



Germination Guide for CO Native Seeds

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INTRODUCTION

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.

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, the place of origin, 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 once a year.

The nomenclature reference is *The Flora of Colorado* by Jennifer Ackerfield, 2nd edition, 2022, 2nd printing 2024.

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 nighttime 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

S = scarify

Sx2 - sandpaper and boiling water treatment

strat = stratification

70-80/40 - daytime/nighttime temperatures

Moist stratification timing:

70(40d) = 70° moist for 40 days

40(3m) = 40° moist for 3 months

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

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

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 or bag the capsules.

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), *Viola spp.* (violets) and *Carex inops* (Sun Sedge) 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 legumes, gentians and iris. Freezing well dried seeds for 2 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.

An alternative method for cleaning fleshy fruits other than fermenting and sieving, is to use a hand held 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.

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. Coin envelopes are available in various sizes. 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.

Endogenous dormancy involves some characteristic of the embryo.

Exogenous dormancy involves some characteristic of the seed structure. It can involve the endosperm, the perisperm, the seed coats or the fruit walls.

AFTER-RIPEN

"The changes that occur in dry, dormant seeds after dispersal is known as *after-ripening*." C & M, p. 49

Seeds can be dispersed before the embryo is fully mature and ready to respond to moisture and begin germination. This is an example of morphological dormancy. Maturation can take days or months.

Seeds that have embryo dormancy must be stored until they are mature enough to germinate. Store the cleaned seeds at 70°F at least a month or two. If you have an adequate backlog of seeds, you can use seeds from the previous year's collection for sowing.

"The disappearance of dormancy in dry seeds over time at room temperature is widespread among many seeds and almost universal in cereals. For most cereals, storage for 1-2 months at 15-20 C (59-68° F) suffices to allow maximum germination." C & M, p. 150. This is probably an example of physiological dormancy because "it is controlled by an inhibitor-promotor balance that is altered by exposing the seeds to lower temperatures under imbibed conditions (stratification) or under higher temperature while unimbibed." C & M, p. 152.

TEPID WATER SOAK

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

LEACH CHEMICALS

One of the obstacles to germination may be chemicals in the seed coat. To speed the germination process, either bubble aerate or soak and rinse the seeds for 3 days or more.

To bubble aerate, put about 1.5-2 quarts of water in a container and insert the bubbler end of an aquarium aerator into the water. Place the seeds into a "favor bag", a small mesh bag, available from craft stores. Add a marble to the seeds in the bag to keep the bag from floating. Each day change the water. This set-up does not need to be in natural light.

Lacking an aquarium bubbler, put the seeds in a small glass bowl and soak the seeds for 3 days or more. Again change the water every day. I usually set the bowl on a windowsill. As far as I know, daylight is not required for the leaching process. Light can encourage radicle emergence for other reasons.

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.

Chemical Methods:

Professionals might use sulfuric acid with a strength of 90%. This requires a ventilation hood and serious lung protection. It is also flammable. I am able to buy sulfuric acid 10% from a lab supply house. I still wear goggles, long heavy rubber gloves and an apron. I only use glass, silicone or plastic vessels and utensils. Sulfuric acid reacts with metal.

Hydrogen Peroxide 3%

This is the first aid liquid most of us already own. It is available in the pharmacy section of grocery stores and many other places. Homeowners can try 3% hydrogen peroxide in various concentrations. I use full strength unless I am cleaning mold from seeds enclosed in paper toweling during stratification. Soak the seeds you plan to sow for 15-30 minutes. Using a strainer, rinse the seeds with tap water.

Hydrochloric acid (0.1M)

Hydrochloric acid is the acid in the guts of animals. The pH of stomach acid is 1.5-3.5. HCl is available at hardware stores and through lab supply businesses. It is much less dangerous than sulfuric acid, but it should be handled with care. Wear gloves and protect your eyes. I always do this work outside. I am trying different time periods for soaking seeds: 30 minutes, 1 hour, and 24 hours. Using a strainer, rinse the seeds with tap water.

Physical Methods:

Physical methods include a hand file, an emery wheel, nail clippers 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 falls in the physical category. The following soak might be chemical as well.

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 cool and soak twelve to twenty-four hours before sowing. The seeds should swell to about double in size, especially legumes. If they do not, repeat the boiling water soak on the ones that have not imbibed water.

STRATIFICATION

Seeds that have physiological dormancy require stratification. All stratification involves moisture and temperature changes. "preconditioning imbibed seeds in cool, moist conditions to

promote germination...” (C & M, p. 81). At lower temperatures, more oxygen is soluble in water, and the oxygen needs of an embryo are more easily met. The cycles can begin with a warm moist treatment as well.

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. Place on the north side of a building if possible. Protect the containers from rodents and birds.

To cold stratify 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. Larger quantities of seeds require larger quantities of medium. Once a week, remove the bag from the refrigerator and add water. Feel the medium to decide how many drops of water to add. Check the medium for moisture weekly. If it feels dryish, add a few drops of water.

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 2-3 Tbsp. of sand, vermiculite or perlite, 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 source 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

GROWTH REGULATOR

Gibberillic acids occur naturally in seeds. GA3 is the most common. It is a phytohormone, a plant hormone. It is often used to regulate growth of plants, but in this guide I am writing about the regulation of seed germination. It can mediate most or all of the requirements for germination such as light, temperature, and overcoming inhibitors. It can speed or slow germination and can promote more uniform germination.

A concentration that is too high or an overly long soak time can lead to weak, leggy plants.

In grasses, GA3 helps convert starches in the endosperm into soluble sugars which can more easily travel to the embryo for growth.

Synthetic GA can be purchased but the choices are a bit confusing. It can be sold as a white crystal that is not water soluble, unless purchased as a potassium salt (K-GA). Straight crystalline GA is dissolved in a small amount of rubbing alcohol and then added to water which has been boiled and cooled to sterilize it. GA can also be purchased as a concentrated solution. Powder GA3 lasts 2 years in the refrigerator. Store a solution made from powder in glass in the refrigerator. It is nontoxic but one should label the bottle well. It is not intended for human consumption!

The liquid product used by the horticulturist at the Denver Botanic Gardens, York Street is shelf stable. pers. comm. Brooke Palmer.

If a shelf stable liquid form of GA3 contains 1 gm of active ingredient per fluid ounce, stir 1.5 tsp of the product into 1 liter of water to achieve 250 ppm. Try to use water with a pH less than 8.5. Aim for a neutral pH.

I normally use a concentration from 200-400 ppm.

Soak for 6-24 hours. Having only 2 years experience I usually soak for 6-12 hours. Seeds with an especially hard seed coat might benefit from a longer soak. There is no need to rinse the seeds before sowing.

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. It may also eliminate beneficial bacteria and fungi.

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.

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.

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.

GERMINATION ENVIRONMENT

Outdoors (OT or outdoor treatment), 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 chance of cooking the seeds is high. Know your own situation!

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

MEDIA

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

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 the soil of 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.

Coir - Coir is the fiber from the outside of a coconut shell. Often sea water is used in the processing, consequently, the material can be high in sodium. Be sure to buy horticultural grade coir. Most commercial germination and growing mixes have some starter charges of nutrients that last for several weeks. Coir has none.

I added some coir to a commercial potting mix of peat:perlite:vermiculite and found I overwatered the seedlings and caused plants to rot. Be judicious with water when using coir.

AMENDMENTS

Adding soil to a commercial mix might 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 very 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.

INOCULANTS

When I talk about inoculants, I am referring to Rhizobia bacteria that are applied to seeds in the Fabaceae family (legumes). Inoculants for the bean/pea family help the plant to harness atmospheric nitrogen to make a usable form of nitrogen. Over time the plant will form nitrogen nodules.

There are other inoculants (mycorrhiza and bacteria), but they will probably be species that are not selected for the environment your seeds came from. I believe some commercial mycorrhiza are aggressive and overpower native fungi.

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 (HCl 10% acid 1-3 hours plus rinsing or sandpaper).

Either sow in situ or in very well draining pots which will cold stratify outside. 40(3m). Cover the seeds to depth. Add half sand, gravel or perlite to the seeding or potting mix.

47% germination in 2023 using 2 year old seeds.

Untreated seeds take a few years to germinate.

Seedlings can bloom the first year.

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.

D *Actaea rubra* (Red Baneberry) - Ranunculaceae

Remove the aril (red covering).

Seeds stored dry over the winter at 70° and soaked 24h. 40(3m) - 70(6m) - 40. 65-75% produce a radicle during that cold cycle but do not produce a cotyledon the following warm cycle. They probably need 2 years to germinate and are most easily maintained if sown in situ.

Twice, I have worked with seeds from an exchange that were stored dry. If the seeds were sown promptly after collection and cleaned promptly, they might germinate in 1 year.

