



Germination Guide for Native Seeds

Jan Midgley 5/11/23

INTRODUCTION AND EXPLANATION OF TERMS

Plants can be increased in numbers in several ways. The four main methods are seeds, cuttings, division and tissue culture. The latter three methods produce clones, plants that are an exact genetic duplication of the parent plant.

Seed germination is the focus of this guide because seed grown plants provide genetic diversity and more assurance for the longevity of a species. They have the strongest resistance to disease and the vagaries of soil and climate. Weak plants die and no longer contribute to the gene pool. When too many cloned plants occupy an area, they are all equally susceptible to disease, insects or the challenges of a changing climate.

Outcrossing, pollinating with a different plant of the same species, is essential to maintain diversity and for seed fertility. Animals and insects can roam around looking for a partner, but plants are stationary. They employ various mechanisms to avoid self pollination.

If an individual plant has both sex organs, how does it avoid self fertilization? It depends on whether it has imperfect or perfect flowers.

Imperfect flowers do not have both sex organs. Imperfect flowers can be dioecious or monoecious. In dioecious plants, the male flowers and female flowers are on different plants. Cross fertilization is essential. A good example is poplars. In monoecious plants, the male flowers and female flowers are on the same plant but not part of the same individual flower. They can avoid self pollination by flowering at different times. *Bothriochloa laguroides* (Silver Bluestem) is an example.

Most angiosperms (ovules and seeds are enclosed in an ovary) have perfect flowers. Each flower has both male and female organs. Some might have different lengths of stamens and styles. Or they might rely on genetic or biochemical mechanisms to prevent development of the pollen grain into an embryo.

If you want to collect fertile seeds, you need genetically diverse parents of the same species. One plant or several which are clonally produced cultivars will not produce a healthy fertile seed.

Provenance matters. Whenever possible use plant material that originates from as close to the intended planting site as possible. Even within the natural range of a species, climate and soils can vary dramatically. Seeds from a state several ranks away may produce a plant that lives the first year but dwindles over time and eventually dies. As climate changes we will be including plants from different regions to our plant palettes. Experimentation and shared information will guide us.

This germination guide is a work in progress. The information I gather every year either validates, modifies or negates the methods I suggest. I edit the guide every 6-9 months.

The nomenclature reference is *The Flora of Colorado* by Jennifer Ackerfield, 2nd edition, 2022.

Temperature is in Fahrenheit degrees. A hyphen between two numbers, ex. 60-80°, indicates a range between the two numbers. A slash between two numbers, ex. 70°/40°, indicates the daytime and the night time temperatures.

Abbreviations:

ASAP - as soon as possible

C - cover well

lt C - light cover

vIC - very light cover

d = days

w = weeks

m = months

L = light

D = dark

L = D means no light or dark requirement

germ. = germinated

OT = outdoor treatment

strat = stratification

70(40d) = 70° for 40 days

40(3m) = 40° for 3 months

40-70 = 3 months at 40°F followed by a temperature shift to 70°F.

40-70-40-70 = 3 month cycles at temperatures of 40°F and 70°F

SEED COLLECTION

When collecting seeds in the wild, have the proper permits and never collect more than a few seeds from a few plants within a stand of plants. A pinch of seeds produces a large number of plants.

WHEN

Seeds can mature anytime from two weeks to a year after the plant flowers. The seed container will change from green to yellow, tan, brown or black. If fleshy material (an aril) covers the fruit, the color will turn white, red, blue, pink, etc. Watch for color changes and for splits along seams. Some species have explosive capsules. If the plant has ballistic seeds, clip the capsule before the seeds are ejected and put them in a paper bag to explode.

HOW

Various methods suit different plant families.

Seeds of some aster family species can be plucked from the receptacle once they are fluffy and release easily. Others in the family are spiky (ex. Echinacea). Let them get extremely dry. Then cut the entire head into a paper bag.

For ballistic dispersers many of which are in the mustard family, cut the entire stalk once one fruit explodes.

Strip seeds from the stalks of grass family plants. Ripe seeds will release easily in your hand.

CONTAINERS

Collect dry seeds in paper bags.

Some seeds need to remain moist. This category includes seeds with an aril (fleshy or sometimes hard, colorful material that surrounds the seed) or an elaiosome (an oily, fleshy attachment to the seed). The edible fruit of *Prunus americana* (Wild Plum) is an aril. *Erythronium grandiflorum* (Glacier Lily) and violets have elaiosomes. Place these seeds in a re-closeable plastic bag.

TRIAGE FOR INSECTS

As soon as possible, examine the plant material for insect activity. Freeze the entire mass or the cleaned seeds if the seeds are being damaged.

FREEZING

Larvae of insects can damage the seeds of some species. Some highly susceptible species are members of the legume family, gentians and iris. Freezing well dried seeds for 2-3 weeks will kill most insect larvae.

SEED CLEANING

Dry seeds can remain in the paper bags for a few days to several weeks. The goal in cleaning seeds is to rid the seeds of spent petals, sepals, capsules, stems, leaves and critters. Work over a clean sheet of white paper on a tray. If you cannot break the material apart by hand, various tools help. Crush hard capsules with a rolling pin. Scrape the mass of plant material across a coarse soil sieve. A hard rubber dog toy can save your knuckles. Sift the material through various grades of sieves to separate the seeds from the chaff. A hair dryer on low speed held below a sieve and gradually moved closer as the sieve is shifted left and right helps remove chaff. A small to moderate amount of debris does not interfere with seeds that are hand sown.

To identify what bit is the seed, use a 10X hand lens or a microscope. To check for fertility, press against the middle of the seed with a fingernail. If it collapses easily, it is infertile.

Seeds encased in fleshy material benefit from having the material removed, because it contains a germination inhibitor. In nature the flesh would be removed by passing through the intestinal tract of a bird or some other animal. Soak the seeds in water for a day or even a week to let the fruit ferment and soften. Then rub the mass in a sieve or strainer. Rinse well.

Seeds with an elaiosome are dispersed by ants (myrmecochory). The elaiosome can be removed, but it is a slippery, difficult task and is not necessary.

SEED STORAGE

Place the seeds in paper envelopes. Write the name of the plant, the date of collection, the location, and the elevation on the envelope. Place the envelopes in a waterproof container of glass, plastic or tin.

Many seeds are viable for five years or more. Never give away all of your seeds of a species unless it is only viable for a year. Some species fail to set seeds every year. For seeds that need to after-ripen, it is convenient to sow seeds from a previous year's collection.

In arid climates seeds can be stored at household temperatures. I prefer storing them in the refrigerator at around 40°F. This temperature slows the metabolism rate of the seeds which prolongs viability and vigor. Shoeboxes full of coin envelopes pack efficiently on refrigerator shelves.

Arillate seeds or seeds with an elaiosome can hold several weeks in the refrigerator if they are packed in a re-sealable plastic bag containing barely moist sphagnum moss.

DORMANCY

Some seeds are mature upon collection and could germinate if sown right away. Others have some type of obstacle that prevents the seeds from germinating too early. This is nature's system to help the seeds germinate at the most auspicious time for their survival. Some potential problems include a formed but immature embryo, a hard seed coat, a germination inhibitor in the fruit or a physiological need for warm or cold temperatures or cycles of warm and cold, and finally light or dark. If you do not know the germination requirements of a species, try to replicate what would happen in nature.

After-ripen

Seeds that require after-ripening may take one to six months before the embryo is ready to respond to moisture and begin growing. Store these seeds dry on the shelf or in the refrigerator until they are mature enough to germinate.

TEPID WATER SOAK

Soak in tepid water for twelve to twenty-four hours before sowing.

SCARIFICATION

Some seeds (ex. legumes) have a thick, hard seed coat. Water (and oxygen) cannot get through this outer layer to the embryo. In nature the seed coats are scarred by passing through an intestinal tract where they are exposed to acid and perhaps the scouring action of grit in a gizzard. Or alternating freezing and thawing temperature may create a crack in the seed covering. In order to crack these hard seed coats, we use a chemical or physical method of scarification or both. Professionals use acid. Homeowners can use 3% hydrogen peroxide in various concentrations to etch the seed coat. Physical methods include a hand file, an emery wheel or two sheets of sandpaper. Place one piece of sandpaper on a stable surface. Better yet, stick a sheet of skate board grit onto an old cookie sheet with sides. Put the seeds on the abrasive surface and rub sandpaper blocks over the top for a few seconds until the surface of the seed looks duller. Choose the grade (fine, medium, coarse) of sandpaper block that is required for the specific species. Start gently and gradually increase the grade of grit and the intensity. Test one or two seeds to avoid crushing a whole batch of fragile seeds.

BOILING WATER SOAK

Place the seeds in a small, heat proof bowl. Bring water to a boil. Take it off the heat. When the bubbling stops, pour the water over the seeds and let them soak twelve to twenty-four hours before sowing. The seeds should swell to about double in size. If they do not, retreat the ones that have not imbibed water.

HAND HELD IMMERSION BLENDER

An alternative method for cleaning fleshy fruits other than fermenting and sieving, is to use an immersion blender. Put the seeds into a sturdy, tall plastic container. Fill it about half full with water. Pulse the blender on low for several seconds. Repeat a few times if necessary. The seeds should

sink. The pulp floats to the top and can be dumped off. Fill the container with water again and dump the debris again. Repeat as necessary.

If you question the hardness of the fruit, test a few before whizzing the lot.

STRATIFICATION

Seeds that have physiological dormancy require stratification. All stratification involves moisture and temperature changes. At lower temperatures, more oxygen is soluble in water, and the oxygen needs of an embryo are more easily met.

The generally accepted temperatures are 40°F for cold treatment and 70°F for warm treatment. A household refrigerator generally maintains a temperature around 40°F. These temperatures do not need to be exact unless you plan to conduct publishable research.

Cold Stratification

Cold stratification can be accomplished in two places, outdoors or in the refrigerator.

Outdoor treatment or OT, means you sow the seeds in medium in a container (cells, pots, milk jugs, plastic bags, etc.) in late fall, winter or very early spring. The timing depends on the amount of time required by each species. Protect the containers from rodents and birds.

A cold moist treatment can also be accomplished in a household refrigerator. Place the seeds in a re-sealable plastic bag with a few tablespoons of builders' sand (sterilized) or vermiculite. Add 2 tsp. of water. Once a week, remove the bag from the refrigerator and add water. Feel the medium to decide how many drops of water to add. For two Tbsp. of medium, 8-12 drops of water should be sufficient each week.

Warm Stratification

Some species require a warm, moist stratification first, followed by cold, moist stratification. Start the seeds in July or August outside if possible. In colder months, warm stratification can be done indoors in a plastic bag or clear container. Label the bag or can. Add 2 Tbsp. of vermiculite, the seeds and about 2 tsp. of water. Maintain a temperature close to 70°. Check the contents weekly and add water as necessary to maintain a barely moist medium.

SMOKE

Prepare a dilute smoke solution by adding one part commercial smoke flavoring to nine parts water. Either soak the seeds in this solution overnight (or until they swell), or water the pot or flat once with this solution. J. L. HUDSON, SEEDSMAN
Liquid smoke is found in the grocery store in the bbq seasoning section. The ingredients should only list smoke and water! You may need to find the product online.

“Some native species that responded favorably to smoke treatments include antelope bitterbrush, big sagebrush, Great Plains tobacco, Indian ricegrass, white sage, beargrass, scarlet bugler, and big sagebrush (Blank and Young 1998; Landis 2000). Success with this novel treatment will require trials; keep good records.”

https://www.fs.fed.us/rm/pubs_series/wo/wo_ah730/wo_ah730_133_151.pdf

SEED STERILIZATION

If you plan to stratify seeds in a paper towel in the fridge, you may want to sterilize the seeds with a bleach solution. Seeds in paper towel sometimes develop mold especially if they are infertile. Using vermiculite or perlite instead of the paper towel helps to avoid the mold issue but makes it more difficult to keep records of radicle emergence. I am not sure if sterilization is a good idea for heavily scarified seeds.

Mix 1 part household bleach with 9 parts water. (DI water if you have it.) Dip the seeds into the solution for 1 minute. Then rinse well. Disposable tea bags are a handy container.

KEEP RECORDS

Record the starting date on a calendar and label the container. Write a reminder in your calendar on the day the stratification will finish so you will remember to advance the seeds to the next stage.

LIGHT OR DARK REQUIREMENT

Many seeds require light to germinate. When surface sowing the seeds, press them into the soil. A ventilated clear dome cover can protect the seeds from wind. Another option is to sprinkle a very light cover of vermiculite over the seeds (vIC). A very light cover holds moisture around the seeds without blocking light.

