, spring, early summer
Wild quinine	<i>Parthenium integrifolium</i>		x	30			fall
Smooth penstemon	<i>Penstemon digitalis</i>		x	30			fall
Slender penstemon	<i>Penstemon gracilis</i>						fall
Beardtongue	<i>Penstemon grandiflorus</i>		x	30			fall
Obedient plant	<i>Physostegia virginiana</i>	x					fall
Jacob's ladder	<i>Polemonium reptans</i>	x					fall, early spring
Great Solomon's seal	<i>Polygonatum canaliculatum</i>		x				fall
Prairie cinquefoil	<i>Potentilla arguta</i>	x					fall
Mountain mint	<i>Pycnanthemum virginianum</i>	x					fall, spring, early summer
Yellow coneflower	<i>Ratibida pinnata</i>	x					fall, spring, early summer
Meadow rose	<i>Rosa blanda</i>		x				Fall
Pasture rose	<i>Rosa carolina</i>		x				fall
Black-eyed Susan	<i>Rudbeckia hirta</i>	x					fall, spring, early summer
Green-headed coneflower	<i>Rudbeckia laciniata</i>	x					fall, early spring
Sweet black-eyed Susan	<i>Rudbeckia subtomentosa</i>	x					fall, spring, early summer
Brown eyed Susan	<i>Rudbeckia triloba</i>	x					fall, spring, early summer
Partridge pea (6)	<i>Senna fasciculata</i>		x	10			fall, spring, early summer
Wild senna (6)	<i>Senna hebecarpa</i>	x					fall, spring, early summer

Wildflowers	Latin Name	Greenhouse propagation methods				Direct seeding in field Optimal planting times
		Dry stratify (1)	Moist stratify (2) ^y	Days to Moist stratify (1) to improve germination	Seed scarification required (3)	
Rosinweed	<i>Silphium integrifolium</i>		x	30		fall
Compassplant	<i>Silphium laciniatum</i>		x	30		fall
Cupplant	<i>Silphium perfoliatum</i>		x	30		fall
Prairie dock	<i>Silphium terebinthinaceum</i>		x	30		fall
Solomon's plume	<i>Smilacina racemosa</i>		x	double dormant(4)		fall
Ohio goldenrod	<i>Solidago ohioensis</i>	x				fall, spring, early summer
Riddell's goldenrod	<i>Solidago riddellii</i>	x				fall, spring, early summer
Stiff goldenrod	<i>Solidago rigida</i>	x				fall, spring, early summer
Showy goldenrod	<i>Solidago speciosa</i>	x				fall
Meadowrue	<i>Thalictrum dasycarpum</i>	x				fall
Spiderwort	<i>Tradescantia ohioensis</i>	x				fall
Blue vervain	<i>Verbena hastata</i>		x	30		fall
Hoary vervain	<i>Verbena stricta</i>		x	30		fall
Tall ironweed	<i>Vernonia altissima</i>		x	30		fall
Ironweed	<i>Vernonia fasciculata</i>		x	30		fall
Culver's root	<i>Veronicastrum virginicum</i>	x				fall
Heartleaf golden Alexanders	<i>Zizia aptera</i>	x				fall
Golden Alexanders	<i>Zizia aurea</i>	x				fall

Sedges

Bottlebrush sedge	<i>Carex comosa</i>	x		fall, early spring
Porcupine sedge	<i>Carex hystrix</i>	x		fall, early spring
Lake sedge	<i>Carex lacustris</i>		x	fall, early spring
Fox sedge	<i>Carex vulpinoidea</i>	x	30	fall, early spring
Dark green bulrush	<i>Scirpus atrovirens</i>		x	fall, early spring
Woolgrass	<i>Scirpus cyperinus</i>		x	fall, early spring

Grasses

Big bluestem	<i>Andropogon gerardii</i>	x		spring, early summer
Sideoats grama	<i>Bouteloua curtipendula</i>	x		spring, early summer
Northern sea oats	<i>Chasmanthium latifolium</i>		x	fall, early spring
Canada wild rye	<i>Elymus canadensis</i>	x	30	spring, early summer
Silky wild rye	<i>Elymus villosus</i>	x		spring, early summer
Virginia wild rye	<i>Elymus virginicus</i>	x		spring, early summer
Rattlesnake grass	<i>Glyceria canadensis</i>	x		fall, early spring
Fowl manna grass	<i>Glyceria stricta</i>	x		fall, early spring
Bottlebrush grass	<i>Hystrix patula</i>	x		fall, early spring
Junegrass	<i>Koeleria macrantha</i>	x		fall, early spring
Switchgrass	<i>Panicum virgatum</i>		x	spring, early summer
Little bluestem	<i>Schizachyrium scoparium</i>	x	30	spring, early summer
Indiangrass	<i>Sorghastrum nutans</i>	x		spring, early summer
Prairie cordgrass	<i>Spartina pectinata</i>		x	fall
Sand dropseed	<i>Sporobolus cryptandrus</i>		x	spring, early summer
Prairie dropseed	<i>Sporobolus heterolepis</i>	x	30	fall, early spring

^z Number refers to seed treatment options (see text).