E *Agastache urticifolia* (Nettleleaf Giant Hyssop) - Lamiaceae

Store dry at 40°.

Sow mid March to mid May. Stratification is not necessary but some cool temperatures do not harm the seeds. Very light cover. Cotyledons emerge in 2-4w.

Hardy at elevations lower than natural range.

M *Agoseris glauca* (Pale Agoseris) - Asteraceae

Store clean dry seeds at 40-70° until sowing and stratification in April-May.

40(3w) -70, v/C

The main limiting factor seems to be seed fertility.

M *Alciella subnuda* (Coral Gilia) - Polemoniaceae

Biennial. Regional species (AZ, UT)

Sow mid December - early Jan. It C. Put outside.

Cotyledons emerge April - May.

When transplanting, use a well draining medium.

M *Allium cernuum* (Nodding Onion) - Amaryllidaceae

Collect seeds when the white capsule opens to reveal black seeds.

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

Following the after-ripening period, cold stratify 60d. Cover the seeds to depth.

Seeds germinate at 70°.

M *Allium geyeri* (Geyer's Onion) - Amaryllidaceae

Collect seeds when the capsules open.

After-ripen 6 months.

Use 1st year seeds if possible.

40(60d), lt C.

May take over a year to produce cotyledons.

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.

After-ripen 6 months unless sowing right away.

Use 1st year seeds if possible.

Sow in situ shortly after you collect the seeds (July-August) or sow Jan-Feb in a container or in situ.

Light to med cover.

Sowing directly in the ground in the fall or early spring results in higher germination than sowing in artificial mix.

E *Amsonia illustris* (Ozark Bluestar) - Apocynaceae

Regional species. Central MO to KS and TX

Scarify the woody seeds with sandpaper and boiling water soak. 40(8w) in the fridge or by sowing in Nov. in deep cells or in situ.

Cover the seeds to depth.

M *Amsonia jonesii* (Jones' Bluestar) - Apocynaceae

Scarify gently with sandpaper. Follow with a boiling water soak. (Sx2)

40(8w) in the fridge or outside, lt -med C.

M *Amsonia tomentosa* (Wooly Bluestar) - Apocynaceae

(syn. *A. eastwoodiana*)

Scarify gently with sandpaper.

Sow in situ or in pots in late winter to early spring to provide about 4-8 weeks of cold treatment outdoors. C.

4-5 years to first bloom.

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.

D *Aphyllon fasciculatum* (Clustered Broomrape) - Orobanchaceae

Syn. *Orobanche fasciculata*

Two species in CO have been lumped under *A. fasciculatum*.

Aphyllon franciscanum yellow, subcorymbose raceme, tight, same ht to individual flowers, corolla tip shape is acute, pointed, calyx lobe shade is dark tipped, shallower calyx cups or long lobes. holds flowers more upright, can have distal corolla compressed.

Aphyllon fasciculatum has hues of pink, +/- corymbose, corolla tip shape is rounded, calyx lobe shade is even-toned

“*Aphyllon* (Orobanchaceae) of CO”, Adam Schneider, U. Wisc. Lacrosse Professor, 2/10/26 Boulder CONPS Zoom talk

Parasitic on herbaceous plants.

“*A. fasciculatum* - *Artemisia*

A. franciscanum - *Eriogonum*, *Eriotrichium*, *Eriophyllum lanatum*, *Phacelia*, *Poliomintha*, in CA, *Salvia* & *Colubaria*”

Self fertile. The smaller the seeds, the longer they persist.” Adam Schneider

Seeds are ready for collection 34d after they bloom.

Seeds collected in July and sown in situ in Sept. of the same year resulted in 2 plants which is a very low percentage.

Two year old seeds sown in situ did not produce plants.

My propagation information is from just 2 germination attempts so it is far from scientific.

M *Aquilegia barnebyi* (Oil Shale Columbine) - Ranunculaceae

40(12w) - 70, vIC

E *Aquilegia chrysantha* (Golden Columbine) - Ranunculaceae

40(60d) - 70, vIC

Golden Columbine can be sown in situ in late fall or in spring (March-April).

E *Aquilegia coerulea* (Rocky Mt. Columbine) - Ranunculaceae

40(60d) - 70, vIC

I have sown 7 month old seeds in cells, placed outside in late February, vIC and had 60% germination.

M *Aquilegia elegantula* (Red Columbine) - Ranunculaceae

Viability in storage at 40° decreases a great deal by 5th or 6th year.

40(60-90d) - 70, vIC.

Argemone pleiacantha (Southwestern Prickly Poppy) - Papaveraceae

Regional species.

Annual to short-lived perennial.

Sow in situ outside in mid to late fall. Cover lightly.

E *Argemone polyanthemus* (Crested Prickly Poppy) - Papaveraceae

Annual to short-lived perennial. Long lived in my loamy clay at 5690'.

Sow in situ or containers and put outside late fall to early winter. OT, Dec., lt C

Arnica fulgens (Foothill Arnica) - Asteraceae

Collect seeds as soon as the pappus is feathery. Store dry.

40(2m) fridge - 70, lt C

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 are tan and 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. Let the bag of seeds dry for a few days. Add several coins to the bag and shake very hard for several minutes. Cut a small slit in the bottom of the paper bag and shake the seeds out.

Store all asclepias seeds dry 40° for 4-6 months before sowing at temperatures 70-85°.

Treatments and Sowing

"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.

Brooke picks out and sows the seeds that germinate.

FOR ALL MILKWEED SPECIES:

Lacking a greenhouse, start around your last frost date or later, begin a soaking treatment.

Lacking an aquarium bubbler for an aerated water bath, soak seeds in tepid water in a clear bowl on a windowsill. Change the water every day. Radicles emerge in 4-15 days. Even soaking for a day or two is helpful.

Sow in small but deep cells or containers. vIC

Cotyledons in 1-2w.

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

E *Asclepias arenaria* (Sand Milkweed) - Apocynaceae

Radicles emerge in 3d (84% on 2 yo seeds stored dry 40°). Cotyledons emerge within 2 weeks.

E *Asclepias incarnata* (Swamp Milkweed) - Apocynaceae

E *Asclepias latifolia* (Broadleaf Milkweed) - Apocynaceae

Seeds viable at least 4 years.

E *Asclepias pumila* (Plains Milkweed) - Apocynaceae

This is a short, small, rhizomatous species.

E *Asclepias speciosa* (Showy Milkweed) - Apocynaceae

E *Asclepias subverticillata* (Horsetail Milkweed) - Apocynaceae

Toxic for cattle.

E *Asclepias sullivantii* (Prairie Milkweed) - Apocynaceae

Regional species.

E *Asclepias syriaca* (Common Milkweed) - Apocynaceae

Regional species.

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

E *Asclepias verticillata* (Horsetail Milkweed) - Apocynaceae

Regional species.

E *Asclepias viridiflora* (Green Comet Milkweed) - Apocynaceae

E *Astragalus spp.* - Fabaceae

(*A. amphioxys*, *A. asclepiadoides*, *A. bisulcatus*, *A. chamaeleuce*, *A. crassicaupus*, *A. drummondii*, *A. lutosus*, *A. parryi*, *A. shortianus*)

Clean the seeds as soon as possible and check for weevils. Freeze the dry seeds 1-2 weeks if you note predation. Store dry seeds at 40-70°.

Sandpaper, tepid water soak 18-24h, inoculate (opt.), sow in 2.5" pots or deep cells, cover well and put outside. 70°. The radicles begin to emerge in 11 days and continue emergence over the next month.

Plant as soon as the seedlings have 1-2 pairs of true leaves. 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. Some bract material will not interfere with germination.

Store dry at 40°.

Start in late April to May. Soak the seeds in diluted peroxide (1/2 C. tepid water + 1 1/2 tsp. 3% hydrogen peroxide) for 24 hours (opt). Rinse well. Skipping the peroxide soak just adds a few days to the germination time.

Sow in cells or in situ. Cover very lightly for light exposure. Leaves emerge in 10 days.

E *Boechea fendleri* (Fendler's Rockcress) - Brassicaceae

40(6w) outside, vIC

Boechea pusilla (Small Rockcress) - Brassicaceae

WY endemic.

Store dry seeds at 40°.

Surface sow in well draining mix Dec- Feb. Put outside. Cold germinator.

E *Brickellia spp.* - Asteraceae

(*B. eupatorioides* (False Boneset), *B. grandiflora* (Tasselflower Brickellbush))

Part shade tolerant

Fertility is best when more than one seed grown plant is in the vicinity.

40(6w) in fridge or outside. Cover the seeds very lightly. The seeds germinate in 7-10 days at 70° after cold stratification in the fridge. Seeds germinate outside at 55-65° after OT.

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 from 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 the leaves of mature plants.

M *Caltha chionophila* (Marsh Marigold) - Ranunculaceae

syn. *Caltha leptosepala*

Elevation 8,000-13,500'

Seeds do not remain viable in dry storage at 70°.