For species that require dark to germinate, cover the seeds with medium. In addition to soil cover, layers of newspaper or cardboard over the flat, blocks light thoroughly. Weight the paper. Check underneath the paper every day starting at day eight to ten. Remove the paper as soon as cotyledon leaves start to emerge.

GERMINATION ENVIRONMENT

Outdoors, the flat should be placed in 40-50% shade when winter sown. Soon after the cotyledon leaves emerge, gradually move the flat into more light. The seeds of species sown in spring to summer should be exposed to the light and wind they will experience ultimately.

Maintain moisture in the soil mix by covering the flats with snow or watering by hand as necessary. Domes for flats, milk jugs or plastic bag containers can help maintain a humid environment around the seeds. But be careful! If a container of seeds is in a humidity chamber in full sun at high elevation, the chances of cooking the seeds is high. Know your own situation!

When germinating seeds under artificial lights be sure to ventilate humidity chambers.

MEDIA

Germination Mix - fine grade peat moss, fine grade perlite, fine grade vermiculite, dolomitic and calcitic limestone, non-ionic wetting agent, standard seedling fertilizer starter charge (minimal amount of fertilizer).

Potting Mix - coarse grade peat moss, coarse grade perlite, dolomitic and calcitic limestone, wetting agent, fertilizer starter charge

Because peat moss is difficult to wet, wetting agents are added to help it wet more easily.

INGREDIENTS

Peat moss - Peat moss decomposes very slowly, retains moisture in the potting mix while providing a balance of air space and water for healthy growing roots. Peat is acidic (low pH) and limestone is usually added to the mix to neutralize the acidic reaction and balance the pH.

Perlite - small white irregular shaped, **volcanic rock** that was crushed and heated. The heating causes it to expand. It is non-toxic, sterile and odorless. Perlite is used to improve drainage and aeration. [I use expanded shale in my gardens. Perlite is not bird friendly.]

Vermiculite - very light, grayish puffy substance that forms when **mica chips** are heated. It contains some potassium, magnesium and calcium that will slowly become available. It is used to increase moisture and nutrient retention in mixes since it can also hold onto fertilizer for a period of time - helping to keep nutrients around the roots of your plants instead of washing out the bottom of the pot.

Ingredients definitions from <https://ag.umass.edu/home-lawn-garden/fact-sheets/bagged-potting-mixes-garden-soils-for-home-gardeners>

Some mixes contain coir instead of peat. Fine pine bark or charcoal might be included. The proportions of the various ingredients can vary.

Commercial mixes are soil-free so they are considered sterile, free of weed seeds and pathogens.

AMENDMENTS

Adding soil to a commercial mix can encourage germination and healthy growth. Many native plant species benefit from the action of soil mycorrhizae. These are specific to the species. Using some soil from the site where the seeds originated, or as close as possible, might be the key to seed germination. Most of the seeds that germinate readily at 70° do not need this extra boost. I do not recommend adding soil to mixes used for indoor or greenhouse growing. Soil diseases thrive in warm humid environments.

Native soil should not be “sterilized” in any way. Baking or microwaving the soil will eliminate the beneficial organisms. The drawback to adding soil to a commercial mix is the presence of weed seeds. Let seedlings develop for a short time until you are sure you want to pull a volunteer. It might be another native plant.

For extra drainage, add perlite, coarse squeegee, expanded shale or road base gravel. Choose road base gravels based on the dominant rock in the area where you live and intend to plant the plants.

For moisture retention, add vermiculite or compost. Compost that has animal manures might have extra sodium.

CONTAINERS

Pots of any shape are fine as long as they have plenty of drainage holes. Tall and skinny drains better than short and fat and accommodates tap roots.

For seed germination, using new clean cell packs or trays reduces disease problems, especially if the trays are going into a greenhouse. For greenhouse use of recycled containers, soak them overnight in a 10% solution of household bleach. Rinse and brush them well. For containers that stay outdoors, rinsing and brushing with water are adequate cleansing.

SEED SOWING

Spread the pre-moistened germination medium in the container. Bounce the tray on the potting bench to settle the medium. Add medium as needed but do not compress the mix aggressively. Air spaces in the medium are essential. Water gently but thoroughly before sowing the seeds. For larger seeds, place two seeds in a cell or space them in rows in a community flat. For small seeds, sow lightly over the top of the medium. Cover very small seeds or seeds that need light to germinate with a very light sprinkle of cover. This minimal cover retains a bit of moisture without blocking light. Cover large seeds to a depth equal to the diameter of the seed. Gently water again or bottom water and label the tray with the name of the plant and the date.

Place the flat outside on a mesh flat, wire fencing panels or gravel. Direct soil contact exposes the seedling to slugs, pill bugs, earwigs and snails.

FERTILIZER

When seedlings develop true leaves, fertilize once every week or two with half-strength liquid fertilizer that has N-P-K in equal proportions.

If you used soil as the germination medium, fertilizer for seedlings is not necessary.

Larger plants can be fed with liquid fertilizer or a slow release fertilizer which is incorporated in the mix or sprinkled on top (1 tsp. for a qt. pot, 1 Tbsp. for a gal. pot)

Once the native plant is in the ground fertilizer is unnecessary.

TRANSPLANTING

If plants are started in cells, transplant to 2.5" - 3.5" pots as soon as the seedlings have 2 sets of true leaves. A clam knife is a handy tool for lifting an entire plug from the cell tray. It is a dull knife with an inch-wide blade. Another version has a half inch-wide blade and is good for lifting very small plugs.

Plants started in larger containers may not need to be planted or transplanted to a larger container until the fall.

INDIVIDUAL SPECIES

E (easy) - M (moderate ease) - D (difficult)

FORBS

D *Abronia fragrans* (Fragrant Sand-verbena) - Nyctaginaceae

In fall or mid winter, scarify the seeds (acid 10 minutes plus rinsing or sandpaper), soak 12-24 hours, sow in situ. Cover the seeds to depth.

Sulfuric acid for 10 minutes cracks the seed coat. I will try 3% hydrogen peroxide for 30-60 minutes next year. Peroxide is much safer to use than sulfuric acid.

The seeds require at least 2 months of cold moist treatment.

Add a large amount of sand or perlite to the potting mix.

Untreated seeds may take a few years to germinate.

E *Achillea millefolium* (Common Yarrow) - Asteraceae

Dry store the seeds at 70° over the winter. Sow, cover very lightly. Expose to 70-77° in the day and 60° at night. These temperatures are goals. A warm daytime temperature is the most important one.

M *Allium cernuum* (Nodding Onion) - Amaryllidaceae

After-ripen: store dry at 40-70° for 6 months before sowing or cold stratification.

Some people cold stratify for 1 month and some just sow the seeds in May after the after-ripening period. Either way seeds germinate at 70°.

Cover the seeds to depth.

M *Allium textile* (Textile Onion) - Amaryllidaceae

Collect the seeds when the scapes easily pull from the bulbs. Place the capsules in a paper bag to dehisce.

Sow in situ shortly after you collect the seeds (July-August) or sow in early March in a container or in situ. Cover the seeds.

E *Amsonia illustris* (Ozark Bluestar) - Apocynaceae

Regional species. Central MO to KS and TX

Scarify the woody seeds with sandpaper and soak in tepid water for 12-24 hours. Then cold stratify for 60 days. The cold treatment can be accomplished in the fridge or by sowing in Nov. in deep cells or in situ.

Cover the seeds to depth.

E *Anaphalis margaritacea* (Pearly Everlasting) - Asteraceae

This species is dioecious or polygamo-dioecious (a plant can have female and bisexual flowers or male and bisexual flowers). If it is dioecious, it has separate male and female plants. You need both to get fertile seeds. The female heads can be recognized when the seeds are ripe by the reflexing of the involucre bracts. The receptacle “sticks its chest out” and displays the pouffy pappus. At this point you can easily pluck the seeds from the receptacle.

Store dry until the following spring.

After the last frost date, sow these tiny seeds on the soil surface and press in. 70°L. Mist or bottom water. Fall sowing might work, but I think losses would be large.

Germinate in 1-2 weeks.

Anemone patens var. multifida (Pasque Flower) - see ***Pulsatilla nuttalliana***

M *Antennaria* spp. (Pussytoes) - Asteraceae

Dioecious. Female heads are taller and skinnier than male heads which look like small heads of cauliflower.

Collect seeds when the pappus is fluffy, June-July.

Store dry at 40° or 70°. The storage allows the embryo to after-ripen which may be required for germination success in spring.

Sow mid-April in the Front Range (55-65°). Be generous with the pinch of seeds. vIC

Germinate in 1-2 months. The seedlings are tiny.

Pussy toes also increase by stolons and can be divided in early spring. Maintain sod-like sections.

Aquilegia chrysantha (Golden Columbine) - Ranunculaceae

“No cold stratification is necessary. Sow in May.” Cover very lightly. email 11/2/20 from Sherry Fuller, propagator at the Gardens on Spring Creek, Ft. Collins, CO
Golden Columbine can be sown in situ in late fall or in spring.

Aquilegia coerulea (Rocky Mt. Columbine) - Ranunculaceae

Sherry Fuller treats the same as *Aquilegia chrysantha*, i.e. no cold stratification.
I have sown in cells, placed outside in February, vIC and had 60% germination.

Argemone pleiacantha (Southwestern Prickly Poppy) - Papaveraceae

Annual to short-lived perennial. Regional species.
Sow in situ outside in mid to late fall. Cover lightly.

Argemone polyanthemus (Crested Prickly Poppy) - Papaveraceae

Annual to short-lived perennial.
Sow in situ outside in mid to late fall. Cover lightly.
Annuals can be started in cells/pots, ItC, in the spring.

M Artemisia frigida (Fringed Sage, Prairie Sagewort) - Asteraceae

Collect seeds Sept-Nov. Store dry at 40° or 70° for 6 months (after-ripen). Viable 2-3 years.
Sow after the last frost date. Ideally, the night time temperature is above 50. Lightly cover the seeds and make sure they do not dry out.
Germinate in 1 week.
Vegetative reproduction by cuttings (Feb-May) and by layering.

***Asclepias* spp. seed collection and cleaning.**

Collect seeds when the follicles begin to split. Contain the fly-away silks by putting a rubber band around the follicle until you are ready to clean the seeds. Clasp the silks and thumb the seeds off onto a piece of paper on a tray.
If the seeds and silks are already escaping, gather the entire mass into a paper bag. Add a coin or two and shake very hard for several minutes. Cut a slit in the bottom of the paper bag and shake the seeds out. Thank you Steven S. for this cleaning tip.

M Asclepias incarnata (Swamp Milkweed) - Apocynaceae

Store seeds dry at 40° for 5-6 months then sow. Sow at 75-85°, vIC.
OR
Cold stratify 30 days. Sow at 75-85°, vIC.

“I have fantastic success with several *Asclepias* spp. by skipping the cold strat times and instead soaking them in an aerated water bath 2-3 days...they almost always germinate in the bath!” email 3/19/23 Brooke Palmer, CCGG, Horticulture Coordinator (Greenhouse Production), Denver Botanic Garden.
Reports on the internet suggest sous vide treatments produce similar results.

Soaking seeds in tepid water until a radicle emerges works for *A. pumila* and is reported to work for other species as well. The radicles begin emerging in 4d and continued emerging for 21d. I will be testing many species with this soaking treatment in late spring of 2023.

Any seeds coaxed to germinate during cold weather need to be kept under lights at 70° or higher.

Asclepias pumila (Plains Milkweed) - Apocynaceae

Store cleaned, dry seeds in the fridge.

Around the last frost date in spring, begin soaking seeds in tepid water. When radicles emerge, carefully insert the seeds into soil in a narrow pot.

If winter sown in pots or in situ, the seeds germinate outside in May in the Front Range of CO.

M *Asclepias speciosa* (Showy Milkweed) - Apocynaceae

Sow outside in fall. Cover **very** lightly.

OR

Cold stratify 60 days. Sow, cover **very** lightly.

Germinates best when the temperature is above 80° day/ 60° night.

M *Asclepias sullivantii* (Prairie Milkweed) - Apocynaceae

Regional species.

Store seeds dry, 40°.

Cold stratify 2 months. Germination temperature should be 70° or higher. Sow in situ or in cells.

Cover very lightly to meet the light requirement.

M *Asclepias syriaca* (Common Milkweed) - Apocynaceae

Regional species.

