Tallgrass Prairie Center's Restoration Guide

Third in a Series

Propagating Native Plants

Ready...

Propagating native plants is hands-on learning at it's best. Gain experience with individual species life-cycle, growth-habits, and natural history... and bring important biodiversity to your out-door living space at the same time!

Basic Equipment Needed

This is a basic list of equipment needed for propagating native plants on a modest scale:

- **Native plant materials (seeds and/or plants)**
- **Ziploc™ bags/permanent marker**
- **Refrigerator**
- **Sterile potting soil**
- **Containers/Labels**
- **Pruning shears, knife**
- **Trowels and shovel**

Starting from Seed

Propagating native plants from seed is a great learning experience, as well as the single most important way to grow a large number of plants from a diverse genetic source. It is the best way to develop seedling identification skills for assessing new restoration plantings. Be sure the seed your planting is viable, either from seed test results or from an experienced collector. It's important to know a bit about seed dormancy and how to overcome it to successfully germinate native seed.

Seed Dormancy and Germination

Dormancy is an important trait of native species, especially forbs, allowing germination to occur over time and in proper season in nature. For direct seeding of prairie species in a planting, sow seeds in late fall so seed will experience a natural winter cycle to break dormancy. If starting seedlings in the greenhouse, it's best to break dormancy artificially using various techniques as described below.

Stratification

Most prairie species, particularly forbs, have a biochemical dormancy requiring a simulated winter treatment, i.e. cold, moist conditions known as stratification to break dormancy. Mix seed with an equal amount of moist sterile sand, sawdust, or vermiculite and place in a Ziploc™ bag. Avoid excessive moisture; water should not be pooled anywhere in the bag. Use vermiculite if working with species adapted to drier conditions to minimize the risk of rot. Place seeds in refrigerator (32 to 45 °F or 0 to 10 °C) for the recommended period of time (see Table). Check bags weekly for mildew or dryness.

A few species, among them American vetch (*Vicia americana*) and butterfly milkweed (*Aesclepias tuberosa*), will germinate at these temperatures, so plant immediately if this occurs.

Adding wet sand to an equal amount of seed in preparation for stratification.

Some species may germinate best when stratified under natural winter temperature fluctuations. If sowing seeds in flats for outdoor stratification, cover with screen mesh to protect seeds from being displaced by animals or heavy rains. Sow seeds in early March in cold frames for stratification and to extend the growing season in early spring. A few species may require warm (68 to 94°F or 20 to 35°C), moist conditions, or warm-moist followed by cold-moist stratification, such as Michigan lily (*Lilium michiganense*). Other species requiring this treatment are found in the Parsley, Buttercup, Arum, Lily, and Iris families (Baskin and Baskin 1998).

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Scarification

Species with a hard or waxy seed coat require scarification. Scarification is a technique that simulates the natural disintegration (such as weathering, abrasion, or partial digestion) of the seed coat to allow water uptake for timely germination. Species in the Sumac, Legume, Geranium, and Buckthorn families may require scarification (Baskin and Baskin 1998). A simple scarification technique is to rub a single layer of seed between two sandpaper-covered boards for a minute or so until seed coat begins to appear dull. Percussion scarification involves shaking seeds vigorously inside a heavy glass bottle for a few minutes.

Scarification equipment

Commercial scarifiers are also available from seed equipment manufacturers, such as a Forsberg scarifier. In all cases, care is necessary to avoid breaking or damaging seeds.

Special case: Wet-Heat Scarification

New Jersey tea (*Ceanothus americana*) and False gromwell (*Onosmodium molle*) require wet-heat treatment. Pour boiling water (212 °F, 100 °C) over the seeds just enough to cover them all and allow to cool to room temperature, or immerse seeds in boiling hot water for five to twenty seconds and remove to rinse and cool. Be sure not to boil the seed! Germination of these species will improve with stratification after wet-heat treatment.

Get Set...

Seeds are primed and ready to grow! Critical to successful propagation of native seedlings are using suitable containers and potting medium, and proper watering, soil temperature, light, and air.