Clean seeds promptly and sow in situ in a moist site or begin processing.

70D & moist(2-7w) - 25-39°(4-6w)

Use a nondraining container such as a clear produce box. Poke about 4 small holes in the bottom with a hot skewer. Put 1/2" of horticultural charcoal in the bottom. Fill to 1" from the top with mucky

soil or potting mix. Sow the seeds over the medium. Cover to depth. Keep the container covered with snow or hand water if the medium becomes dry.

Cotyledons emerge at 41-54 (70)°, in early April at 5,690’.

M *Campanula rotundifolia* (Harebell) - Campanulaceae

40(30d) either outside or in the fridge, vIC.

Very small cotyledons emerge in 5w.

E *Campanulastrum americanum* (Tall Bellflower) - Campanulaceae

syn. *Campanula americana*

Regional biennial.

Sow Oct-March in situ, It C.

Sow in cells/pots mid March, It C. Germinate within 50d.

E *Cassia fasciculata* (Partridge Pea) - Fabaceae

syn. *Chamaecrista fasciculata*

Annual.

Scarify: Sand or boil soak. If seeds do not swell, redo the boil soak. 40(8w), Inoculant (opt.), C, OT.

Sow in cells or pots in mid-March 5,690’.

Do not scarify if fall-winter sowing in situ.

***Castilleja* spp.**

Store dry 40. Will still lose as much as 40% of viability in 1 year.

D *Castilleja chromosa* (Red Desert Paintbrush) - Orobanchaceae

Treat the same as *Castilleja integra*.

35% of radicles emerged in 35-81d in fridge stratification at 38-40°. Only 1 cotyledon emerged in 2 different years. They died within a month in the 2.5” pot containing a host (*Artemisia ludoviciana* and *Festuca arizonica*). *Artemisia ludoviciana* is aggressive. *Artemisia frigida* would be a better choice as a host plant.

M *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 2-4 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 seed of a host species seems logical, but they are not likely to germinate at the same time.

D *Castilleja linariifolia* (Wyoming Paintbrush) - Orobanchaceae

Hemiparasitic.

Rub the seeds. Give 1-3 months cold stratification or plant outside fall to early spring. Cover very lightly.

Sow beside a host plant in situ (see *Castilleja integra* suggestions) or pot with a host plant when the seedling has 1-2 sets of true leaves.

D *Castilleja miniata* (Red Indian Paintbrush) - Orobanchaceae

40(90d) or plant outside in the fall. Often takes 2 years to germinate. Plant on soil surface or to 1/16th" deep - Western Native Seeds

When the plants have 2-4 sets of true leaves pot with a seedling of *Artemisia frigida* or another non aggressive host plant.

M *Chamerion angustifolium* (Fireweed) - Onagraceae

Capsules alternate along a raceme and ripen from the bottom up over 2-3 weeks. They split along 4 seams to release tiny seeds tufted with long white hairs to the wind.

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 1 year old seeds 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 turn 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.

Seed viability at 40° dry may decrease rapidly each year.

Seven month old seeds stored dry at 40° and given a cold stratification (outside or in the fridge) germinate (extend a radicle) 75-79% 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 deep cells/pots mid February (5,690') and place the container outside for a cold treatment. Cover the seeds to depth. Plant by mid June (5,690') or bump up to a tall narrow pot.

This species attracts the Two-Tailed Swallowtail.

About year 3 in a garden, plants produce offsets from rhizomes. They are not overly aggressive. You can edit/curate your garden, ie dig and toss.

E *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.

Seeds (collected in March following bloom the summer before) soaked in tepid water developed radicles in 19-31 days.

Stored seeds: Soak and rinse for 2-3 days. 40(2m) in the fridge or outside in situ or in containers. It C

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

syn. *Polanisia dodecandra*

Annual. Excellent viability for at least 4 years.

(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

Annual.

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.

Or direct sow in situ in late fall to winter. Cover.

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

syn. *Cleome* or *Peritome serrulata*

Annual.

Direct sow where you want them in the garden late fall to 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, vIC.

Germinate in 8-9d.

Cucurbita foetidissima (Buffalo Gourd) - Cucurbitaceae

"Seed germinated at constant temperatures in the dark...optimum germination at 25C (77F). pH8 Seedlings were able to emerge from depths as great as 12 cm."

<https://www.cambridge.org/core/journals/weed-science/article/abs/germination-emergence-and-seedling-establishment-of-buffalo-gourd-cucurbita-foetidissima>

I had very erratic germination over 18 months. 70%

Cylindropuntia imbricata* var. *imbricata (Tree Cholla) - Cactaceae

Scarify, sow in early spring, vIC, L, rain water, OT

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

(*Dalea aurea*, *D. candida*)

Store seeds dry at 40°.

After the last frost in spring, sandpaper the seeds. (Purchased dehulled seeds do not need to be sandpapered.) Next put them in a pyrex bowl and pour boiling water over them (Sx2). Let the water cool and soak the seeds for 24 hours. Every 24 hours, remove seeds that have imbibed water and doubled 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)

In order to avoid the days of boiling water soaking, place the scarified or dehulled seeds in a pyrex bowl and cover with 3% peroxide for 20 min. Rinse and proceed with the next steps.

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.

Datura wrightii (Indian Apple, Sacred Datura, Jimsonweed) - Solanaceae
Montezuma county, CO and introduced in gardens in rest of state.

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

M Delphinium carolinianum ssp. virescens (Plains Larkspur) - Ranunculaceae
After-ripen. Dark.

Store seeds dry 40°. Viability decreases rapidly after 1-2 years. Older seeds benefit from 40(60d). No cold stratification is necessary if seeds are fresh. Sow mid April (5690'). Cover well for dark. Put outside.

E Delphinium ramosum (Mountain or Showy Larkspur) - Ranunculaceae
Store seeds dry 40°. Viability decreases rapidly after 1-2 years.
No cold stratification is necessary. Sow mid April (5690'). Cover well for dark. Put outside. 72% germination (radicles) in 9-45d.
Plants self seed and germinate in September and in spring in a garden setting.

Delphinium spp.

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)

If using 2 year old or older seeds, leach 3 days (bubble or soak & rinse) and treat with GA3 200 ppm 24h rinse, sow, C, 60-70°.

Desmanthus illinoensis (Bundleflower, Prairie Mimosa) - Fabaceae
Collect seeds July-Aug.

Store seeds dry, 40°.

Sow green seeds in Aug. Cover to depth. Germinate in 6 days. Pot in 2 weeks.

For dry seeds, scarify with sand paper and give a boiling water soak (Sx2) before sowing at 70°+. Cover to depth.

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 (after-ripen) before sowing. Viable at least 3 yrs.

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

D. bigelovii is a pioneer plant and self seeds heavily. It can be cut back, even mowed several times and will bloom at 6" in height in the fall.

E *Echinacea angustifolia* (Prairie Coneflower) - Asteraceae

For easy seed cleaning, wait to collect until chickadees begin to pluck seeds, Oct-Jan. The seeds should be rising up between the bracts.

Sow in situ in fall. OR. Cold stratify for 3w-3m before the last spring frost date. Sow in cells or in situ. Cover the seeds. Cotyledons emerge in 2-3w.

Bloom by second year when started without a greenhouse.

D *Echinocereus viridiflorus* (Nylon Hedgehog) - Cactaceae

Use dechlorinated water. Stephen Hornbeck at CO Native Plant Landscaping Conference 2/24/24.

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.

E-M *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

Seeds stored 40 °dry over the winter, germinate in 3d if sown 3w after last frost date. It C.

Germination rate outdoors (without lights or a greenhouse) is 20-40%.

D *Epilobium canum* ssp. *garrettii* (Hummingbird Trumpet, CA Fuchsia) - Onagraceae

syn. *Zauschneria garrettii*

Regional.

Viability decreases slowly when stored 40 dry, germination rate down to 5% with 7 yo seeds.

40(3w)-70L; 35% germination.

Many died after moved to a bigger pot containing commercial soil free potting mix.

E *Epilobium ciliatum* (American Willow-herb) - Onagraceae

40(60d), L

E *Erigeron* spp. - Asteraceae

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

Self Incompatible

Dry store at 40° or 70°. Viability of *E. speciosus* excellent at 5 years. This species self seeds fairly heavily.

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

Leaves emerge in 1-2 weeks.

Plants can flop in a garden setting without full sun.

***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 alatum* (Tall Winged Buckwheat) - Polygonaceae

Seed viable 2-3 years maybe more. Store seeds dry 40°.

40(30-60d). A few radicles emerge in 30d at 40°, so either be prepared to pick out a few seeds and insert them into a pot of soil which can go outside or under lights or conduct the cold treatment outside. Med C.