Follow directions for *Asclepias incarnata*.

M *Asclepias tuberosa* (Butterflyweed, Orange Milkweed) - Apocynaceae

Store the seeds dry at 40° at least 2 months and no stratification is necessary.

Sow when the temperature is above 70°, preferably 80°+ at least part of the day. Cover the seeds **very** lightly to allow light to the seeds. They should germinate in 7-10 days if the temperature is high enough.

Asclepias viridiflora (Green Comet Milkweed) - Apocynaceae

Sow in winter in cells and place outdoors or sow in situ.

OR

Cold stratify for 1 month in the fridge before sowing around the last frost date or later.

Cover the seeds very lightly.

Germination occurs when daytime temperatures hit highs of 70-80+.

M *Astragalus drummondii* (Woolly Milkvetch) - Fabaceae

Sandpaper, inoculate (opt.), sow in 2.5" pots or deep cells, cover well and put outside 1 month before your last frost date. The radicles begin to emerge in 11 days and continue emergence over the next month.

Avoid root disturbance.

Bahia dissecta - see *Hymenothrix*

E *Berlandiera lyrata* (Chocolate Flower) - Asteraceae

Collect when the bracts are very dry and brownish for easy removal of the bracts. Rub hard on a soil sieve screen to dislodge the bracts.

Store dry at 40°.

Start in late April to May. Soak the seeds in diluted peroxide (1/2 C. tepid water + 1/4 oz. 3% hydrogen peroxide) for 24 hours. Rinse well. Sow in cells or in situ. Cover very lightly for light exposure. Leaves emerge in 10 days. Skipping the peroxide soak just adds a few days to the germination time.

E *Brickellia eupatorioides* (False Boneset) - Asteraceae

No pretreatment necessary for this part shade tolerant plant. Sow at 70°. Cover the seeds very lightly. The seeds germinate in 7-10 days.

D *Callirhoe involucrata* (Wine Cups, Purple Poppy Mallow) - Papaveraceae

Scarify with sandpaper and sow in situ in fall.

OR
Pour boiling water over the seeds in a pyrex dish. Let the water cool and soak the seeds 12-24 hours. Sandpaper scarify and try to peel the seed coat off of the seeds. Cold stratify for 1 month. Sow, cover lightly and expose to 70°. Flower the second year.

“Take tip cuttings as early as February, before buds form.” Ann Grant 2/20/21 Zoom chat box at her propagation talk for CoNPS

E *Calochortus gunnisonii* (Gunnison’s Mariposa Lily) - Liliaceae

Sow in November. Put several seeds in each cell. Use about 1/8” cover. Put outside. The radicles emerge in late fall and survive the winter in cells or pots. In the Denver area, the first leaves emerge early April.

Move to larger pots in clumps within 3-6 weeks. First year seedlings in the Liliaceae tend to go dormant earlier than mature plants.

D *Calochortus nuttallii* (Sego Lily) - Liliaceae

Sow outside in late fall or early winter, in cells or in situ. L=D. Germinate in very cool temperatures. The first above ground shoot will emerge after temperatures warm.

E *Castilleja integra* (Wholeleaf Paintbrush) - Orobanchaceae

Hemiparasitic.

Place the seeds in the palm of one hand. Rub them with a finger to remove a loose net that surrounds each seed. Cold stratify the seeds for 3-4 months either in the fridge or outside. If giving an outdoor winter treatment, sow in situ near a grass or less aggressive artemisia or sow in cells/pots and cover lightly. Pile snow on top of the cells/pots. Water as necessary during the winter. With a constant moist 40°, radicles begin to emerge as early as 16 days. Cotyledon leaves appear in 3.5 months. As soon as the seedling has two sets of true leaves, pot it in well draining soil with a host plant such as *Artemisia frigida*, *Liatris punctata*, *Penstemon* spp. or a nonaggressive grass.

Sowing the *Castilleja* along with a host species seems logical, but they are not likely to germinate at the same time.

Castilleja linariifolia (Wyoming Paintbrush) - Orobanchaceae

Hemiparasitic.

Give 1-3 months cold stratification or plant outside fall to early spring. Cover very lightly. Sow beside a host plant (see *Castilleja integra* suggestions) or with host plant seeds or pot with a host plant when the seedling has 1-2 sets of true leaves.

M *Chamerion angustifolium* (Fireweed) - Onagraceae

Harlequin Garden's propagator, Gary, and the USFS (www.fs.fed.us/database/feis/plants) say no cold stratification is required. Some other sources recommend 60 days of cold before sowing at 70+°. I'm voting for no stratification. Past failures may be due to aged seeds. They are only viable in dry storage for 18-24 months (USFS).

Sow after danger of hard frost has passed. If sowing in situ, press into the soil and protect with burlap until they germinate (Prairie Moon Nursery). The seeds need light. If sowing in cells, cover **very** lightly.

Leaves emerge in 3-4 weeks.

Rhizomes of mature plants sprout readily and can bloom within a month (USFS).

E *Cirsium undulatum* (Wavy Leaf Thistle) - Asteraceae

The seeds of this species are often infested with weevils. Infested seeds get a darker color. Promptly after collecting dry heads of seeds, place the entire head in the freezer for 2 weeks. Then clean the seeds. Press the seeds with a thumbnail. Dispose of any that collapse under pressure.

Seven month old seeds stored dry at 40° and given a cold stratification (outside or in the fridge) germinate (extend a radicle) 75% in 1 month at the cold temperature. Because the seeds produce a gel when exposed to moisture it is easiest to sow the seeds in cells/pots and to place the container outside. Cover the seeds to depth. I used ant grit from the collection site to cover the seeds.

Clematis ligusticifolia (Western White Virgin's-bower) - Ranunculaceae

Store dry seeds at 40°. Avoid longterm storage. Viability decreases rapidly.

Sow fresh seeds in fall in situ or in cells. Cover lightly.

Stored seeds: Soak for 2-3 days. Remove the style and the pericarp by peeling the fruit with your fingernails or a dull paring knife. Cold stratify stored seeds for 2-6 months.

Sow in situ or in cells. Cover lightly.

E *Cleome trachysperma* (Red-whisker Clammyweed) - Capparaceae

syn. *Polanisia dodecandra*

Annual.

(Horrible common name. It should be Beeblossom. There is a strange smell from the glandular foliage if you touch it, but it does not waft in the air.)

Late fall to winter, right before a snow, sow seeds of this annual outside where you want the plants to germinate. For me, this is more successful than container growing.

It can be sown in pots in late winter. Plant as soon as it has a few true leaves.

***Cleome* or *Peritome serrulata* (see *Cleomella*)**

E *Cleomella lutea* (Yellow Spiderflower) - Capparaceae

Sow seeds in deep cells filled with 1:2, expanded shale:high perlite potting mix in early Feb. (5690', FR).

Cotyledon leaves emerge in 8w.

E *Cleomella serrulata* (Rocky Mountain Beeplant) - Capparaceae

syn. *Cleome* or *Peritome serrulata*

Annual.

Direct sow where you want them in the garden fall to late winter. Cover 1/8-1/4".

Radicles begin emerging after 3 weeks of cold stratification.

E *Coreopsis lanceolata* (Lanceleaf Tickseed) - Asteraceae

Introduced to CO from more eastern and southern states.

Sow the seeds in cells or in situ when the soil warms in spring. The seeds have a light requirement so cover them very lightly just to help keep them moist. Leaves emerge in about 18 days.

E *Coreopsis tinctoria* (Plains Coreopsis) - Asteraceae

Annual.

About 4 weeks after bloom, the inner bracts should be turning brown. If the seeds remove easily, cut the heads into a paper bag. Clean to remove chaff, leaves, receptacles, and any extraneous matter. Store dry at 40°. Viable 3 years or more.

No pretreatment is necessary. Sow in fall or spring. Light requirement, vlc.

Germinate in 8-9d.

M *Dalea purpurea* (Purple Prairie Clover) - Fabaceae

Store seeds dry at 40°.

After the last frost in the spring, sandpaper the seeds. Next put them in a pyrex bowl and pour boiling water over them. Let the water cool and soak the seeds for 24 hours. Every 24 hours, remove seeds that have imbibed water and double in size. Repeat the boiling water treatment as many times as necessary until the seeds increase in size. (Success with multiple boiling water treatments information from Kristine Johnson of Boulder, CO, email 4/3/23) Roll moist seeds around in a light dust of inoculant (opt. but helps). Sow in cells or pots. Cover with 1/8" of medium. Expose to 70°. Seeds can be sown in situ outside. I prefer early spring sowing to fall. The seeds need no cold stratification. After all the pretreatments, press into a prepared surface if you cannot easily cover the seeds lightly.

Rabbit candy.

***Datura wrightii* (Indian Apple, Sacred Datura) - Solanaceae**

Regional.

In spring after danger of frost is past, soak the seeds for 24 hours, sow the seeds and cover with 1/8" soil. worldseedsupply.com

***Delphinium spp.* - Ranunculaceae**

D. geyeri (Geyer's Larkspur), *D. nuttallianum* (Nuttall's Larkspur)

Sow ASAP. Use fresh seeds. Sow in situ outdoors in fall and cover well. Delphinium species require dark. They germinate at 50-55°. Dorn & Dorn, "Growing Native Plants of the Rocky Mountain Area", p 81)

Cold stratification of 120 days might replace outdoor treatment.

E *Dieteria spp.* - Asteraceae

D. bigelovii (Bigelow's Tansyaster), *D. canescens* (Hoary Tansy-aster)

Store seeds dry at 40 or 70° for 3-6 months before sowing (after-ripen).

Sow seeds at 70°. Cover **very** lightly to meet the light requirement, 70L.

E *Echinacea angustifolia* (Prairie Coneflower) - Asteraceae

Sow in situ in fall. OR. Cold stratify for 1-3 months before the last spring frost date. Sow in cells or in situ. Cover the seeds. 40(1-3m) - 70, C.

D *Echinocereus viridiflorus* (Nylon Hedgehog) - Cactaceae

Sow in late fall in situ. Add drainage material to loamy clay or clay soils. Cover very lightly.

The seeds benefit from a period of cold moist conditions. Seeds of some cactus species can sit in the soil bank for a number of years before germinating.

Engelmannia peristenia (Engelmann's Daisy) - Asteraceae

syn. *E. pinnatifida*

Sow in situ in early fall. Press tightly into the soil. The seeds require light to germinate.

wildflower.org

E *Erigeron* spp. - Asteraceae

(*E. divergens*, *E. speciosus*, *E. vetensis*)

Self Sterile

Dry store at 40° or 70°.

Surface sow (light requirement) or cover **very** lightly. Expose to 70°. 70L.

Leaves emerge in 1-2 weeks.

***Eriogonum* spp.** collection and cleaning.

When the perianths turn brown or rusty colored, strip the seeds from the heads into a paper bag.

The radicle of buckwheat seeds is in the pointed tip. It can be damaged by aggressive rubbing on a screen. Rigorous cleaning is not necessary because the seeds can germinate with the perianth attached.

E *Eriogonum flavum* var. *flavum* (Golden Buckwheat) - Polygonaceae

Winter sow seeds outside. Seeds collected 9/22 (8400'), stored dry 40° and sown 1/8/23 (5690', FR) began developing cotyledon leaves in 12 weeks.

M-D *Eriogonum jamesii* (James' Buckwheat) - Polygonaceae

Store seeds at 40°. Long term storage at 70° may be detrimental.

About Dec. 1 to Jan. 1, sow the seeds outside (in cells or in situ), cover with about 1/16" of fine vermiculite and put the cells outside. Germination may occur at 70° or at 40° or anywhere in between.

M-D *Eriogonum umbellatum* (Sulfur Flower) - Polygonaceae

Store dry at 40° (Storing 6 months at 70° is very detrimental according to Norm Deno, 2nd ed., 140.)

Sow outside in late fall. Cover the seeds lightly. To cold stratify in the fridge, you must sow in cells or pots because the radicles emerge erratically for 2-3 months. Leaves will not emerge until they are darned ready in the spring.

Escobaria missouriensis (Missouri Foxtail Cactus, Nipple Cactus) - Cactaceae

syn. *Corypantha missouriensis*

Collect soft red fruits late April-May (FR, 5690'). Store cleaned seeds dry at 40.

Sow just cleaned or stored seeds on very well draining soil (add extra expanded shale, gravel, perlite, etc), vlc. In 1m, seeds turn from black to red and a radicle appears.

The first vegetative material is a stem and spines (leaves). It looks like a miniature ball cactus.