Containers

Containers should provide good drainage, space for strong root development, and yet be small enough to provide efficient use of potting medium and bench space. Deeper containers aren't necessarily better, but they will help accommodate tap-rooted species. It's important to allow roots to 'air-prune' (can't grow any further) as they reach the bottom of the soil column so lateral root development will occur within the container. This is accomplished with good drainage around and away from the container (no water puddling under pots). Good lateral root development will aid later in transplanting (and survival!) of seedlings.

Potting Medium

A good potting medium should be light enough to allow for good root development, provide adequate drainage, and have enough fertility for seedlings to grow quickly for timely transplanting. It should also be sterile, meaning weed seed- and disease-free. A soil-less mix (less than 20% soil) is a good choice, and pre-mixed and packaged sterile potting soil is available commercially. Just be sure it's well moistened before filling containers and sowing seed.

Soil-less Mix Recipe

This recipe makes about 1 cubic yard of potting medium:

• **Peat moss (4 cu. ft/bag)**	**2 bags (8 cu. ft)**
• **Vermiculite (medium 4 cu. ft/bag)**	**1/2 bag (2 cu. ft)**
• **Perlite (4 cu. ft/bag)**	**1/2 bag (2 cu. ft)**
• **Sterile soil**	**two 5-gal buckets**
• **Composted (sterile) manure**	**40-lb bag**
• **Osmocote® Plus fertilizer 15-9-12 (180 days)**	**8 lb**

For best consistency, screen peat moss, soil, and composted cow manure through a ½-in. mesh hardware cloth. Add remaining ingredients, mix with shovels on clean floor. Caution: All of these materials are extremely dusty in their dry form. Wear high quality dust mask and moisten materials thoroughly with water as they are mixed to reduce dust and aid water uptake of finished medium. Store unused medium in plastic tubs with tight fitting lids to prevent drying out.