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

40(3m) Seeds cold stratified in the fridge will begin to germinate in 60d and continue for another 30d. These germinants will need to be potted and protected from frosts.

It is easier to 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 (April).

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/pots outside. Germination may occur at 70° or at 40° or anywhere in between.

M *Eriogonum umbellatum* (Sulfur Flower) - Polygonaceae

There are 4 varieties in CO. Most have bright yellow flowers.

E. umbellatum var. *majus* has cream or pale yellow flowers. The natural range is 6,500-12,800' but seed grown plants are hardy at 5,690' in loamy clay.

Seeds of the previous season have the best germination rate.

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

Sow outside in situ or in cells/pots in late fall-winter. 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.

E. umbellatum var. *majus*: fresh seeds sown mid October., It C, OT had cotyledons mid March.

E *Erysimum asperum* (Western Wallflower) - Brassicaceae

Biennial.

Thirty days before the last frost date, sow in situ or in cells/pots. Cold stratify outdoors. It C.

Cotyledon leaves emerge in 4-5 weeks.

E *Erysimum capitatum* (Sand Dune Wallflower) - Brassicaceae

Biennial or Perennial.

The fruit is a silique ascending along a flowering stalk. Fruits ripen from the bottom up. Mature fruits split along two side seams dropping the tiny fruits quickly. To collect without losing too many seeds, grasp the dehiscent fruit at the base to press the seeds against the center septum and clip the peduncle. If most of the siliques are tan, collect the entire raceme. Place it in a paper bag and fold the top down a few times.

About 1 week before your last frost date in spring, sow in situ or in cells/pots. It C.

Cotyledon leaves emerge in 10 days.

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

syn. *Corypantha missouriensis*

Use dechlorinated water. 2/24/24 Stephen Hornbeck at CO Landscaping Conference.

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), v/C, 70-77°. 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.

M *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 Joepyeweed) - Asteraceae

Fertile seeds are black and resist pressure from a fingernail. They do not bend in half readily.

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.

For germination in pots, sow early April in Front Range.

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*) Latter is tetraploid with large blooms.

No cold stratification is needed. Sow in situ after danger of frost has past in the spring. Press into the soil or sow in cells and cover the seeds lightly. Germination can be erratic. 70, v/C.

D *Gentiana bigelovii* (Bigelow's Gentian) - Gentianaceae

1-3 yo seeds seem to germinate best. ? Viability in storage.

I have had good results germinating under lights but not with OT.

Sow a small pinch of seeds in cells, 70L. They can flush cotyledons as many as 3 times (after 2-3 weeks, after 3-5 months).

Move entire cell of seedlings to a small pot containing well draining medium. The seedlings are very small and can rot easily if watered too heavily.

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 gently in one spot with a nail file. The seed coat is quite thin, and you will quickly see a soft green interior. Stop filing! Next, soak in warm water, not boiling, for 12 hours. After treatment, plant outside 1/4" deep in fall or in spring after the last frost.

OR

In spring, about 3 weeks before the last frost, scarify with care, soak, cold stratify 21-30 days, sow in cells, cover to depth and put outside in sun.

Transplant into a deep pot filled with very well draining soil.

Cold treatment indoors or outdoors in pots seems to result in the same number of plants:

First year seeds, germinate in 1-2 weeks after scarification, soak and stratification in the fridge.

Germination is close to 100%. Cotyledons emerge at about 41%.

If the scarified, soak seeds are put outside for cold stratification, the cotyledon emergence rate is the same.

***Geum triflorum* (Prairie Smoke) - Rosaceae**

Reduce plume. 40(3m) - 70 C.

Can stratify outside. Sow 3m before last frost date. Cover 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. 70, It C. Leaves emerge within 2 weeks.

Self seeds.

***D Harbouria trachypleura* (Whiskbroom Parsley) - Apiaceae**

Bubble or soak/rinse seeds for 3 days. This is important to remove chemical inhibitors.

Sow in situ in the fall.

OR

Winter sow or cold stratify in the fridge.

Radicle emergence is erratic. At 40°, it can occur in 7-60+ days. About 30% emerge in 50d.

Insert each germinated seed in a container of soil and place under lights if the temperature is freezing outside.

Plant soon after last frost date since first year plants go dormant quickly. Label well.

***M Hedysarum boreale* (Utah Sweetvetch) - Fabaceae**

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

Mid April (5690') scarify with a boiling water soak. Leave in the cooled water 12-24 hours. Inoculate (opt.). Sow in situ or in deep pots in fall or spring. Cover the seeds with 1/4" of medium.

Avoid root disturbance.

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 maximiliani* (Maximiliani Sunflower) - Asteraceae

Store dry at 40 or 70°.

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

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

M *Helianthus pumilus* (Little Sunflower) - Asteraceae

Clean (sieves #10 or #14, rub seeds with hard rubber dog toy - use #18 sieve & hair dryer (winnow) to remove chaff) the seeds as soon as possible and put in the freezer for 2 weeks to treat for predatory insects. Be sure they are very dry before freezing.

Store dry at 40°.

The seeds of this species have a higher germination rate when sown outside for cold stratification (temperature fluctuations?) than when cold treated in the fridge.

Sow in mid Dec. whether sowing in a container or in situ. lt C.

Native soil may increase germination rates.

Self sows moderately.

M *Heliomeris multiflora* (Showy Goldeneye) - Asteraceae

Keep seeds dry at 70° for a year to after-ripen. Sow at 70-80, lt C.

OR

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

Self sows. After 3 years, can become a bit unruly in a garden.

E *Heterotheca spp.* - Asteraceae

H. foliosa (Foliose False Goldenaster), *H. villosa* (Hairy False Goldenaster)

Store seeds dry at 40°.

Sow after last frost in situ or in cells. 70+, lt C.

Heuchera parvifolia (Littleleaf or Common Alumroot) - Saxifragaceae

Collect small black seeds in paper bags when the capsules turn brown and split. May-Aug.

Sow, C, outdoors for 5m cold stratification. Keep slightly moist. Germinate in cool weather in spring.

4-6 true leaves 3 weeks after germination.

<https://nnpn.rngr.net/renderNPNProtocolDetails?selectedProtocolIds=saxifragaceae-heuchera-203&referer=wildflower> - Tara Luna, et. al.

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.

Be careful when sourcing seeds. In the Front Range around Denver, the native and cultivated hops have hybridized. Pers. comm. Mike Bone, 2018.

E *Hymenothrix dissecta* (Cutleaf) - Asteraceae

syn. *Bahia dissecta*

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

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

E *Hymenoxys grandiflora* (Old Man of the Mountain) - Asteraceae

syn. *Tetranneuris grandiflora*

No pretreatment needed. Sow in cells or pots, vlc, 60-70°. Cotyledons begin to emerge in 3-4 weeks.

Alpine plant that does not survive very far below 9000'.

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

syn. *Helenium hoopesii*

Viability reduced to 12.5% after 6 years dry storage at 40°.

No pretreatment needed. Sow in cells/pots or in situ in fall or spring, lt C. Cotyledons appear in 10-19 days. Bump up from cells 2 weeks after seedlings emerge.

Survives happily at least 1300' below recorded elevation.

M-D *Iliamna rivularis* (Wild Hollyhock) - Malvaceae

One month before last frost date, boiling water treatment to seeds. Let water cool. Add liquid smoke to water 1:9. Soak 2.5 hours. Sow 1-2 seeds in 2.5" pots. C. Put outside. With 2 yo seeds, 64% of cotyledons emerged.

M *Ipomoea leptophylla* (Bush Morning-glory) - Convolvulaceae

Store dry 40.

Clip the seed coat at the pointy end opposite the hilum. Expose a bit of green. Tepid water soak 24h. Sow in deep, air pruning pots (more than 6 inches). Use very well draining mix. Cover by at least an inch. 70°. Avoid root disturbance. Thanks to Stephen Hornbeck and Rick Phillips.

Sanding, peroxide 3% soak for 15 min, rinse and water soak 18-24h worked really well for treatment of 2 yo seeds for me.

Germination is erratic. Plant in sandy soil before the end of August. Hummingbird attractor.

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

Biennial to short lived perennial, self incompatible, monocarpic. Hummingbird pollination if red.

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, lt C.

Leaves emerge in 3 weeks.

M *Ipomopsis congesta* (Ball-head Ipomopsis) - Polemoniaceae

Perennial.

Seeds produce a gel when soaked.

40(60d) - 70, vlc. Alplains.com

E *Ipomopsis rubra* (Standing-cypress) - Polemoniaceae

TX, OK, MO and east to the Atlantic coast in alkaline soils..

Biennial.

Direct sow in situ in fall. 1/16" C. Blooming plants produce copious amounts of seeds and will replace themselves every year with dark green ferny rosettes.

OR

Start inside 6-8w before the last frost in spring, 70, It C. Transplant to the ground as soon as possible (long taproot).