Clean one year old seeds have a 3x higher germination rate than fresh seeds.

Euphorbia marginata (Snow-on-the-Mountain) - Euphorbiaceae

Annual

In my experience, one month of cold stratification followed by a high germination temperature (up to 86-90° daytime and 68° at night or at least not below 40°) results in good germination. The seeds should be covered to depth whether sown in cells or directly in the ground. If sowing in situ, sow 3 weeks before the last frost.

One online source recommends sandpaper scarification and soaking with no stratification.
selectseeds.com

E *Eutrochium maculatum* (Spotted Joepeyeweed) - Asteraceae
Seed viability in storage may be 3 years or less.

Cold stratify for 1 month or more either in the fridge or by sowing in situ Jan. 1 to Ap.1. 40(1m)-70L.
Light requirement. Either surface sow and bottom water or cover the seeds very lightly with medium.

D *Frasera speciosa* (Monument Plant) - Gentianaceae
Collect seeds August to Sept. Store dry at 70° until January 1. Sow in situ outdoors or cold stratify 4 months and then sow in cells or in situ. This plant is monocarpic. It dies after blooming and fruiting. It can take many years to germinate and 18-28 years to bloom.

E *Gaillardia* spp. (Blanketflower) - Asteraceae
G. aristata, *G. x grandiflora* (*G. aristata* X *G. pulchella*) Tetraploid with large blooms.
No cold stratification is needed. Sow in situ after danger of frost has past in the spring. and press into the soil or sow in cells and cover the seeds lightly. Germination can be erratic. 70, v/C.

E-M *Geranium viscosissimum var. incisum* (Sticky Purple Geranium) - Geraniaceae
Scarification increases germination. If seeds have been air-dried, they are more permeable to water and will require less scarification. www.wildflower.org
Scarify with sandpaper, then soak in hot water for 12 hours. After treatment, plant outside 1/4" deep in fall or in spring after the last frost.

OR
In spring, about 4 weeks before the last frost, scarify, soak, cold stratify 30 days, sow in cells, cover to depth and put outside in sun.
Transplant into a deep pot filled with very well draining soil.

In late Feb. 2023, scarified each black seed in one small area with a nail file. Green interior exposed rapidly. Soaked in tepid water for 18h. Placed in fridge. Radicles on 75% formed in 1w at 40 in the fridge. Sown in cells, 3 per, C. Placed under lights. Cotyledon leaves emerged 1w after sowing. Full sturdy plants 1m later. Total of 6w. Could be transplanted. Remaining seeds without radicle sown in cells and put outside.

Glycyrrhiza lepidota (Wild Licorice) - Fabaceae
No cold stratification is required, but it will not harm the seeds.
If sowing outside in the fall, do not scarify the seeds. Inoculate the seeds with rhizobium inoculum (opt.) and cover the seeds well.
If sowing in the spring in situ or in cells, scarify the hard seed coat with sandpaper, inoculate (opt.) the seeds, and cover them well.
prairiemoon.com

E *Grindelia* spp. - Asteraceae
G. subalpina (Subalpine Gumweed), *G. squarrosa* (Curlycup Gumweed)
Super pollinator plant. Long blooming perennial.
Collect the seeds as late as possible hoping the stickiness of the involucre bracts will decrease. The pappus of the seeds can glue the seeds to each other and to the bracts. The involucre bracts make a cup that is upright, and the seeds remain in the cup for months. Alternatively cut a long stalked

inflorescence and stick it into a chain link fence with the cup upright. After a month or more, the cleaning is much less gummy.

Freeze dry seeds for 2 weeks to kill seed eating pests.

Store dry at 40°.

Sow mid-May. Cover lightly. 70, It C. Leaves emerge within 2 weeks.

Harbouria trachypleura (Whiskbroom Parsley) - Apiaceae

Sow in situ in the fall.

Hedysarum boreale (Utah Sweetvetch) - Fabaceae

Remove the seeds from the loment before storing dry at 40°.

Scarify. Boiling water soak. Leave in the cooled water 12-24 hours. Sow in situ or in cells in fall or spring. Cover the seeds with 1/4" of medium.

E Helianthus annuus (Common Sunflower) - Asteraceae

Annual.

After danger of frost is past in the spring, sow directly onto the soil where you want the plants.

Space the seeds at least 12" apart. Cover with 1/2" of soil.

If the temperature is 68-75°, the seeds should germinate in 2 weeks.

Self seeds prolifically so the seeds can survive very cold temperature outside.

E Helianthus maximiliana (Maximilian Sunflower) - Asteraceae

Store dry at 40 or 70°.

Sow 40(4-6w) - 70-85, L=D so It C.

Cotyledon leaves emerge in a few days once the temperature is above 70°.

M Helianthus pumilus (Little Sunflower) - Asteraceae

Once cleaned the seeds may need to go in the freezer for 2 weeks to treat for predatory insects. Be sure they are very dry first.

Store dry at 40°.

The seeds of this species have a higher germination rate when sown outside for cold stratification (temperature fluctuations?) and when they have some native soil in the medium.

Sow in mid Dec. in native soil instead of artificial mix whether sowing in a container or in situ. It C

Expose to outdoor winter and spring temperatures.

M Helioneris multiflora (Showy Goldeneye) - Asteraceae

Keep seeds dry at 70° for a year to after-ripen. Sow at 70-80°. Cover lightly with soil.

OR

For fairly fresh seeds, 40(4-6w) - 70-80, It C.

E Heterotheca foliosa (Foliose False Goldenaster) - Asteraceae

Store seeds dry at 40°. Sow after last frost in situ or in cells. 70+, It C.

E Heterotheca villosa (Hairy False Goldenaster) - Asteraceae

Store seeds dry at 40°. Sow after last frost in situ or in cells. 70+, It C.

E Humulus neomexicanus (Hops) - Cannabaceae

syn. *Humulus lupulus* var. *neomexicana*

Cold stratify in the fridge or outside for at least 3 months. After sowing the seeds, cover them well (dark requirement). Germinate in 2.5-3.5 weeks at temperatures about 60° daytime and 35-45° nighttime.

E *Hymenothrix dissecta* (Cutleaf) - Asteraceae

syn. *Bahia dissecta*

Sow after your last frost date. 70L, vlc. Heavy germination occurs from 7-28 days.

This biennial to short-lived perennial self seeds in the garden.

E *Hymenoxis hoopesii* (Orange Sneezeweed, Owl's Claw's) - Asteraceae

syn. *Helenium hoopesii*

No pretreatment of the seeds is required. Sow in cells or in situ in fall or spring. It C. Seeds germinate in 10-19 days. Bump up from cells 2 weeks after germination.

M *Ipomopsis aggregata* (Skyrocket, Scarlet Gilia) - Polemoniaceae

Biennial to short lived perennial, self sterile, monocarpic.

When stored at 40°, viability decreased by years 3 and 4.

Sow the seeds promptly in situ shortly after collection. For stored seeds, 40(30d) - 70, It C.

Leaves emerge in 3 weeks.

M-D *Iris missouriensis* (Rocky Mountain Iris) - Iridaceae

Native iris have a deep dormancy that is best tackled with scarification (in this western species) and outdoor stratification.

Sandpaper the seeds. Sow outside in situ or in cells or pots. Cover lightly. Exposure to temperature fluctuations coaxes higher germination percentages than consistent 40° in the fridge.

Including soil with artificial mix may increase germination.

E *Liatris ligulistylis* (Rocky Mountain Blazing Star) - Asteraceae

40(60d) either in the fridge or by sowing in situ in the fall. Press the seeds into the soil and/or cover them to depth. Leaves emerge in 19 days.

They bloom in 2-3 years.

If the soil is quite rich and moist the plants can get to 5' and require staking.

E *Liatris punctata* (Dotted Blazing Star or Gayfeather) - Asteraceae

40(1-2m). Outside stratification in situ or in cells is preferable to seeds in a resealable plastic bag in the fridge, because the radicles begin to emerge in 19 days. Cotyledon leaves emerge 9 days after that at 65-70°. Use light to medium cover. If you have an indoor grow light array and want to cold stratify in the fridge, it works well.

Seeds sown in late Feb. to early March, in cells placed outside (5690', FR) had leaves in 34-42 days.

M *Ligustichum porteri* (Osha) - Apiaceae

Sow mid Dec. in cells or in situ. Cover with 1/4" soil or mix. Place outside. Germinate in about 5 months in the Front Range.

E *Linum lewisii* (Blue Flax) - Linaceae

Blue Flax germinates best when it has big temperature fluctuations before the seeds are exposed to 70°. The easiest way to provide temperature swings is to cold stratify outdoors. Sow the seeds in winter either in cells or pots or in situ. Cover lightly. Pile snow on the cells regularly during the winter.

D *Lithospermum occidentale* (Western Marbleseed) - Boraginaceae

syn. *Onosmodium bejariense* var. *occidentale*

After cleaning, freeze the seeds for 2 weeks to kill any pests.

Store dry at 40° for 4-6 months or longer (after-ripen).

Sow in situ in the fall.

OR

In winter, cold stratify after scarifying with a boiling water soak. Fertile seeds will sink.

1. Sow around Jan. 1, cover the seeds 1/8" deep with medium, and put the cells/pots outside.
2. Or 3 months before the last frost date, cold stratify the seeds in the fridge, 40°(3m). Sow in cells or direct sow in garden. Cover 1/8" deep.

Lomatium orientale (Salt-and-Pepper) - Apiaceae

Collect seeds of this early bloomer May-June. Store the seeds dry at 70° for 3m.

Place in a reusable cloth tea bag and suspend from a dowel in a bubbler (aquarium with water and an air bubbler) for 3 days. Place a marble in the bag to weight it. Soaking and rinsing every day for 3 days might work.

Cold stratify in the fridge for several months or sow in a container and place outside.

Germination occurs in dark anywhere from 44-133d (1.5-4.5m).

Under lights at room temperature, cotyledons emerge from 4-21d.

M Lupinus argenteus var. argenteus (Silvery Lupine) - Fabaceae

Store seeds dry at 40° or 70°.

For fall sowing: Scarify by pouring boiling water over the seeds. Let the water cool. Soak for 24 hours. Repeat if necessary. Inoculate the seeds with rhizobium legume inoculant (opt.). Sow in situ or in cells/pots, cover the seeds. Containers will stay outside all winter.

OR

For spring sowing: 46 days before the last frost date, do a boiling water treatment and 24h soak. Inoculate the seeds with rhizobium legume inoculant (opt.). Sow, cover the seeds, place containers outside if you did not sow in situ.

After scarification, radicles begin to emerge in 9 days at 40°.

If you collect the seeds slightly "green" before they form a hard seed coat, you can sow them immediately. They will germinate in 10-14 days. They will be sticky and the color will be more tan than green. This has worked on every legume I have tried. It also helps avoid seed predation by insects. I use the term "green" to indicate a hard seed coat has not formed.

E Machaeranthera tanacetifolia (Tansyleaf Tansy-Aster) - Asteraceae

Taprooted Annuals or Biennials

Store seeds dry at 40°.

Sow outside in spring in situ or in cells after the last frost date. No pretreatment is necessary. Cover very lightly.

Germinate in 4-8 days, even if the temperature is 20° below normal.

Maianthemum stellatum (False Solomon's Seal) - Ruscaceae

Remove the tan seeds from the red fruit. Sow them as soon as possible. Keep them moist until beginning required temperature cycles. The seeds require two years with 4 temperature cycles of 40-70-40-70. (Possibly one long cold period of 100+ days would suffice.) They form a radicle the first spring. Leaves emerge the second spring. The easiest way to germinate the seeds is outdoors in situ.

Take rhizome cuttings after flowering is finished.

Melampodium leucanthum (Blackfoot Daisy) - Asteraceae
see Jim Borland article in the Colorado Native Plant Society journal
www.CoNPS.org *Aquilegia* Volume 46 No. 1 Winter 2022, pg. 28

Mentzelia decapetala (Ten-petal Evening Star) - Loasaceae
Biennial or perennial.

Collect seeds when the pore in the membrane at the mouth of the wide capsule opens.

Seeds fall into the paper bag as they dry.

About 5 weeks before the last frost date, soak the seeds for 24 hours in tepid water. Seeds that float may not be fertile. Cold stratify in the fridge for 4-5 weeks. Sow in cells or in situ. Cover very lightly. They germinate in 14 days. They can be potted in a well draining mix in a 2.5" pot as early as 9 days later.

To sow in situ, sow fairly soon after collecting the seeds or in the fall.