PROPAGATION PROTOCOLS

FAMILY	SPECIES		OUTDOOR PROPAGATION			GREENHOUSE SEEDLING PROPAGATION				
	Common Name	Scientific Name	Propagation Methods	Sowing Time Outdoor/Flats	Division/ Transplant	SCARIFICATION	STRATIFICATION COLD	# Weeks	SOWING DEPTH	OUT-PLANTING TIME
	WILDFLOWERS									
APIACEAE	Rattlesnake master	*Eryngium yuccifolium*	SEED	Dormant	Spring	-	Moist	8-12	1/4"	Spring
(Parsley)	Golden Alexander	*Zizia aurea*	SEED, DIV	Dormant	Spring/Fall	Scarify?	Moist	12-16	1/4"	Spring
ASCLEPIADACEAE (Milkweed)	Butterfly milkweed	*Asclepias tuberosa*	SEED	Dormant	-	-	Moist	4-8	1/4"	Spring
ASTERACEAE	Prairie sage	*Artemisia ludoviciana*	SEED, DIV	Dormant	Spring/Fall	-	Dry	12	SURFACE	Spring
(Composite)	Sky blue aster	*Aster azureus*	SEED	Dormant	-	-	Moist	8	1/4"	Spring
	Smooth blue aster	*Aster laevis*	SEED	Dormant	-	-	Moist	8	1/4"	Spring
	New England aster	*Aster novae-angliae*	SEED, DIV	Dormant	Spring/Fall	-	Moist	8	1/4"	Spring
	Prairie coreopsis	*Coreopsis palmata*	SEED, DIV	Dormant	Spring/Fall	-	Moist	12	1/4"	Spring
	Pale purple coneflower	*Echinacea pallida*	SEED	Dormant	-	-	Moist	12	1/4"	Spring
	Oxeye false-sunflower	*Heliopsis helianthoides*	SEED	Dormant	-	-	Moist	12	1/4"	Spring
	Rough blazing-star	*Liatris aspera*	SEED, CORM	Dormant	Fall	-	Moist	8-12	1/4"	Spring
	Prairie blazing-star	*Liatris pychnostachya*	SEED, CORM	Dormant	Fall	-	Moist	8-12	1/4"	Spring
	Wild quinine	*Parthenium integrifolium*	SEED	Dormant	-	-	Moist	8-12	1/4"	Spring
	Greyhead coneflower	*Ratibida pinnata*	SEED	Dormant	-	-	Moist	8-12	1/4"	Spring
	Sweet coneflower	*Rudbeckia subtomentosa*	SEED	Dormant	-	-	Moist	8-12	1/4"	Spring
	Rosinweed	*Silphium integrifolium*	SEED, DIV	Dormant	Spring/Fall	-	Moist	8-12	1/4-1/2"	Spring
	Compass plant	*Silphium laciniatum*	SEED	Dormant	-	-	Moist	8-12	1/4-1/2"	Spring
	Stiff goldenrod	*Solidago rigida*	SEED, DIV	Dormant	Spring/Fall	-	Moist	8-12	1/4"	Spring
	Showy goldenrod	*Solidago speciosa*	SEED, DIV	Dormant	Spring/Fall	-	Moist	8-12	1/4"	Spring
CAMPANULACEAE (Bell Flower)	Great blue lobelia	*Lobelia siphilitica*	SEED	Dormant	-	-	Dry	12	SURFACE	Spring
COMMELINACEAE	Prairie spiderwort	*Tradescantia bracteata*	SEED, DIV	Dormant	Spring/Fall	Scarify	Moist	12	1/4"	Spring
(Day Flower)	Ohio spiderwort	*Tradescantia ohioensis*	SEED, DIV	Dormant	Spring/Fall	Scarify	Moist	12	1/4"	Spring
GENTIANACEAE	Bottle gentian	*Gentiana andrewsii*	SEED	Dormant	-	-	Moist	12	SURFACE	Spring
IRIDACEAE	Blueflag iris	*Iris shrevei*	SEED, DIV	Dormant	Spring/Fall	-	Moist	12	1/2"	Spring
(Iris)	Blue-eyed grass	*Sisyrinchium campestre*	SEED, DIV	Dormant	Spring/Fall	-	Moist	16	SURFACE	Spring
LAMIACEAE	Wild bergamot	*Monarda fistulosa*	SEED, DIV	Dormant	Spring/Fall	-	Dry	8-12	SURFACE	Spring
(Mint)	Hairy Mt. mint	*Pycnanthemum pilosum*	SEED, DIV	Dormant	Spring/Fall	-	Dry	12	SURFACE	Spring
	Narrowleaved Mt. mint	*Pycnanthemum tenuifolium*	SEED, DIV	Dormant	Spring/Fall	-	Dry	12	SURFACE	Spring
	Virginia Mt. mint	*Pycnanthemum virginianum*	SEED, DIV	Dormant	Spring/Fall	-	Dry	12	SURFACE	Spring
LILIACEAE	Wild garlic	*Allium canadense*	BULBLETS	Fresh	Fall	-	-	-	-	Spring
(Lily)	Turk's cap lily	*Lilium michiganense*	SEED,BULB	Dormant	Late Fall	-	4wk warm/4wk cold		1/4"	Spring
RANUNCULACEAE	Canada anemone*	*Anemone canadensis*	SEED,DIV	Dormant	Spring/Fall	Scarify	Moist	16	1/4"	Spring
(Buttercup)	Thimbleweed	*Anemone cylindrica*	SEED	Dormant	-	Scarify	Moist	12	1/4"	Spring
RHAMNACEAE (Buckthorn)	New Jersey tea	Ceanothus americana	SEED	Dormant	-	WetHeat	Moist	12	1/4"	After last frost
SCROPHULARIACEAE	Culver's root	*Veronicastrum virginicum*	SEED, DIV	Dormant	Spring/Fall	-	Dry	12	SURFACE	Spring
POACEAE	**GRASSES-WARM**									
(Grass)	Big bluestem	*Andropogon gerardii*	SEED, DIV	Late Spring	Spring	-	Dry	-	1/4"-1/2"	Late Spring
	Side-oats grama	*Bouteloua curtipendula*	SEED, DIV	Late Spring	Spring	-	Dry	-	1/4"-1/2"	Late Spring
	Switchgrass	*Panicum virgatum*	SEED, DIV	Late Spring	Spring	-	Moist	4	1/4"	Late Spring
	Little bluestem	*Schizachyrium scoparium*	SEED, DIV	Late Spring	Spring	-	Dry	-	1/4"	Late Spring
	Indian grass	*Sorghastrum nutans*	SEED, DIV	Late Spring	Spring	-	Dry	-	1/4"	Late Spring
	Prairie cordgrass	*Spartina pectinata*	SEED, DIV	Late Spring	Spring	-	Moist	4	1/4"	Late Spring
	Tall dropseed	*Sporobolus asper*	SEED, DIV	Late Spring	Spring	-	Dry	-	1/4"	Late Spring
	Prairie dropseed	*Sporobolus heterolepis*	SEED, DIV	Late Spring	Spring	-	Moist	4	1/4"	Late Spring
	GRASSES-COOL									
	Bluejoint grass	*Calamagrostis canadensis*	SEED, DIV	Early Spring	Spring/Fall	-	Dry	-	1/4"	Spring
	Woodland reedgrass	*Cinna arundinacea*	SEED	Early Spring	-	-	Dry	-	1/8"	Spring
	Canada wildrye	*Elymus canadensis*	SEED	Fall	-	-	Dry	-	1/4"	Spring
	Virginia wildrye	*Elymus virginicus*	SEED	Fall	-	-	Dry	-	1/4"	Spring
	Junegrass	*Koeleria macanthra*	SEED	Early Spring	-	-	Dry	-	1/8"	Spring
	Upland wild timothy	*Muhlenbergia racemosa*	SEED	Early Spring	-	-	Dry	-	1/8"	Spring
	Porcupine grass*	*Stipa spartea*	SEED	Fall	-	-	Moist	16	1/4"	Spring
CYPERACEAE	**SEDGES**									
(Sedge)	Prairie sedge	*Carex bicknellii*	SEED, DIV	Fall	Early Spring	-	Moist	8	SURFACE	Spring
	Plains Oval Sedge	*Carex brevior*	SEED, DIV	Fall	Early Spring	-	Moist	8	SURFACE	Spring
	Heavy sedge	*Carex gravida*	SEED, DIV	Fall	Early Spring	-	Moist	8	SURFACE	Spring
FABACEAE	**LEGUMES**									
(Legume)	Leadplant	*Amorpha canescens*	SEED	Dormant	-	Scarify	Moist	12	1/4"	After last frost
	Canada milkvetch	*Astragalus canadensis*	SEED	Dormant	-	Scarify	Moist	2	1/4"	After last frost
	White wild indigo	*Baptisia alba*	SEED	Dormant	-	Scarify	Moist	2	1/4"	After last frost
	Cream Wild Indigo	*Baptisia bracteata*	SEED	Dormant	-	Scarify	Moist	2	1/4"	After last frost
	White prairie clover	*Dalea camdida*	SEED	Dormant	-	Scarify	Dry	-	1/4"	After last frost
	Purple prairie clover	*Dalea purpurea*	SEED	Dormant	-	Scarify	Dry	-	1/4"	After last frost
	Showy tick-trefoil	*Desmodium canadense*	SEED	Dormant	-	-	Dry	-	1/4"	After last frost
	Roundhead bush clover	*Lespedeza capitata*	SEED	Dormant	-	Scarify	Moist	2	1/4"	After last frost