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.

Nick with nail file or clipper at the pointy end. 40(90d) outside for temp fluctuations - Brook Palmer 4/23/24

Sow outside in situ or in cells or pots. Cover lightly. Outside for temperature fluctuations.

***Liatris* spp.** Seed cleaning and storage (Check for insects. Put in freezer if needed.)

Pluck the clump of seeds from the sepal cup by grasping the pappus and pulling. If you cut stems and put them into a paper bag to clean later, do the same thing. Store dry in paper at 40 or 70°.

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

40(60d) either in the fridge or in cells/pots sown in Feb. (5690') and put outside. P

Press the seeds into the soil and/or cover them to depth. Germination (radicle) about day 60 and cotyledon leaves 2-3w later.

They bloom in 2-3 years.

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

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

Viable at least 5 years when stored dry at 40°.

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 *Ligusticum porteri* (Osha) - Apiaceae

Start treatments in late Nov-mid Dec. First leach inhibiting chemicals out of the seed coat. Bubble aerate or soak for 4 days, changing the water each day. Cold stratify in the fridge or outside.

Radicles begin to emerge in 12-13w of cold stratification. Cotyledons begin to emerge 1-2w later. If radicles appear mid winter during fridge stratification, the plants should be kept under light indoors. If cold treating outdoors, sow in deep pots, C. Place outside. Cotyledons appear in about 5 months in the Front Range.

Plant seedlings as soon as possible.

E *Linum lewisii* (Blue Flax) - Linaceae

To clean the seeds, work over a tray with sides and pieces of 8.5x11 paper. Scruff the capsules over the bottom of a soil sieve. I use a hard dog chew toy. Put the entire mess into a soil sieve that will contain the seeds above the wire. Holding a hair dryer set on low at arms length below and to the side of the sieve, slowly raise the air stream holding the sieve at a slight angle. Gently blow the chaff up and out. Seeds that are not fertile will blow away also.

Store seeds dry at 40.

Sow in spring around the last frost date or a bit later. Cover lightly.

Cotyledon leaves emerge about 2 weeks later.

No cold treatment is required. Seeds can be sown in fall or winter, but the germination percentages will be lower.

D *Lithospermum incisum* (Plains Stoneseed) - Boraginaceae

Seeds can be collected from the ground under the plants.,even a year later. They have an extremely hard seed coat.

HCl 4h, rinse, tepid water soak 22h - 70L (20% germ so far)

D *Lithospermum occidentale* (Western Marbleseed) - Boraginaceae

syn. *Onosmodium bejariense* var. *occidentale*

Self Incompatible.

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 or HCl 10%. 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.

E *Lobelia cardinalis* (Cardinal Flower) - Campanulaceae

Store seeds dry 40°.

55-70L

M *Lomatium orientale* (Salt-and-Pepper) - Apiaceae

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

If any seeds are left from the first sowing store 40 dry. Viable at least 5y stored 40 dry.

In late Nov., bubble aerate for 3d or soak and rinse for 3d. Change the water every day.

Sow in a deep cell/pot, C. Place outside.

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

After the cold treatment, cotyledons emerge from 4-21d in 70L. 50-90%

Plant as soon as possible. This species goes dormant May-July. depending on altitude.

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 7-9 days at 40°.

If you collect the seeds slightly "green" before they form a hard seed coat, you can sow them immediately. They can 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.

Lygodesmia juncea (Rush Skeletonplant) - Asteraceae

Be sure to check if the seeds are filled out. Often they are not fertile.

Viability dry 40° seems to decrease quickly over 4 years.

40(30d), It C, 70.

E Machaeranthera tanacetifolia (Tansyleaf Tansy-Aster) - Asteraceae

Taprooted Annuals or Biennials

Store seeds dry at 40°. Viability may last only 4-5 years.

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.

E Maianthemum stellatum (False Solomon's Seal) - Ruscaceae

Use fresh seeds, keep moist.

Remove the tan seeds from the red fruit. Sow them as soon as possible. Keep them moist until beginning required temperature cycles. In nature, the seeds require two years with 4 temperature cycles of 40-70-40-70. Radicles extend the first spring. Leaves emerge the second spring. The easiest way to germinate the seeds is outdoors in situ.

One long cold period of 100+ days leads to germination says Kristine Johnson, pers. comm. July 2025.

I tried the long cold stratification with gift 2 yo seeds. During cold stratification in the fridge, more from the batch rotted than remained firm. The firm ones showed heavy radicle emergence in 118-155 days at 40 moist. Unfortunately, these 2 yo seeds which had been stored dry, uncleaned, failed to produce cotyledons.

A second flush of radicles at 6 1/2 months cold stratification did produce cotyledons in another 4 months. This process took less than a year which is certainly quicker than the natural 18 months.

I will try this again with fresh seeds.

Take rhizome cuttings after flowering is finished.

Melampodium leucanthum (Blackfoot Daisy) - Asteraceae

Seeds viable 1 year only. 70L. Disc flowers do not develop fertile seeds. Rays do.

see Jim Borland article in the Colorado Native Plant Society journal

www.CoNPS.org *Aquilegia* Volume 46 No. 1 Winter 2022, pg. 28

***Mentzelia* spp.**- Loasaceae

M. decapetala (Ten-petal Eveningstar) Biennial or perennial, *M. multiflora* (Adonis Blazingstar)

Perennial, *M. nuda* (Bractless Eveningstar) Biennial or perennial.

Viable at least 5-6 years when stored dry at 40°.

Collect capsules when the pore in the membrane at the mouth of the wide capsule opens. Place in a paper bag. 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 or just sow and put outside. Sow in cells/

pots or in situ. Cover lightly. Cotyledons emerge in 14 days after 4-5w cold (83%). They can be potted in a well draining mix in a 2.5" pot as early as 9 days later. Or sow in situ, in fall fairly soon after collecting the seeds.

M *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. After cleaning store the seeds dry, 40-65° until the fall.

A cleaning method: Remove leaves and stems. Crush capsules lightly. Sieves: let dust thru #25, Let seeds fall thru #18. Tilt & tap in a manilla folder.

In mid November, sow in situ and cover the seeds lightly. They will germinate the following spring and bloom the second year. This works! 1 year old plants are easy to transplant in early spring. I have had minimal success sowing the seeds in deep cells shortly after collection and leaving them outside. It is difficult to keep the moisture consistent from June, through the summer and over the winter. They may 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* spp. - Nyctaginaceae

M. lanceolata (Lanceleaf Four O'Clock), *M. glabra* (Smooth Four O'Clock), *M. hirsuta* (Hairy Four O'Clock), *M. linearis* var. *linearis* (Narrowleaf Four O'Clock)

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.

Mirabilis linearis self seeds heavily!

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°.

About 1-2 weeks after the last frost date, 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

Collect the seeds when the corollas are brown, very dry and about to shatter. Nutlets are firmly held at the base of the corolla. Put flower clusters in a paper bag. Some seeds will drop, but to harvest most of them, rub the corollas on a sturdy sieve with a hard dog chew toy.

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.

Seeds collected the previous fall may be best.

E *Monarda pectinata* (Plains Beebalm) - Lamiaceae

Annual

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

Nuttallanthus canadensis (Blue Toadflax)- Plantaginaceae

Annual or biennial.

Collect seeds May-July.

Sow in fall or store seeds dry, 40°.

Seeds sown in spring may germinate mid June (2-3 weeks) or not until mid Sept (<4 months).

Bloom first year.

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

Annual

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

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

Many seeds and plants in the trade key out to *Oenothera harringtonii* which has a caulescent stem 6-24 inches in length. It sprawls in the garden and blooms for months.

O. cespitosa forms a clump with the bloom on a leafless stem. Very tidy.

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.

D *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.

Rhizomatous and easy to transplant in April (FR, 5690'). Aggressive ground cover in garden soil.

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

Locucidal fruits cluster at the base of the rosette of leaves. The capsules are woody and upright.

Many seeds remain in the capsules the following spring. Collect in Dec. or wait until spring.

No pretreatment is required. 65-70 vIC. Germinate in about 2 weeks.

M *Oenothera harringtonii* (CO Springs 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 seams split halfway. 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 seeds out. Don't struggle too hard. Place capsules back in paper bag and try again in a few weeks.

Viable dry 40° at least 4 years.

Follow directions for *O. cespitosa*. My results vary from 25-33% germination over 5 years and 5 different seed batches.

E *Oenothera macrocarpa* (Missouri Primrose) - Onagraceae

syn. *Oenothera missouriensis* - a regional species for CO. It has large yellow 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. The central column 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 serrulata* var. *serrulata (Yellow Sundrops) - Onagraceae

syn. *Calylophus serrulatus*

2x2' shrub blooms during the day. Can self pollinate or cross.