Mentzelia multiflora (Adonis Blazingstar) - Loasaceae

Collect seeds when the pore in the membrane at the mouth of the wide capsule opens.

Seeds fall into the paper bag as they dry.

Soak the seeds in tepid water for 24 hours. Sow in situ in the fall or early spring. To sow in cells or pots, soak the seeds, then cold stratify for 5 weeks. Use very light cover when sowing. Germinate in 10-14 days at 70°.

Mentzelia nuda (Bractless Eveningstar) - Loasaceae

Biennial or perennial.

Collect seeds when the pore in the membrane at the mouth of the wide capsule opens.

Seeds fall into the paper bag as they dry.

Sow in situ in fall or cold stratify for 60 days. Cover very lightly. Dorn & Dorn, "Growing Native Plants of the Rocky Mountain Area", 123.

Seeds sown in mid March in the Front Range germinated 42% in 35-66 days. This includes the time to cold stratify outdoors before warm weather.

Mertensia lanceolata (Plains Bluebells) - Boraginaceae

From mid June to mid July, depending on elevation, collect fruits and put them in a paper bag. Each may have as many as 4 nutlets. Store the seeds dry, 40-65° until the fall.

In mid November, sow in situ and cover the seeds lightly. They will germinate the following spring and bloom the second year. This works!

I have had minimal success sowing the seeds in deep cells and leaving them outside. It is difficult to keep the moisture consistent from June, through the summer and over the winter. They may also require mycorrhizae in the soil to germinate.

I have had no success with cold stratification in the fridge (2 years trying).

Rabbits are not overly fond of them but may snip a bloom just to taste.

E Mirabilis linearis var. linearis (Narrowleaf Four O'Clock) - Nyctaginaceae

Two weeks before the last frost date, sow in cells/pots or in situ. Cover the seeds.

When they are exposed to moisture the seeds form a gel so fridge stratification is difficult unless you have space to put the germination container in the fridge.

Leaves appear within 39 days.

Plants bloom the first year.

E *Mirabilis multiflora* var. *glandulosa* (Colorado Four O'Clock) - Nyctaginaceae

Collect the large dark seeds in early Sept. in the Front Range. The persistent bracts enfold the seeds. Put the whole thing into a paper bag. Many of the seeds will fall out of the bracts as they dry. It is fairly easy to remove the rest manually. Store dry at 40°.

Give the seeds a peroxide soak for 24h (1 tsp 3% peroxide to 16 tsp water). Sow the seeds in cells or in situ. Cover lightly.

All the seeds will germinate over a 2 week period.

OR

Seeds can be sown in situ in the fall.

No cold treatment is required but it also does no harm. Many of the seeds will extend a radicle at week 7 and will need to be sown if they are in a baggie in the fridge.

E *Monarda fistulosa* var. *menthifolia* (Wild Bergamot) - Lamiaceae

No pretreatment of seeds is necessary. Sow the seeds in cells, pots or in situ after the last frost date, probably about May 10 on the Front Range.

Cover the seeds **very** lightly (light requirement). They germinate in 10-14 days.

E *Monarda pectinata* (Plains Beebalm) - Lamiaceae

Annual

Cold stratify for 45 days whether in a container or in situ. Cover the seeds very lightly. Germinate around 70°.

E *Oenothera albicaulis* (Whitest Evening Primrose) - Onagraceae

Annual

No pretreatment of the seeds is necessary. 70C. Dark requirement.

M *Oenothera cespitosa* (Tufted Evening Primrose) - Onagraceae

Fruit formation is not reliable every year so do not share all of your seeds. Store some at 40°.

Collect (cut off) the woody seed capsules when they turn brownish and the tips spread open. Put them in a paper bag to release as many seeds as possible. Let them dry for a week or more. Pliers may still be required to get the last seeds out.

Sow right away in situ or in containers outside.

OR

Store seeds dry at 40° and sow Dec-Jan outside in situ or in cells/pots. Cover the seeds with 1/8" of grit or vermiculite.

Germination will be staggered after temperatures begin to warm.

Oenothera coronopifolia (Crownleaf Evening Primrose) - Onagraceae

Collecting any quantity of seeds is challenging.

Sow in situ in fall. Barely cover with soil. Dorn & Dorn, "Growing Native Plants of the Rocky Mountain Area", p. 128.

E Rhizomatous and easy to transplant in April (FR, 5690').

E *Oenothera flava* (Yellow Evening Primrose) - Onagraceae

Locucidal fruits cluster at the base of the leaves of the basal rosette. The capsules are woody and many seeds are still contained the following spring.

No pretreatment is required. 70 v/C. Germinate in about 2 weeks.

E *Oenothera macrocarpa* (Missouri Primrose) - Onograceae

syn. *Oenothera missouriensis* - a regional species for CO. It has large yellow daytime blooms and makes a fine bedding plant.

The wings of the large fruits catch wind dispersing the seeds by tumbling freely.

Remove the wings before cleaning or sowing the fruit which contains many small dark seeds.

Sow 2 months before the last frost date either in situ or outside in cells/pots. Cover the seeds well.

Radicles begin to emerge in 1 month. Leaves begin to emerge about a week before the last frost date. About 75% or more of the seeds germinate. A good number of the plants bloom the first year.

Oenothera villosa (Hairy Evening Primrose) - Onograceae

“No pretreatment. Plant outside fall to spring. Plant to 1/16 inch deep. Takes 3-4 weeks to germinate.” - westernnativeseed.com

***Opuntia* spp.**

“Opuntias germinate more effectively the second year after harvest. Fresh seed often lies in the ground for about a year before germination.” jelitto.com

Opuntia Fruit Cleaning

Use tongs to handle fruit or paddles.

Soak/ferment the fruit for several days to soften the flesh around the seeds. The chemical action of bacteria, yeasts or other microorganisms breaks down the soft flesh. Do not change the water, let it roil. Eventually you can lift and discard the skin with glochids. Again, use tongs or tweezers. Rub the remaining seeds and pulp on a sieve under running water to separate the seeds which are about half a cm. in size. Dry the seeds on a paper towel in a warm place for a week or two until completely dry. Store dry at 40°.

Opuntia Soil Mixes

I have minimal experience germinating and growing cacti.

Ex. of a cactus potting mix: 3 parts light potting soil, 3 parts sand, gravel, or grit, and 2 parts perlite or pumice

M *Opuntia macrorhiza* (Western Pricklypear) - Cactaceae

No gel forms when seeds are soaked in water.

“When you are ready to sow the seeds, scarify with sandpaper or a boiling water soak or both. Sow the seeds 1” apart in pots. Just push them into the cactus mix gently and barely cover with medium. Mist regularly until they germinate. Maintain an ambient temperature of 70° in the daytime and above 45° at night. When potting, add extra drainage material to the mix and use small pots.”

<https://homeguides.sfgate.com/grow-prickly-pear-cactus-seeds-69589.html>

I have extremely low germination rates the first year in pots. It is probably best to sow in situ if you do not have a set up for long term monitoring of seeds in containers.

E Cuttings

Use tongs to remove paddles from a large plant. Let them dry and callus for a few days. Stick the callused end into a pot of cactus soil mix or directly into the ground.

Opuntia phaeacantha (Tulip Pricklypear) - Cactaceae

When soaked in water overnight, a gelatinous material appears around the seeds. I am not sure if it is a germination inhibitor or if it helps hold moisture around the seeds in the ground in a natural situation. Maybe it does both.

See *Opuntia macrorhiza*.

M *Opuntia polyacantha* (Plains Pricklypear) - Cactaceae

Gel forms when seeds get wet.

See *Opuntia macrorhiza*.

Oreocarya virgata (Miner's Candle) - Boraginaceae

Biennial to short lived perennial.

The drying stalks are prickly. Wear gloves. Cut a stalk and invert it into a large paper bag. In a few weeks tip the bag and let seeds roll out onto a paper on a tray with sides.

Store the seeds at 40°.

These seeds germinate cool. Sow in cells or in situ in mid April. They germinate in 2 weeks in the dark (cover heavily).

Bloom the second year.

M *Oxyria dignya* (Alpine Mountain-sorrel) - Polygonaceae

Sow seeds collected the previous June to Sept. in mid-April to May. Use medium cover. Germinate in 48-63 days.

Seeds that have been stored longer may require pretreatment(s).

***Oxytropis* spp.**

Some sources recommend scarification and cold stratification. I get germination rates of around 45% with scarification and no stratification.

E *Oxytropis lambertii* (Purple Locoweed) - Fabaceae

Store seeds dry at 40°.

When daytime temperatures hover consistently around 70° or after the last frost date, scarify seeds with sandpaper. Inoculate with rhizobium inoculant (opt.) and sow promptly in cells or direct sow in garden. Cover to depth.

Germinate in 3 days to 2 months.

Germination is **E**. Maintenance in pots is **D**. Use a well draining medium. It might be best to sow in situ or to sow in 2.5" pots instead of cells to avoid disturbing roots.

E *Oxytropis sericea* var. *sericea* (White or Silky Locoweed) - Fabaceae

Treat the same as *Oxytropis lambertii*

D *Pediocactus simpsonii* (Mountain Cactus) - Cactaceae

In early winter, sow in a very well draining mix. Cover to depth with coarse sand or gravel. Let them be moist for 2-3 weeks, then dry for 2-3 weeks. Some seeds will germinate in the spring. Keep the tiny plants on the dryish side. Other seeds may take 5 years to germinate. <https://www.new-mexico.cactus-society.org/pdocs/GerminationTipsforSclerocactus...--Rev1-09.pdf>

***Penstemon* spp. germination information**

<https://tomclothier.hort.net> (updated 11/2000 by Jim Swayne <https://tomclothier.hort.net/page08.html>)

<jas3255@yahoo.com> (Jim Swayne)

Penstemon clutei (Sunset Crater Beardtongue) - Plantaginaceae

Arizona endemic.

Store seed @ 70°F (21°C) in a non-humid environment for 6 mo. Sow barely covered 8 wks @ 40°F (4°C), move to 60°F (16°C) for germ. under light. <https://tomclothier.hort.net/page08.html>

E *Penstemon cobaea* (Cobaea Beardtongue) - Plantaginaceae

Cold stratify 8 weeks outside in cells or in situ. Radicles begin to emerge at 5 weeks so fridge stratification is difficult unless you can place containers in the fridge. v/C (light requirement). True leaves develop when the temperature gets above 65° part of the day.

E *Penstemon grandiflorus* (Large Beardtongue) - Plantaginaceae

Regional.

Soak the seeds for 3 hours in tepid water. Sow 12 weeks before the last frost date in situ or in containers. Put the cells or pots outside for chilling. v/C (light requirement).

Cotyledon leaves emerge in about 2.5 months at 40°-55°.

E *Penstemon pinifolius* (Pineleaf Penstemon) - Plantaginaceae

Regional.

Soak the seeds in tepid water for 2-3 hours before sowing.

Cold stratify the seeds 8 weeks at 40° in the fridge or sow midwinter in situ or in containers. Cover the seeds lightly. Put the container outside. Outside treatment in cells requires regular piling on of snow but avoids radicle extension from the seeds while in the fridge.

Germinate at around 50°.

P. pinifolius can be grown from stem cuttings treated with rooting hormone.

E *Penstemon rostriflorus* (Bridges' Penstemon) - Plantaginaceae

Sow in cells or in situ 3 months before the last frost date. v/C. Leaves emerge 85 days after sowing.

M *Penstemon secundiflorus* (Sidebells Penstemon) - Plantaginaceae

Cold stratify the seeds 6-8 weeks at 40° in the fridge in a pot or sow midwinter and put the container outside. v/C (light requirement). Outside treatment in cells requires regular piling on of snow.

OR

Sow late Dec. to Jan. in situ. Cover **very** lightly.

Radicles emerge at 40°. Leaves emerge at 70°.

E *Penstemon strictus* (Rocky Mountain Penstemon) - Plantaginaceae

Cold stratify the seeds at 40° for 3 months, preferably outside in cells/pots. v/C. Radicles develop in 6 weeks and leaves a month later.

OR

Sow the seeds in situ in the fall.

Self sows prolifically in gardens.

E *Penstemon virens* (Blue Mist or Front Range Beardtongue) - Plantaginaceae

Sow the seeds in cells or in situ 2 months before the last frost date. v/C.

Leaves emerge in 2.5 months.

M *Penstemon virgatus* var. *asa-gray* (Oneside Penstemon) - Plantaginaceae

syn. *P. unilateralis*

40(8w), v/C. Germinate around 65-70°.