* Species with an asterix have double dormancy, requiring 2 yrs, or two stratification cycles, to break dormancy.

Sow!

Sow several seeds in each container. Thin later if necessary. Cover with no more than ¼ inch of soil for most species. Caution: Very tiny seeds should not be covered! Species such as Culver's root (*Veronicastrum virginicum*), mountain mints (*Pycnanthemum* spp.), grass-leaved goldenrod (*Euthamia graminifolia*), Joe-pye weed (*Eupatorium* spp.), great blue lobelia (*Lobelia siphilitica*), and prairie sage (*Artemisia ludoviciana*) do best if sprinkled on top of the soil surface and kept continually moist until the seed leaves (cotyledons) are evident.

Literature Cited:

Baskin C.C. and J.M. Baskin. 1998. Seeds: Ecology, biogeography, and evolution of dormancy and germination. San Diego (CA): Academic Press, 666.

Preventing 'Damping Off'

If otherwise healthy seedlings suddenly fall over, appearing to be cut off at soil level, then "damping off" fungus is present. Legumes are particularly susceptible, but other species can be affected if planted too densely. Maintain good air circulation to evaporate excess water from stems and soil surface. A box-fan set on low facing seedlings will help. Thinning may be necessary. Sprinkling a layer of perlite over the top of the soil surface after seeding or on infected seedlings will prevent or stop infection from spreading. Washing and sterilizing containers, benches, and equipment and using sterile potting medium will also help reduce the risk of damping off.