Seeds can be difficult to collect and to clean. If you wait until the very end of the year, or better yet January of the next year, to cut branches and put them into a paper sack, the seeds will release into the bottom of the bag easily.

Roll a rock core or rolling pin over any remaining capsules to release the tiny seeds. Sieve.

Store dry 40°.

Sow seeds in early winter. Add gravel to soil mix. Med C. Put outside. Cotyledons emerge in 14-20 weeks.

Oenothera suffrutescens (Scarlet Beeblossom) - Onagraceae

syn. *Gaura coccinea*

40(2m) prairiemoon.com

Oenothera villosa (Hairy Evening Primrose) - Onagraceae

"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

Use dechlorinated water. Stephen Hornbeck at CO Landscaping Conference, 2/24/24.

If your water supplier uses chlorine, let the water sit in an open vessel for 24h, and the chlorine will dissipate. If the water company uses chloramine, put 1/8 tsp of powdered ascorbic acid in a gallon of water to deactivate it. Christine Gust, 4/7/24.

Opuntia Fruit Cleaning

Use tongs to handle fruit or paddles. Sheets of newspaper work too but are unwieldy.

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.

Scarify. Boiling water soak. 40(12w) - 70L but provide mist or a humidity chamber.

I have low germination rates (~38%) 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* but due to gel, stratify outdoors unless you have a dedicated fridge for cold treatment of seeds in cells/pots.

M *Opuntia polyacantha* (Plains Pricklypear) - Cactaceae

Gel forms when seeds soak in water.

See *Opuntia macrorhiza* but due to gel, stratify outdoors unless you have a dedicated fridge for cold treatment of seeds in cells/pots.

E *Oreocarya virgata* (Miner's Candle) - Boraginaceae

Biennial to short lived perennial. Self seeds.

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 (5,690'). They germinate in 2 weeks in the dark (cover heavily). Leaf rosette for the first year.

Bloom the second year.

E *Oreochrysum parryi* (Parry's Goldenrod) - Asteraceae

Clonal. This species seems to be self incompatible. To obtain fertile seeds, you need more than one seed grown plant.

Clean the seeds as soon as possible and freeze the dry seeds for a week or longer. Insect predation is a problem. Sow after frost. 70L.

Ottleya wrightii (Wright's Deervetch) - Fabaceae

A week or 3 before the last frost date, boil soak the seeds. Inoculate (opt), sow in pots, C, OT.

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

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

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

E *Oxytropis* spp. - Fabaceae

O. lambertii (Purple Locoweed), *O. multiceps* (Nuttall's Oxytrope), *O. sericea* var. *sericea* (White or Silky Locoweed)

Store seeds dry at 40°.

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

When daytime temperatures hover consistently around 70° or after the last frost date, scarify seeds with sandpaper. Inoculate with rhizobium inoculant (opt.) Sow in deep pots or direct sow in situ to avoid disturbing the roots.

Cotyledons emerge in 3 days to 2 months.

Germination is **E**. Maintenance in pots is **D**.

Packera fendleri (Fendler's Ragwort) - Asteraceae

40(45d). Many radicles emerge in 30 days so it is best to sow mid March (Front Range) in containers, v/c. Put outside.

D *Pediocactus simpsonii* (Mountain Cactus) - Cactaceae

"Pediocactus are primarily very active in the spring when hard frost is over and then again in early fall when the hot days of summer are over. In late fall many of them will bud; they hold the buds over the winter. It does not hurt the buds to freeze...By late spring, they will have finished flowering; when the days turn hot, they will go dormant for the summer. Let them become dry so they shrink down into the soil a bit; in nature most species pull down into the soil and can go underground. Just give them very little water during the summer; it is fine if the plants have some wrinkles on the epidermis. In late summer and early fall, they will show signs of growth, so give them a few waterings, which improves flowering and growth the following spring. During the winter, they need a couple of waterings, but most of the time they can be dry.

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

Use dechlorinated water. Stephen Hornbeck at CO Landscaping Conference, 2/24/24.

If your water supplier uses chlorine, let the water sit in an open vessel for 24h, and the chlorine will dissipate. If the water company uses chloramine, put 1/8 tsp of powdered ascorbic acid in a gallon of water to deactivate it. Christine Gust, 4/7/24.

M *Pediomelum esculentum* (Indian Turnip, Large Indian Breadroot) - Fabaceae

syn. *Psoralea esculenta*

Clean seeds. Freeze 1-2 weeks. Store 40-70° dry.

Scarify with sandpaper and a boiling water soak. (Sx2) Inoculate (opt.)

70D in deep cells or pots to avoid root disturbance. OR sow in situ.

Protect from rodents in the first season.

M *Pediomelum tenuiflorum* (Slimflower Scurfpea) - Fabaceae

syn. *Psoralea tenuiflora*, *Psoralidium tenuiflorum*

Can get invasive in a garden and flowers are very small.

Boiling water soak - 40(2.5m) - 70, C OR acid 20 min, rinse - 40(2.5m) - 70, C. Either treatment results in 58% germination. Radicles emerge from 6w on so it is best to cold treat outside starting in early-mid Feb. (5690'). Cotyledons emerge in 3m.

E *Penstemon* spp. germination information from my experience and

<https://tomclothier.hort.net> (updated 11/2000 by Jim Swayne <https://tomclothier.hort.net/page08.html>)
<jas3255@yahoo.com> (Jim Swayne)

Penstemon seedlings tolerate handling. They can be started in cells or pots.

Penstemon albidus (White *Penstemon*) - Plantaginaceae

40(90d) - 65°. vLC. Radicles emerge (75%) anytime from 30-90d at 40°.

Cotyledons emerge soon after.

M *Penstemon angustifolius* (Broadbeard *Penstemon*) - Plantaginaceae

Viability strong at 7 years store 40dry.

Begin treatments Feb. 1 (5690').

Rinse for 3 days using a bubbler or by soaking in a small bowl of water and changing the water every day.

40(3m) in fridge - 70, lt C, sow in deep pots. Put outside.

Cotyledons in 3.5m.

Penstemon barbatus (Beardlip *Penstemon*, Scarlet Bugler) - Plantaginaceae

After-ripen 6m at 70.

40(2-3m) - 70, vLC. Well draining soil.

M *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 cobraea* (Cobaea Beardtongue) - Plantaginaceae

Cold stratify 8-12 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. vLC (light requirement). True leaves develop when the temperature gets above 65° part of the day.

Penstemon crandallii (Crandall's Beardtongue, Mat *Penstemon*) - Plantaginaceae

Store seeds dry, 40.

Seeds develop a gel in water.

40(12w) in cells in the fridge or in 2.5" pots outside. vLC for light. Radicles in 43d.

Use a very well draining medium.

E *Penstemon degeneri* (Degener's Beardtongue) - Plantaginaceae

G2S2. Colorado endemic.

Collect seeds late July through August. Store dry 40° F or lower.

“Studies by the Denver Botanic Gardens in conjunction with the CPC found that there was 80 percent germination for seeds stored from 1990 to 2002 [-20°C] (Ann Grant personal communication 2003).

The seeds were cold stratified for 2 months and then moved into the greenhouse. Seeds that were not cold stratified but were kept in pots on a warm bench with periodic mist did not germinate (DePrenger-Levin personal communication 2003).” www.cnhp.colostate.edu/rareplants.guide
Seeds stored 12y at 65°F and then 2y at 40°F had a 65% germination rate when sown late Dec., vIC and put outside 5690’.

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. vIC (light requirement).

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

E *Penstemon palmeri* (Palmer’s Penstemon) - Plantaginaceae

Regional. Self seeds copiously.

Collect seeds Aug-Sept. Store seeds dry 40°.

Cold stratify in fridge or outside. Sow in pots or in situ about January 1. vIC.

E *Penstemon pinifolius* (Pineleaf Penstemon) - Plantaginaceae

Regional.

Sow 9 weeks before the last frost date. Put the container outside. vIC. If no precipitation, water the pots as needed.

First cotyledons appear when the temperature is 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. vIC. 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. vIC (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. vIC. 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. vIC.

Leaves emerge in 2.5 months.

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

syn. *P. unilateralis*

40(8w), vIC. Germinate around 65-70°. Fridge or OT.

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 helps to produce fertile seeds.

Collect seeds late Aug-Oct. Store dry. First year seeds seem to germinate best.

40(4w) - 65-70, vIC

Radicles begin to emerge in 16 days. Outdoor cold treatment may be preferable to the fridge or you will need to put the germinated seeds into containers and then under lights.

Leaves emerge when temps are 65-70°.

E *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. at 5690', 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.

E *Phacelia tanacetifolia* (Lacy Phacelia) - Hydrophyllaceae

Native to AZ, CA and northern Mexico.

Annual.

Sow in fall, winter or spring. 59-70D.

Self sows in gardens.

E *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.

Bloom second year.