OR

In mid winter sow the seeds in situ or in cells/pots placed outside.

E Pericome caudata (Mountain Tail-leaf) - Asteraceae

More than one seed grown plant is necessary to produce fertile seeds.

Collect seeds late Aug-Sept. Store dry. Viability unknown. First year seeds seem to germinate best.

40(6w) - 65-70, v1C

Radicles begin to emerge in 16 days if cold stratified in the fridge. Leaves emerge when temps are 65-70°.

Phacelia hastata (Silverleaf Phacelia) - Hydrophyllaceae

Store the seeds dry at 40°.

Cold stratify for 3-4 months to break the seed dormancy. This can be done several ways.

1. Soak the seeds in tepid water for 24 hours, mix with a small amount of vermiculite or sterilized sand, add water to just barely moisten the mix, refrigerate for 3-4 months. Check the bag once a week for moisture level and any possible mold or even radicle emergence. Sow, cover with 1/4" of soil, expose to 70°.
2. Sow in situ in early winter. Cover seeds lightly.
3. Sow in cells/pots, cover seeds lightly and place the container outside all winter, covering with snow or watering during warm dry periods.

https://plants.usda.gov/plantguide/pdf/pg_phha.pdf

In early Dec., I soaked seeds for 24 hours, sowed, covered to depth and put the cells outside. 69% of the seeds produced true leaves in 4.5 months.

Phlox longifolia ssp. brevifolia (Longleaf Phlox) - Polemoniaceae

Regional.

In Dec., sow, C. Place outside. Leaves emerge in 3.5-4m. 80%. Pot in 1-2w.

E Physalis longifolia (Longleaf Ground Cherry) - Solanaceae

In early Nov., sow in cells. Cover. Put outside. Germinate heavily in 6.5 months or when temperature is 70°.

M Physaria bellii (Front Range Twinpod) - Brassicaceae

40(6w). v1C. Sow in cells or in situ. In mid April (FR, 5690'), sow in cells containing germination mix. Leaves emerge in 50-60 days.

In two weeks, bump up to a 2.5" pot of well draining mix plus soil spiked with some broken cement (3 parts potting mix, 1 part soil).

Plant by early July.

Polanisia dodecandra ssp. trachysperma (see Cleome)

Polemonium brandegeei (Brandegee's Sky Pilot) - Polemoniaceae

One to two months before your last frost date, sow the seeds in situ or in cells/pots. v1C. Put outside. Cotyledon leaves emerge when the temperature is 65° part of the day. Bump up in 3 weeks, using well draining mix.

Polemonium foliosissimum (Leafy Jacob's Ladder) - Polemoniaceae

The seeds form a gel when soaked in water. Frog eggs are difficult to separate out into cells.

Sow dry seeds in cells about 2 weeks before your last frost date. Cover very lightly, water well and put outside. Cotyledon leaves emerge in 18 days. My germination rate with newly purchased seeds was 20%.

Some folks use no cold stratification and others recommend 2 months cold treatment or fall sowing.

M *Pulsatilla nuttalliana* (Pasque Flower) - Ranunculaceae

Sow outside from fall to early spring. Sow on the soil surface and cover with a thin layer of sand.

Western Native Seed and Prairie Moon Nursery.

First year seeds, deplumed, sown in early March on germination mix in cells, covered lightly with grit and put outside (FR, 5690') germinated 100%.

E *Ratibida columnifera* (Prairie Coneflower) - Asteraceae

Sow outside in fall or spring, It C. Cotyledon leaves in 8-21 days at 70° (slower if lower temp).

No strat or strat works.

E *Rudbeckia hirta* var. *pulcherrima* (Black-Eyed Susan) - Asteraceae

Annual, Biennial or Perennial

No pretreatment required according to most sources. *R. hirta* has varieties over most of the country so seed germination protocols could vary considerably.

Sow by the end of May. vIC.

They germinate within 2 weeks. Avoid overwatering and thin seedlings.

E *Rudbeckia laciniata* var. *ampla* (Cutleaf Coneflower) - Asteraceae

40(30d) in the fridge or outside. Sow 70-75°, It C. Some germinate in 9-10 days. Others will continue to germinate into very hot weather.

E *Salvia azurea* var. *grandiflora* (Azure Sage, Pitcher Sage) - Lamiaceae

Unstratified seed can be planted in the fall or stratified seed can be planted in the field in the spring.

With no cold, moist stratification approximately 40 percent of the seed will germinate. Pretreatment of cold, moist stratification for 4 to 8 weeks will increase total germination to around 80 percent.

https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/kspmcf8483.pdf

E *Salvia reflexa* (Rocky Mountain Sage) - Lamiaceae

Annual.

Sow in situ or in cells in the fall. Cover the seeds to depth. Germinate several weeks before last frost in the spring.

The blue blooms are quite small, but the plants bloom all summer well into fall if sheared a few times. This species is a prolific seeder and would make a good green mulch. It does not get out of control if planted with prairie grasses.

E *Scabrethia scabra* (Whitestem Sunflower) - Scabrethia

syn. *Wyethia scabra* - Asteraceae

Purchased seeds (unknown age but more than 2 years) sown in cells, in Feb., in Lakewood, 5690', covered and put outside developed cotyledon leaves (50%) in 40 days, early April, more than a month before the last frost date.

Tolerate transplanting well.

Scrophularia macrantha (Red Birds in a Tree) - Scrophulariaceae

New Mexico.

No pretreatment is required. Sow the tiny seeds, cover **very** lightly, and expose to 70°. alplains.com

M *Sedum lanceolatum* (Stonecrop) - Crassulaceae

After-ripen the seeds for 4-6 months at 40 or 70°.

Collect seeds mid to late July. Seeds seem to lose viability over 4 years even when stored at 40°.

Cold stratification is not necessary but will not harm the seeds.

Sow in early May (temps 50-60° and fluctuating). Surface sow. Mist or provide high humidity chamber.

True leaves appear in 3-10 days.

Bump up to pots with well draining medium and water sparingly.

Easy to germinate but difficult to maintain in pots.

Senecio flaccidus var. flaccidus (Theadleaf Ragwort) - Asteraceae

Sow in situ or in cells in early spring, late April to mid May in the FR. vIC.

Germinate in 2 weeks.

Senecio spartioides (Narrow-leaved Butterweed) - Asteraceae

Follow directions for *Senecio flaccidus*.

Solidago spp. In order to collect fertile seeds, you must have more than one seed grown plant.

After-ripen: Store seeds dry for 4-6 months to allow the embryo to mature.

Light requirement.

Sow after last frost date. 70-75°, vIC. Leaves emerge in 1-3 weeks.

Goldenrods generally do not need cold stratification, but it probably does no harm to sow outside a month before the last frost date. Sowing in the fall could result in a larger loss of seeds.

Solidago altissima (Late or Canada Goldenrod) - Asteraceae

syn. *Solidago canadensis*

Reproduces aggressively by rhizomes.

Solidago gigantea (Giant Goldenrod) - Asteraceae

Likes a bit of moisture so the medium does not have to be well draining.

Solidago multiradiata (Rocky Mountain Goldenrod) - Asteraceae

Rhizomatous.

It occupies similar sites to those of *S. simplex*, and they can hybridize.

Solidago ptarmicoides (Prairie Goldenrod) - Asteraceae

White ray flowers.

Solidago simplex var. simplex (Mt. Albert Goldenrod) - Asteraceae

Tends to clump. Grows well in gardens at elevations below it's recorded range.

M Sophora nuttalliana (Silky Sophora, Necklace Pod) - Fabaceae

Cleaning is a challenge. Enveloping the loment completely in a tarp (to contain runaway seeds) and stomping with heavy soled boots would work. Sandpapering with coarse sandpaper, then crushing with a rolling pin and finally scraping around on a strong soil sieve wire works but is time consuming.

Seeds can be stored dry for many years at 40-70°.

Before sowing, scarify the seeds with sandpaper and a boiling water soak. Inoculate (opt). Sow the seeds in deep cells or in situ either in late fall or in spring. Cover the seeds well.

Mature plants are rhizomatous.

D Sphaeralcea coccinea (Scarlet Globemallow) - Malvaceae

Store the seeds dry at 40°.

There is a woody mericarp enclosing each seed. It does not have to be removed, but it does help to breach it. Scarify the seeds with sandpaper followed by a boiling water treatment and water soak. Cold stratify outside in cells or in situ, lt C. Radicles emerge erratically from 38-60+ days which makes stratification in the fridge inconvenient. My germination % is very low.

D *Sphaeralcea munroana* (Munro's Globemallow) - Malvaceae

Store the seeds dry at 40°. Starting about 8 weeks before the last expected frost, scarify the seeds with sandpaper and a boiling water treatment. Cold stratify for 6 weeks. Sow and cover the seeds **very lightly** if the mericarp has been removed which may be the situation with purchased seeds. Expose to 70°.

D *Sphaeralcea parvifolia* (Small-leaf Globemallow) - Malvaceae

See *S. munroana*.

M *Stanleya pinnata* (Prince's Plume) - Brassicaceae

Many online references say that *Stanleya pinnata* seeds are not dormant and require no cold stratification. For 2 years, that technique did not work for me.

Add two steps: a gibberellic acid soak and cold stratification. Mix 3 Tbsp distilled water + a tiny bit (just dust on the end of a palette knife) of gibberellic acid (The Science Company, Lakewood, CO). Add the seeds and soak overnight. Cold stratify 3 months outside. Soaking the seeds reveals a thin covering of gel around each seed. If you cold stratify in the fridge, the seeds will clump together and be difficult to sow. I also found that some seeds developed a radicle in just 2 weeks when cold stratified in the fridge.

The Extension Service at Utah State University has a site called Native Plants in the Landscape. An article from that source is referenced by fs.fed.gov. They suggest cold stratification for 90 days and to "sow seed to a depth of 1/4'' in a well drained, peat-based soil-less substrate".

E *Symphotrichum ericoides* (White Heath Aster) - Asteraceae

Store seeds dry at 40 or 70°.

No pretreatment is required. Sow a week or two after the last frost date in spring. vIC

E *Symphotrichum laeve* var. *geyeri* (Smooth Blue Aster) - Asteraceae

40(30d) either in the fridge or outside. Sow at 70, vIC. Leaves in 7-9d. Pot 2-3w later.

E *Symphotrichum oblongifolium* (Aromatic Aster) - Asteraceae

Follow directions for *S. ericoides*.

Symphotrichum porteri (Smooth White Aster) - Asteraceae

After-ripen dry 4-6m at 70. Sow at 70, vIC.

Tetraneuris acaulis (Stemless Four-nerve Daisy) - Asteraceae

syn. *Hymenoxys acaulis*

Store seeds dry 70 4-6m. Sow 64°, vIC. Intolerant of overwatering and root disturbance.

***Thalictrum* spp.** (Meadowrues) - Ranunculaceae

Store dry seeds longterm at 40° or lower.

40(8w) fridge or outdoors. Sow 68 day and 50 night, lt C. Radicles in 15-30d. Leaves in 3-4w.

E *Thelesperma filifolium* (Stiff Greenthread) - Asteraceae

Annual.

Cold stratify 2-4 weeks. Do it in situ or in cells outside, not a baggie in a fridge, The radicles emerge in 9-17 days. vIC.

M *Thelesperma megapotamicum* (Hopi Tea Greenthread) - Asteraceae

Perennial.

Sow in cells or in situ in mid March (about 7 weeks before the last frost date). Cover lightly.

Leaves emerge in 2 months when temps are around 60-65 and fluctuating widely night to day.

D *Thermopsis rhombifolia* (Goldenbanner) - Fabaceae

Scarify with sandpaper. Do a boiling water soak until the seeds swell. You may need to repeat the boiling water soak. Sow. Cover to depth. Expose to 70°.

They can also be scarified and sown in the fall.

E *Verbena stricta* (Hoary Verbena) - Verbenaceae

Store seeds dry at 40 or 70°.

49(60d) in the fridge. Sow, vIC. Leaves appear in 9 days.

Verbesina encelioides (Golden Crownbeard) - Asteraceae

Regional.

Annual.

This species is both self and cross pollinated.

In fall, surface sow in situ.

OR

In spring, surface sow the seeds in situ or in pots. If the crop is too heavy, snip off some of the seedlings.