Growing

Prairie seedlings need full sunlight for normal development. Sow seeds in early February in a greenhouse environment (mid-March in cold frames). Keep the soil surface moist until germination has occurred. Use a gentle spray wand so seed isn't dislodged, forced deeper into the soil, or splattered out of the containers. Expect germination and emergence to occur over a 2-6 week period. Warm season grasses and legumes germinate best in warm soils greater than 70 °F (21 °C). Cool season grasses and many forbs germinate more readily in cool soil temperatures 40 to 50 °F (5 to 10 °C) and may cease germination at temperatures above 77 °F (25 °C). If sowing seed in flats, precise regulation of soil temperature can be achieved with propagation mats. These are commercially available at reasonable cost from nursery or greenhouse supply companies. Water established seedlings thoroughly at least once a day, moistening the entire soil column. Allow the soil to drain and surface soil to begin to dry somewhat between waterings.

Transplanting Seedlings

Strong root development is the key to successful transplants. Roots should fully occupy the entire soil column forming an intact root "plug" (retains the shape of the container when removed for transplanting). The ideal time for transplanting is in the spring after the last frost-free date for your region. Acclimate seedlings gradually to outdoor conditions of sun and wind through a process called "hardening off." Set flats or trays outside (sheltered from strong winds and full sun) for a few hours each day from mid-morning to mid-afternoon about a week before transplanting. If transplanting in summer, be prepared to water regularly and deeply until plants are established. Transplanting in the fall (early to mid-September) is an option if strong root development is present to survive the winter months.

Vegetative Propagation *(Roots, Corms, Bulbs)*

Vegetative propagation of native plants (via root/corm/bulb division) is a fun, fast, and rewarding way to get mature flowering plants for display gardens and landscaping projects. All of the resulting plants will be genetically the same, however, and only a limited number of new plants can be started in this way from each 'donor' plant. See Table for recommendations for vegetative propagation of various species.

PLEASE NOTE: Native plants should never be dug from a 'wild' source (prairie, woodland, etc.) unless they are being salvaged from a site threatened by destruction. Either grow plants from seed initially, or purchase from a reputable nursery or trade with a gardening friend.

Roots

Almost any plant with fibrous roots and multiple stems can be propagated by division. Dig up or un-pot plant and use a sharp knife or trowel to cut down into root mass. Some damage will occur, but be sure to include intact root and shoot portions for re-potting/transplanting. Divide in half for two large plants, or multiple times for maximum number of smaller plants. Fall or early spring are the best times for division, depending on the species (see Table).

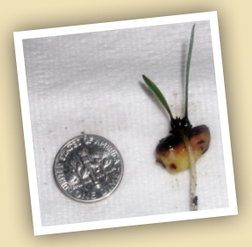
Corms

A corm is a short, fleshy, vertical underground stem. The blazingstars (*Liatris* spp.) grow from corms. In the fall these can be dug up and divided in a way similar to potatoes, and transplanted for mature flowering plants the next growing season. Small corms (cormels) can be broken off the main corm, or cut larger corms (2 inch diameter or more) in half vertically.

Rough blazing star corms dug in fall for transplant. Large corms can be cut in half.

Bulbs

A bulb is a thickened, underground bud with fleshy scales. Species like prairie onion and wild garlic (*Allium* spp.) and Michigan and Wood lily (*Lilium* spp.) have bulbs. In vigorous plants smaller side bulbs (bulbels) may develop that can be removed and re-planted. Lilies have scaley bulbs, and each scale can grow into a separate plant. Under good growing conditions, lilies will send out one or two short rhizomes a short distance (2-3") and a new bulb will form which can be carefully dug up and transplanted for mature flowering plants the next season.



Michigan lily scaly bulbs (above), dug in fall, all from a single plant. Side bulbs or individual scales can be broken off and transplanted. Bulb scale (right) growing new leaves and rootlet.

Native Plant Propagation Resources

- Native Plant Prop. Protocol:www.nativeplantnetwork.org/network/
- Ontario Rock Garden Society:www.onrockgarden.com/
- Prairie Moon Nursery Cultural Guide: www.prairiemoon.com/
- Missouri Botanical Garden, www.mobot.org/gardeninghelp/plantfinder/Alpha.asp.
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