E *Physalis longifolia* (Longleaf Ground Cherry) - Solanaceae

Rhizomatous!

Viable at least 5 years at 40 dry.

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

40(13w) - 70, C.

M *Physaria bellii* (Front Range Twinpod) - Brassicaceae

Self incompatible? More than one seed grown parent plant always improves seed fertility.

Store seeds dry, 40°.

Two to four weeks before your last frost date, sow in cells/pots or in situ. 40(6w), lt C. Leaves emerge 8-9 weeks after beginning treatment.

If started in cells, bump up to a 2.5" pot two weeks after cotyledons emerge. Use a well draining mix.

Plant by early July.

Physaria ovalifolia (Roundleaf Bladderpod) - Brassicaceae

Self incompatible?

Store seeds dry, 40°.

Seeds develop a gel when soaked in water.

40(6w) - 70L.

Physaria vitulifera (Fiddleleaf Twinpod) - Brassicaceae

Self incompatible?

Store seeds dry, 40°.

40(8w)-70L or sow and put outdoors to cold strat.

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. vIC. 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

Store dry 40°. Viable at least 6 years.

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 months before your last frost date. Cover very lightly, water well and put outside.

Germination rates with 40(2w), OT: 1 yo, 28%, 3 yo 31%, 4 yo 3%, 5 yo 0

6 yo seeds, **40(2m)**, OT resulted in 76% germination!

Potentilla norvegica (Norwegian Cinquefoil) - Rosaceae

40(2w) - 65-70L. Sow right into 2.5" pots. Put outside.

E Primula pauciflora (Darkthroat Shooting Star) - Primulaceae

syn, *Dodecatheon pulchellum*

(60 to 90 days stratification) USDA Forest Service Gen. Tech. Rep. RMRS-GTR-274. 2012, 71

40(60d) in the fridge or outside worked with seeds only 1-2 years old. Use very light grit to cover seeds.

Rhizome cuttings: two to three weeks before the last frost date in spring, rinse mature plants. Push up on a "leg" of the "mini octopus", and it will release with a bud at the top of the leg. Remove no more than half of the legs from each donor plant. Put 2-3 pieces into mix (no extra drainage material needed for this species that grows in moist sites) in a 2.5" pot. Just cover the buds. Leaves begin to emerge in two weeks.

Psoralea esculenta (See *Pediomelum esculentum*)

Psoralea tenuiflora (See *Pedimelum tenuiflorum*)

E 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, stored dry, sown in early March (5690') on germination mix in cells, covered lightly with grit and put outside (FR, 5690') germinated 100%.

Older seeds did not germinate over 4 years.

Ranunculus pensylvanicus (Pennsylvania or Bristly Buttercup) - Ranunculaceae

Seeds that had been stored 40 dry for 7 years, sown at 70L took 1.5-3m to germinate.

Prairie Moon Nursery recommends 40(60d).

E Ratibida columnifera (Prairie Coneflower) - Asteraceae

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

No strat or strat works. Self sows heavily.

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

Annual, Biennial or Perennial

Viability in storage decreases over 5 years.

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

Store dry 40°. Viability down to 25% at 5 yo.

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

E-M Rumex venosus (Wild Begonia) - Polygonaceae

40(1-2m) - 70

Only 1 yr of experience. Started stratification mid March at 5,690'.

Half of the seeds had radicles after 3-4 weeks in the fridge. Cotyledons emerged 2 weeks later. The remaining seeds sowed and put outside after 2m in the fridge never developed into seedlings.

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

40(6w) fridge on 1 yo seeds - 70L resulted in 67% germination. Roots tolerate disturbance during transplanting. Seeds of previous summers collection have the highest germination rate.

E Salvia dorrii var. dorrii (Purple Sage) - Lamiaceae

Regional

Store seeds dry 40-70°.

40(6-7w) outside for temperature fluctuations during the day. It C.
Bloom second year.

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 when 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.

M *Scrophularia macrantha* (Red Birds in a Tree) - Scrophulariaceae
New Mexico.

Blooms for 3 months. Hummingbirds love it.

40(12-13w) outside, L.

Scrophularia marilandica (Late Figwort) - Scrophulariaceae
Regional species.

40(60d) - 70L - prairiemoon.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. Water sparingly.

Easy to germinate but difficult to maintain in pots past mid summer.

Does not persist in loamy clay.

E *Senecio flaccidus* var. *flaccidus* (Threadleaf Ragwort) - Asteraceae

If several seed grown plants are fairly close to each other, seeds may be fertile.

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

Germinate in 2 weeks.

E *Senecio spartioides* (Narrow-leaved Butterweed) - Asteraceae

Follow directions for *Senecio flaccidus*.

Self sows.

Senna marilandica (Maryland Wild Senna) - Fabaceae

Regional.

For dry stored seeds, winter sow. Scarify with sandpaper & boiling water soak (Sx2), inoculate (opt.), sow in 2.5" pots, C, OT.

Silene acaulis (Moss Champion) - Caryophyllaceae

Sow in cells in germination medium around the last frost date. 68L. Place outside. Mist regularly or provide high humidity until the seeds germinate. Cotyledons emerge in 18d.

Silene drummondii (Drummond's Catchfly) - Caryophyllaceae

30-90 day cool moist stratification or plant outside in the fall. Plant to 1/16 inch deep. westernnativeseed.com
I got 23% germination of 4 year old seeds with 50d cold stratification, lt C.

Silene regia (Royal Catchfly) - Caryophyllaceae

Regional species.

Cold stratify 40(3-4w) - 70L. Germinate in 1w. Can divide small plants in cells at age 2-2.5m.

Silene stellata (Starry Champion) - Caryophyllaceae

Regional.

"Seed Collection: This plant declines quickly after flowering so it is best to flag the plant. Seeds mature 2-3 weeks after the bloom period. Vigorous plants may have flowers and dehiscent capsules at the same time. Mature capsules should be swollen, pale green or tan, and split readily when pinched. Refrigerate in sealed containers.

Seed Treatment: 3-4 weeks of cold-moist stratification." wildflower.org

40(60d) - Prairie Moon - vIC

***Silphium* spp.** (Rosinweed)

2 spp. in CO, and they are rare.

Only the ray flowers of *Silphium* spp. produce fertile seeds.

***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°L, vIC. Leaves emerge in 1-3 weeks.

Goldenrods generally do not need cold stratification, but it does no harm to sow outside a month before the last frost date. Sowing in the fall can be done but 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 glutinosa (Mt. Albert Goldenrod) - Asteraceae

syn. *S. simplex* var *simplex*

Tends to clump. Grows well in gardens at elevations below its recorded range (6,000-13,000').

E *Solidago missouriensis* (Missouri Primrose) - Asteraceae
Rhizomatous.

E *Solidago mollis* (Soft Goldenrod) - Asteraceae
Rhizomatous, 1-1.5' tall

E *Solidago multiradiata* (Rocky Mountain Goldenrod) - Asteraceae
Rhizomatous.
It occupies similar sites to those of *S. glutinosa* (*S. simplex*), and they can hybridize.

E *Solidago ptarmicoides* (Prairie Goldenrod) - Asteraceae
White ray flowers, flat topped inflorescence.

E *Solidago rigida* (Stiff Goldenrod) - Asteraceae
Yellow ray flowers, flat topped inflorescence. Self seeds heavily.

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. I resorted to pulsing in a food processor with a dull blade.
Seeds can be stored dry for many years at 40-70°.
After your last frost date, scarify the seeds with sandpaper and a boiling water soak. Repeat the boiling water treatment if the seeds have not swollen. Inoculate (opt). Sow the seeds in deep cells or in situ either in late fall or after your last frost date in spring. Cover the seeds well.
Mature plants are rhizomatous.
Sx2, 70, C

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.
Sx2. Cold stratify outside for 3m in cells/pots or in situ, It C. Radicles emerge erratically from 38-60+ days which makes stratification in the fridge inconvenient.
My germination % is very low.

M *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. Sx2. Cold stratify for 6 weeks. Sow and cover the seeds **very lightly** if the mericarp has been removed which may be the case with purchased seeds. Expose to 70°.

D *Sphaeralcea parvifolia* (Small-leaf Globemallow) - Malvaceae
See *S. munroana*.

M *Stanleya pinnata* (Prince's Plume) - Brassicaceae
When the siliques are white and splitting, cut whole stalks into a large paper bag. The flowers mature from the top down so you can collect over 2 weeks.

Stanleya Seed Cleaning:

After the fruits have dried in the paper bag at room temperature, put the mass into a plastic trug and massage the mass with leather gloved hands. Sieve handfuls separately through a #14 soil sieve. Winnow or gently blow remaining silique parts away from the seeds. Most hairdryers have an overly intense airstream for this species.

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.

Tepid water soak 24h. 40(3m), sow in deep cells or pots, C, OT

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 a few seeds developed a radicle in just 2 weeks when cold stratified in the fridge.