M *Viola nuttallii* (Yellow Prairie Violet) - Violaceae

"I find the fullness of the seed to range from full to empty. I collect the entire above ground part of the plant when the first capsules dehisce and let them finish in a paper sack. I screen it as best as I can. I find the best way to separate these seeds from similar chaff is to gently move a sloping, flat surface and let them roll away from the debris. It can be done with a fan, but this is more efficient as far as yield. You still need to blow away some of the empty seeds."

Rick Brune email 6/21/21

The seeds need a period of cold stratification. Either sow them in situ upon collection or sow them as soon as you receive them. The seeds can be held dry until early fall of the year collected. The seeds have an aril which suggests a long dry period in dry storage would be detrimental. Most plants with an aril are ant dispersed so ants may move them from where you sow them to another spot.

Sow the seeds in situ and cover them with about 1/8" of soil or grit. Label the location so you will not disturb them before they can germinate early the following spring.

E-M *Wyethia amplexicaulis* (Mule's Ears) - Asteraceae

Store the seeds dry at 70° for 6 months (after-ripen).

40(90d) outside in the winter or in the fridge. Sow, lt C. Leaves emerge at 60-70° in 2 weeks.

Wyethia scabra - see *Scabrethia scabra*

Xanthisma spinulosum (Spiny Goldenweed) - Asteraceae

Clean to remove chaff. Store dry at 40 or 70 for 6 months.

Sow 70, vIC.

Yucca baccata (Blue Yucca) - Asparagaceae

“Yuccas will germinate promptly from fresh seed held over winter (in moist sand in the fridge). Seeds germinate best in 60-70 degree temperatures. Yuccas may also be grown from rhizomes, stem cuttings, or by digging offsets from the side of established plants. Transplant into a well draining medium.” wildflower.org

M Yucca glauca (Great Plains Yucca) - Asparagaceae

Check the seeds carefully for insect predation. Discard seeds with holes. Put in the freezer for 2 weeks.

Sow the seeds at 70°. Cover lightly. They will germinate erratically over 3 months.

Fall sowing should work as well.

Zinnia grandiflora (Rocky Mountain. Zinnia) - Asteraceae

Sow in situ or in cells from mid spring to early summer, 65-75, ItC. Germination may be erratic.

Zizia aptera (Heartleaf Golden-Alexanders, Meadow Zizia) - Apiaceae

Collect seeds in a paper bag Aug-Sept when the seeds roll easily from the umbel. Store at 40°.

Sow in cells or in situ outside in fall or at least by the first of the new year. Cover. Germinate in cool temperatures (in about 3.5 months if sown the first week of January).

Bloom in 2 years.

SHRUBS

M Amorpha canescens (Lead Plant) - Fabaceae

Scarify with sandpaper and a boiling water soak. 40(30d). Inoculate (opt.). Sow 70° on well draining mix in deep cells or pots, vIC. Germinate in 1 week.

M Amorpha nana (Dwarf or Fragrant Wild Indigo) - Fabaceae

Treat the seeds the same as *A. canescens* seeds.

M Atriplex canescens (Fourwing Saltbush) - Amaranthaceae

The plants are usually dioecious, ie. male and female flowers are on separate plants.

After-ripen (store dry at 70°) for 90 days. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-274. 2012 , p 69.

Soak the seeds in water for 24 hours. 40(5d). Sow and cover well.

Seed can also be sown in situ in fall or early spring and covered well. westernnativeseed.com

When I used the fridge for the cold stratification, about 1/4 of the seeds germinated (radicles emerged) 5 days after putting in the fridge. The rest of the seeds never germinated.

Sowing soaked and cold stratified seeds directly into a 2.5” pot containing well draining mix in mid February works well.

When advancing from cells to a small pot, use a very well draining medium. This species can rot easily in pot culture.

Berberis aquifolium (Holly-leaved Barberry) - Berberidaceae

Pacific Northwest native plant.

Seed production is best when you have more than 1 seed grown plant. Remove flesh.

Soak the seeds for 24 hours. 40(180d) either in the fridge or outside. Cover with 3/8" medium.

Berberis fremontii (Fremont's Barberry) - Berberidaceae

Remove flesh from the fruit.

Warm stratify for 3 days or more. 40(2-3m). Radicles emerge in 5.5-8.5w. Cotyledon leaves emerge 1-2w later. Cover seeds to depth when sowing.

In the Front Range, seeds started in the middle of January had to be kept under grow lights. A later start date would allow adaptation to outdoor conditions sooner.

B. fremontii only has physiologic dormancy while some other species in the genus have morphophysiological dormancy. Baskin, Baskin and Susan E. Meyer. www.jstor.org/stable/3672059

Berberis repens (Creeping Oregon Holly) - Berberidaceae

Soak and ferment the berries for a few days. Remove the soft dark blue flesh. An immersion blender is helpful and does not harm the seeds if the blade is dull.

Warm stratify the seeds for 90-120 days followed by cold stratification 90-120 days. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-274. 2012 , p 69

Cover the seeds to depth.

Ceanothus spp. (Redroot, Jersey Tea) - Rhamnaceae

Sandpaper scarify the seeds followed by a boiling water treatment and 24h soak. 40(60-90d). The stratification may not be necessary, but it will not hurt.

Cercocarpus ledifolius (Curl-Leaf Mountain Mahogany) - Rosaceae

60-90 days cold-moist stratification. Sow outside in fall to early spring. <https://klamathsiskiyouseeds.com>

Cercocarpus montanus (Birchleaf Mountain Mahogany) - Rosaceae

De-plume the seeds and store the seeds dry at 40°. The plume drills the seed into the ground in nature, but in horticulture, we cover the seeds with some medium.

Soak the seeds in water for 30 minutes. 40(1m). Sow at 70, v1C. First leaves appear 17 days after sowing.

Seeds can be soaked, and direct sown in the garden about a month or more before the last frost date. Cover the seeds lightly.

Chamaebatiaria millefolium (Fernbush) - Rosaceae

Regional native.

Sow outside in fall or early winter. Cover seeds to depth.

Fresh seeds are nondormant, whereas stored seeds require 1 to 3 months of chilling to overcome dormancy. The optimum temperature range for germination of southwestern populations is 18 to 26 °C (65-80°F). https://www.fs.fed.us/rm/pubs_other/wo_AgricHandbook727

With fresh seeds cold stratification is ok but reduces the germination rate. Norman C. Deno, Seed Germination..., First Supplement, p30.

E *Ephedra viridis* (Mormon Tea, Green Ephedra) - Ephedraceae

Sow in well draining soil, C, 40(1m) outside. Germinate (radicles) in 19 days. Leaves emerge in another 29 days. Bump up as early as a week after leaves appear.

E *Ericameria nauseosa* (Rabbitbrush) - Asteraceae

Whether standard sized or dwarf this plant can self seed voraciously.

Use fresh seeds.

Sow in late fall either in situ or in cells. vlc (light requirement).

They germinate about 4 weeks before the last frost in spring.

Sow in Dec. rather than in spring to have plants ready for spring sales or swaps.

E *Eriogonum effusum* (Spreading Buckwheat) - Polygonaceae

Collect seeds Sept-Oct. Store dry at 40°.

Sow in early Feb. It C. Radicles begin to emerge in 38d. Leaves emerge when temperatures hit about 60-65°. Bump up can begin 3-4w later. Pot in well draining mix.

E *Fallugia paradoxa* (Apache Plume) - Rosaceae

Collect seeds when the pink plumes turn white and the seeds are easily plucked. Dry and remove the style (plume). This will provide better soil contact for the seeds when they are sown.

In more southern states with summer rains, no pretreatment is necessary. In CO, store the seeds dry at 40°. One month before the last frost, 40(1m) - 70, It C.

D *Fendlera rupicola* (Cliff Fendler-bush) - Hydrangeaceae

Alcohol sterilization, soak 24h; 40(2m) fridge; sow, vlc, 60-70. Cotyledon leaves in 19d.

Require excellent drainage. I have not managed to keep seedlings alive (FR 5690') after moving to pots with well draining soil. I may have overwatered.

G *Gutierrezia sarothrae* (Broom Snakeweed) - Asteraceae

Sow heavily in spring., vlc. Mist or bottom water or cover with glass or plastic.

The seeds should germinate in 7 days at 70°.

M *Holodiscus discolor* var. *dumosus* (Rockspirea) - Rosaceae

Store the seeds dry at 40° for 6 months to allow the embryo to mature (after-ripen).

The tiny seeds may have a low 7% viability, and they have a deep dormancy. [fs.fed.us/database](https://www.fs.fed.us/database)

At the Denver Botanic Gardens, the horticulturists treat the seeds with sulfuric acid, cold stratify for 4.5 months, treat with Wright's Liquid Smoke and then surface sow. The tray of cells goes under mist at 70°.

Cold stratification for 4 months is necessary. I have had excellent germination when I sow in Nov-Dec. I treat the seeds with liquid smoke, sow in cells, vlc, and put outside. They germinate about 1 week into April (FR, 5690').

Physocarpus monogynus (Mountain Ninebark) - Rosaceae

Collect seeds in Aug. in the Front Range.

Sow seeds mid-March (5690', FR), vlc, outside. Tiny leaves emerge in about 1m. In 1m more, transplant in an intact clump into well draining soil. Avoid over watering.

Cuttings: The ninebarks are easily propagated by softwood cuttings planted under mist, or hardwood cuttings planted in the field (Everett 1981; Dirr and Heuser 1987), (USDA Woody Plant Seed Manual, 2008, pg 792)

E Prunus americana (American Plum) - Rosaceae

Remove the flesh (aril) from around the pits.

Shortly after cleaning, sow in situ or in pots outdoors. Cover to depth. They germinate in about 7 months in cool temperatures, including some frosts.

Cold stratification for 3 months or more could be done in the fridge.

Protect from rabbits when young.

Prunus pumila var. besseyi (Sand Cherry) - Rosaceae

Clean ASAP. Embryos have a dormancy period of several months, but dry storage reduces viability down to <30%. Store in barely moist perlite or vermiculite in the fridge over winter which accomplishes 3 months or more of cold stratification. Sow in spring, cover, protect from birds. Seedlings have two pairs of true leaves by early June.

Softwood cuttings, IBA/NAA dip, take in cool part of day. Stick right away. They don't recover from wilting. Phillips, Judith, "Plants for Natural Gardens", p 64.

Prunus virginiana var. melanocarpa (Chokecherry) - Rosaceae

Warm stratify the seeds in moist sand for 2 weeks. Then cold stratify (36-41 degrees) for 60-90 days. Plant well before high temperatures. wildflower.org

70(2w) - 40(8-12w) - 65-70, C

Purshia tridentata (Antelope Bitterbrush) - Rosaceae

40(2w) in fridge, consistent radicle development in 2w - sow in deep cells or pots at 65, med C. True leaves develop 55-60d after sowing in cool temperatures. They are frost tolerant. Do not overwater.
OR

In winter, sow in deep pots in very well draining soil, cover just to depth, and put outside.

E Rhus glabra (Smooth Sumac) - Anacardiaceae

Dioecious

Collect the seeds when they strip easily from the rachis.

The red drupes have an oily mesocarp. The fruits can be cleaned after collection or stored at 40° dry until winter and cleaned when they are drier. Rub them on a sieve to remove the red mesocarp.

Another cleaning method is to "Place the seed heads in a plastic grocery bag, once they are completely dry. Tie the bag shut, and bang it against a hard surface to separate the seeds from the berries." <https://homeguides.sfgate.com/grow-rhus-glabra-seeds>

When you are ready to sow the seeds either fall or late winter, scarify the seeds with acid or sandpaper or a blender with plastic blades. Give them a boiling water treatment and soak for 24h or 2-3d. If the seeds are imbibing water, they should sink. After treatments, sow in containers or in situ.
40(2-3m) - 65-70, C

If using the fridge, start the treatments in Jan-Feb. Sow in April-May. The seeds germinate quickly. Leaves emerge in 10 days at 65°. The seedlings can be potted 3 weeks later.

Rhus trilobata var. trilobata (Skunkbush or Aromatic Sumac) - Anacardiaceae

Dioecious.

Follow the directions for *Rhus glabra*.

Ribes americanum (American Black Currant) - Grossulariaceae

Soak and ferment the black berries to remove the fruit from the seeds.

Cold stratify the seeds in the fridge or outside for 90-120 days. They can be sown in cells or in situ.

www.fs.fed.us/database/feis/plants/shrub/ribame

Location matters. This species grows in “shady places along streams (and in) moist meadows, 5500-7500’.” Ackerfield, Jennifer, “Flora of Colorado”, 2022, p 525.

Ribes cereum (Wax Current) - Grossulariaceae

Soak and ferment the berries to remove the fruit from the seeds.

Soak in water for 24h. 40(4m) - 65-70, It C.

M Rosa woodsii (Smooth or Woods’ Rose) - Rosaceae

syn. *Rosa blanda*

Remove fleshy material promptly after collection. Put the fruits in a small bowl with enough water to cover the seeds by 1 inch. Let the concoction ferment for several days. When the fruits soften, remove the seeds.

Sow in early fall, scarify the seeds with sandpaper, boil soak 24h, cover.

Scarify, soak, 70(3m)-40(3-4m)-70C.

Sambucus racemosa (Red Elderberry) - Adoxaceae

Soon after collection, soak/ferment the fruits and remove the fleshy material. The seeds can be stored dry.

Scarify, 70(2m) - 40(3m) - 70L.

Directions are roughly based on the FS database. <https://www.fs.usda.gov/database/feis/plants/shrub/samrac>

Shepherdia argentia (Silver Buffaloberry) - Elaeagnaceae

Soak 24h, 40(3m) - 65-70C.

Symphoricarpos albus (White Snowberry) - Caprifoliaceae

70(3m) - 40(4m) - 70 USDA Forest Service Gen. Tech. Rep. RMRS-GTR-274. 2012, p 69

Scarification before the start of stratification may be necessary.

WOODY VINES

Parthenocissus quinquefolia (Virginia Creeper) - Vitaceae

Introduced to CO from eastern states.

“Collect fruits after they have turned bluish black by hand-stripping from vine. Extract seeds from pulp and air-dry. Store in sealed containers at 42 degrees.

Sow seeds in fall or stratified (in moist sand or peat for 60 days at 41 degrees.) and sow in spring.”

wildflower.org

Cover the seeds 1/4”.

D Smilax lasioneura (Blue Ridge Carrionflower) - Smilacaceae

Soak, ferment and macerate the blue berries to remove the fleshy material around the seeds.

40(60d or more). Cover to depth. They may take a few years to germinate. Sowing in situ may be the easiest method.

SEDGES

Carex brevior (Short-beaked Sedge, Plains Oval Sedge) - Cyperaceae
40(60d) - prairiemoon.com. The perigynia are removed from their seeds.

Carex hystericina (Bottlebrush Sedge) - Cyperaceae
40(60d) - prairiemoon.com.
40(60d) - prairielegacyinc.com. The perigynia are on their seeds. Scarify.

Carex nebrascensis (Nebraska Sedge) - Cyperaceae
Nebraska sedge can be efficiently germinated in nurseries if perigynia are removed by scarification and achenes stratified 32 d at 3 °C (37 °F) with a sphagnum peat moss substrate. <https://www.fs.fed.us/rm/pubs/npn.rngr.net/renderNPNProtocolDetails?selectedProtocolIds=cyperaceae-carex>

GRASSES

Many grasses, especially warm season grasses, benefit from big temperature swings anywhere in the range of 80-90° in the day to 34-50° at night.

Protect the seeds from birds and small mammals whether you sow in cells or in situ.

Spring-summer planting of grasses is desirable.

Cool season grasses thrive if planted before June 1 (FR). Cool season grasses left in cells in the heat of summer easily rot from overwatering and heat. Many cool season grasses tolerate part shade.

Warm season grasses can be planted into the summer. Fall planting of warm season grasses may succeed if the plants have a substantial root system which is not divided. Warm season grasses do not grow over the fall and winter so the plants just sit in the hole in the ground. They begin active growth when temps warm in spring.

E-M *Andropogon gerardii* (Big Bluestem) - Poaceae

Warm season.

Store seeds dry at 40°. Sow seeds at 75-80° (a germination blanket might be helpful to achieve the desired warm temps but temps should drop dramatically every night).

Big Bluestem has a low percentage of fertile seeds. I collected at least 5 ecotypes of seeds and established them in a meadow. Thereafter, I collected many more fertile seeds.

Andropogon hallii (Sand Bluestem) - Poaceae

Warm season.

Grows on the top of sand dunes.

It is related to Big Bluestem, and it has the same fertility issues. It may have few fertile seeds in the inflorescence.

Store seeds dry at 40°.

Seeds do not require cold treatment to germinate. They germinate in the fall and overwinter as seedlings. [fs.fed.gov/database](https://www.fs.fed.gov/database)

No pretreatment. Plant seeds outside fall or spring 1/8 to 1/4" deep. - westernnativeseed.com

E *Bothriochloa laguroides* (Silver Bluestem) - Poaceae
(syn. *Andropogon saccharoides*)

Warm season.

At 5690', seeds sown in mid March germinate within 2m. Sow in cells or in situ. Cover very lightly and put the cells outside.

They bloom the first season.

E *Bouteloua curtipendula* (Sideoats Grama) - Poaceae

Warm season.

Store seeds dry at 40°.

From mid March-mid May sow outside in cells or in situ. Cover to depth. The seeds do not require a pretreatment (cold stratification), but they germinate best when they are exposed to large temperature swings (70-90° with nights 35-45°). They will germinate in 2-7w. The plants often bloom the first year.

M *Bouteloua gracilis* (Blue Grama) - Poaceae

Warm season.

Store dry at 40°.

Sow mid April to mid May in situ or in cells. Cover lightly. Germination seems lower than in some of the other warm season grasses. Be generous when sowing the seeds.

Seeds collected from a cultivar such as 'Blonde Ambition' will probably be fertile, but the plants produced will not have the exact features for which the cultivar was selected.

M-D *Buchloe dactyloides* (Buffalo Grass) - Poaceae

syn. *Bouteloua dactyloides*

Warm season.

Purchased seeds primed with KNO₃ sown after the last frost day, germinate in less than 3w. Wild collected seeds may need to be older or have a cold stratification period. It C.

E *Deschampsia caespitosa* (Tufted Hairgrass) - Poaceae

Cool season.

Sow heavily in cells or in situ in mid March in the Front Range, It C.

Heavy germination in 1m. Began to pot mid May.

E *Elymus canadensis* (Canada Wild Rye) - Poaceae

Cool season. Partial shade to sun.

Sow early-mid April in the FR. vIC. They germinate in 11-17d. If you sow them in situ, protect the seeds from birds. If grown in cells, plant the plants by June.

They may bloom the first year.

E *Elymus elymoides* (Squirreltail) - Poaceae

Cool season.

Collect seeds mid June to mid July. The inflorescence tumbles. Store dry at 40-70°.

No pretreatment is required. Sow in situ or in cells about 2w before the last frost date. Cover with 1/8-1/4" of soil. The seeds germinate in about 2w.

They can be moved from cells to small pots in 2-3w.

E *Elymus glaucus* (Blue Wildrye) - Poaceae

Cool season.

Seeds sown mid March in the FR and covered lightly germinate in a month or less.

Pot or plant plugs directly into the ground before June 1.

E *Elymus trachycaulus* (Slender Wheatgrass) - Poaceae

Cool season.

Treat the same as *E. glaucus*.

E *Festuca arizonica* (Arizona Fescue) - Poaceae

Cool season.

About the third week in March (in the FR, 5690'), soak in tepid water for 24h. Sow in cells and cover by 1/4". Leaves emerge in 24d. Pot as early as one week later if you have a clump of plants.

E *Festuca idahoensis* (Idaho Fescue, Blue Bunchgrass) - Poaceae

Cool season.

Treat the same as *F. arizonica*. The water soak is not necessary.

E *Festuca saximontana var. saximontana* (Rocky Mountain Fescue) - Poaceae

Cool season.

Treat the same as *F. arizonica*. The water soak is not necessary.

E *Festuca thurberi* (Thurber's Fescue) - Poaceae

Cool season.

Treat the same as *F. arizonica*. The water soak is not necessary.

E *Hesperostipa comata* (Needle & Thread) - Poaceae

syn. *Stipa comata*

Cool season.

In mid March (in FR 5690'), sow in cells. Scarification does not hurt but is not necessary. Cover 1/8" deep. Put outside. Leaves emerge in 34-44d. Plant the cells or pot within a few weeks.

Hilaria jamesii (Galeta) - Poaceae

Warm season.

Sow about m before the last frost date or through the summer, lt C. Germinate from 14d to 2m depending on the temperature.

E *Koeleria macrantha* (Junegrass) - Poaceae

Cool season.

Mid March (in the FR, 5690'), sow pinches of seeds in cells, vIC. Put outside. Leaves emerge in about 1m in cool temperatures.

E *Muhlenbergia montana* (Mountain Muhly) - Poaceae

Warm season.

Sow the seeds 2w before your last frost date in the spring or on into the summer, vIC. Put outside. Leaves emerge in 1-2w.

E *Nassella viridula* (Green Needlegrass) - Poaceae

Cool season.

In the FR (5690') collect seeds in July. Store dry until the next spring.

In early to mid March, sandpaper to scarify the seeds. Cold stratify 2 months in the fridge. Sow around your last frost date, vIC. Begin to show a few leaves in 1w.

E *Panicum virgatum* (Switchgrass) - Poaceae

Warm season.

Sow seeds anytime from April 1- May 1, in cells kept outdoors or sow in situ. Cover lightly. Switchgrass germinates best when the seeds receive large temperature swings (70-90° day-34-50° night). Leaves emerge in 22-25d.

E Pascopyrum smithii (Western Wheatgrass) - Poaceae

syn. *Elymus smithii*

Cool season.

Cold stratify for 2w or sow 2w before your last frost date. Pretreatment is not required but speeds germination a bit. Cover well to provide dark. Germinate in 8d if cold stratified.

Rhizomatous and tends to form monocultures.

E Schizachyrium scoparium (Little Bluestem) - Poaceae

Warm season.

Sow April 1 to mid summer in cells or in situ, lt C. Leaves emerge in about 20d.

E Sorghastrum nutans (Indian Grass) - Poaceae

Warm season.

Store seeds dry at 40°.

Sow anytime from April 1- May 1, in cells kept outdoors or in situ, lt C. Germinate in 30-48d.

E Sporobolus airoides (Alkali Sacaton) - Poaceae

Warm season.

Collect seeds in the fall and store dry to after-ripen until the spring.

Sow in mid March in the FR (5690'), med C. Large temperature fluctuations speed germination which can occur anywhere from 2-6w. Pot or plant plugs anytime after the leaves are 1.5"-2" tall.

E Sporobolus heterolepsis (Prairie Dropseed) - Poaceae

Warm season.

Sow about 5-6w before your last frost date, vIC. Germinate around the last frost date and can be potted or planted 2 weeks later.

Flower the first season.

FERN ALLIES

Marsilea vestita (Buffalo Clover) - Marsileaceae

"Marsilea is infrequently found in intermittent pools in small drainages on the Pawnee National Grassland. They are often classified as buffalo wallow plants. The areas are often heavily trampled by cattle which may serve to scarify the sporocarps. They produce floating fronds when water is present. As the water recedes, sporocarps are produced on the drying mud flats. Eventually the fronds shrink as moisture disappears. Then they bake in the hot sun on scorching soil during the summer. I believe their habitat is usually quite dry during the winter and the plants regrow with spring moisture. They do not do well indoors for a long period of time.

My procedure for growing it from sporocarps is as follows:

Scarify or cut in half the sporocarps. [Jan suggests large nail clippers.]

Outdoors! Place on soil (mine is Nunn-Clay Loam) in 0.5 inches of water or less. Add water to soil from bottom to neutralize any chlorination products. Provide different depths from about 1mm to 12mm. [The water is over the top of the soil.]

Sporophylls are produced in one hour.

Germination of megaspores in about 10 days. Fine, grass-like growth. It may or may not help to lightly tip the container to spread the microspores around with the megaspores.

After 3 more days, 200 - 300 grass-like growths 3-4 mm tall.

After 1 day, first fronds begin to appear as broader blade.

After 11 more days, first four-parted fronds appear.

After doing this several times, I think the procedure can probably vary considerable.

Have fun!" email from Rick Brune, 6/12/21

Useful Resource:

free downloads of Deno, Norman, [Seed Germination Theory and Practice 2nd ed. and 2 supplements.](#)

Copy and paste the link below.

<https://naldc.nal.usda.gov/download/41278/PDF>

SEED COLLECTION DATES IN THE FRONT RANGE

To be continued in the next edition.

MAY

Carex inops

Escobaria missouriensis

Lomatium orientale

Vesper montanus

Viola nuttallii

JUNE

Astragalus drummondii

Mertensia lanceolata

JULY

Astragalus parryi

Astragalus shortianus