Stenosiphon linifolius (False Gaura) - Onagraceae

syn. *Oenothera glaucifolia*

Biennial

Winter sow in pots, C.

E Symphyotrichum ericoides (White Heath Aster) - Asteraceae

Store seeds dry at 40 or 70°.

Sow 1 month before the last frost date in spring. vIC. 100% germination at 70 after a cool period.

Self sows aggressively.

Can prune back by 1/3 in early spring.

E Symphyotrichum 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.

Can prune back by 1/3 in early spring.

E Symphyotrichum oblongifolium (Aromatic Aster) - Asteraceae

Follow directions for *S. ericoides*.

E Symphyotrichum porteri (Smooth White Aster) - Asteraceae

After-ripen dry 4-6m at 70. Sow 1m before last frost., vIC.

M Tetraneuris acaulis (Stemless Four-nerve Daisy) - Asteraceae

syn. *Hymenoxys acaulis*

Store seeds dry 70 4-6m. For long term storage store 40° dry. May not be viable after 6 years.

Sow in well draining mix, vIC, 64°. Intolerant of overwatering and root disturbance.

M-D Thalictrum dasycarpum (Purple Meadowrue) - Ranunculaceae

Store dry seeds long term at 40° or lower.

Leach 3d - Sow, lt C, 40(3-4m) outdoors. Cotyledons emerge 4 weeks before last frost date.

E Thelesperma filifolium (Stiff Greenthread) - Asteraceae

Annual. Viability greatly decreases over 4 years.

Sow late fall to early winter in situ.

Or

OT: Cold stratify 2-4 weeks, in cells/pots outside, not a baggie in a fridge. The radicles emerge in 9-17 days. vIC.

Plant 3 or more seed grown plants to produce fertile seeds.

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

Perennial.

Sow in cells/pots or in situ in mid March (about 7 weeks before the last frost date). Cover lightly. Leaves emerge in 2-2.5 months when temps are around 60-65 and fluctuating widely night to day. Self seeds lightly.

M *Thermopsis rhombifolia* (Goldenbanner) - Fabaceae

Scarify with sandpaper. Peroxide 3% soak 30 min. Boiling water soak 24h. You may need to repeat the boiling water soak until the seeds swell. Inoculate (opt.) Sow 70C.

No cold stratification is necessary.

They can also be scarified and sown in the fall.

E *Townsendia grandiflora* (Largeflower Easter Daisy) - Asteraceae

Biennial

Sow in cells early April (6w before last frost date), lt C. Cotyledons in 2m. Transplant in 5w.

Using early April start date (5,690') and using the fridge for cold stratification 40(8w) resulted in 86% germination.

Townsendia hookeri (Hooker's Easter Daisy) - Asteraceae

Sow ASAP or the seeds will enter dormancy and need cold stratification - Stephen Hornbeck, Landscaping with Colorado Native Plants Conference, 2/24/24.

Use well draining medium and don't overwater. Full sun.

Trollius albiflorus (Globeflower) - Ranunculaceae

syn. *Trollius laxus* ssp. *albiflorus*

70(6m) of dry storage deadly. Store at 40 and sow first fall and put outside - Deno, 225, 2nd ed.

Seeds from Alplains, germinated 21% after 2y dry 40°. No germination after year 3.

E *Verbena stricta* (Hoary Verbena) - Verbenaceae

Store seeds dry at 40 or 70°.

In late fall, sow in situ or in pots placed outside vIC. In the fridge the radicles emerged (80%) slowly over weeks, 40(120-180d). Once germinated seeds are exposed to warmth, leaves appear in 9 days.

E *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.

E *Vernonia baldwinii* (Western Ironweed) - Asteraceae

40(60d) - 70, lt C. 77% germination.

M *Vesper montanus* (Mt. Springparsley) - Apiaceae

syn. *Cymopterus montanus*

Collect seeds in May before the whole plant goes dormant. Store seeds dry 70°.

Starting mid September of the year collected, bubble (or soak & rinse) the seeds for 3 days. Cold stratify in the fridge. 40(3m)-70(3m)-40. Check the seeds once a week. As the radicles emerge, insert the seeds into pots of growing mix. Hopefully the timing allows you to put the pot outside. 78% germination for me in '25.

E *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

Collect end of May into June.

The seeds need a period of cold stratification. Either sow them in situ upon collection or sow them as soon as you receive them. If necessary, the seeds can be held dry until early fall of the year collected. The seeds have an elaiosome which suggests a long period in dry storage would be detrimental. Most plants with an elaiosome are ant dispersed. 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). Viability 60% on 5 year old seeds.

40(80-90d) outside in the winter or in the fridge. Sow, Lt C. Leaves emerge at 60-70° in 2 weeks.

Wyethia scabra - see *Scabrethia scabra*

M *Xanthisma spinulosum* (Spiny Goldenweed) - Asteraceae

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

Sow 70L, vIC.

Excellent overall germination on 7m old seeds grown under lights indoors.

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 dry seeds in the freezer for 2 weeks.

Sow the seeds at 70°. Cover lightly. They will germinate erratically over 3 months. (Soak in water on a windowsill before sowing and at least half of the seeds form a radicle.)

Fall sowing should work as well.

Zauschneria garrettii - see *Epilobium canum* ssp. *garrettii*

M *Zinnia grandiflora* (Rocky Mountain. Zinnia) - Asteraceae

Probably self-incompatible. Many seeds offered at exchanges are not fertile.

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

M *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° dry.

Sow in situ outside in fall or begin treatments in November of the year of collection.

Soak and **rinse each day** for 3d. A bubbler is helpful. Do this soak for seeds sown in situ or cells.

This leaching of chemicals definitely increases germination percentages. Sow in cells/pots, C. Put outside.

Germinate in cool temperatures (in about 3.5-4.5 months).

Bloom in 2 years.

SHRUBS

Amelanchier alnifolia (Western Serviceberry) - Rosaceae

Shrub to small tree.

Store clean seeds 40 dry. About 1/4 still viable at 6 yo stored 40 dry.

When soaked, the seeds form a light gel coat.

Soak the seeds in 3% peroxide for 15 minutes. Rinse well. 40(60-120d). If leaving in the fridge after the first 60d, check every week for germination. Stick a germinated seed into a hole in a pot of mix. Maintain a temperature of 60-70°.

It is easier to cold treat the seeds in the fridge for 60d starting about 120 days before your last frost. Then sow the seeds in pots of well draining mix, med C. Put outside.

Growth is slow for 1-2 seasons.

I find this species difficult to overwinter in pots in a cold frame even with temperature control.

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, lt C. Cotyledons emerge in 1 week.

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

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

D Arctostaphylos uva-ursi (Kinnikinnick) - Ericaceae

Scarification (of cleaned seeds), then 60 to 90 days warm, moist treatment then 90 to 120 days cold stratification. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-274. 2012 p 69

Cuttings: Oct.- Nov.; add sand & some of existing soil(with fungus) to mix; hormone; scarification not necessary; stick directly into pot, do not disturb; mist (or high humidity chamber?); 70-80/40-55; takes about 8 months to root.

Artemisia filifolia (Silver Sage, Sand Sage, Old Man Sagebrush) - Asteraceae

Seeds may have limited viability in storage.

Sow in self pruning deep pots, C (no more than 1/2"), 50-70°.

Plant as soon as possible that season or long roots may rot in the bottom of the pot.

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.

In February, soak 10 month old seeds 24h. Sow in a 2.5" pots containing well draining mix, C and place outside for cold stratification. 100%

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.

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

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

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.

Soak seeds in tepid water for 5 hours. 70(3d) - 40(3.5m). Radicles emerge in 5.5-8.5w. Cotyledon leaves emerge 1-2w later.

When sowing, cover seeds to depth. Use deep cells or pots containing a rocky mix.

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 (so they only need cold stratification). 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.

Store 40 dry.

Start treatments in early November. 70(3m)-40(3-5m) - 70, C.

Germination 100% over a very long time period.

***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, cover the seeds with some medium.

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

Seeds can be soaked, sown in pots put outside or 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.

Viability decreases every year in storage even at 40° dry.

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

Cold stratify stored seeds. Radicles emerge in 3w when cold stratified in the fridge. Cotyledons emerge 11d after sowing stratified seeds.

For cold stratification outdoors, sow 3-4w before last frost date, lt C.

Sow in situ in fall or early winter. Light cover.

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

Viability stored dry 40° about 40% when 6 years old.

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 self seeds readily.

If possible, use fresh seeds but viable at least 4y at 40° dry.

Sow in early winter or in spring, either in situ or in cells/pots. vIC (light requirement).

Seeds sown in early winter, germinate about 4 weeks before the last frost in spring and may be large enough to give away in spring.

E *Eriogonum effusum* (Spreading Buckwheat) - Polygonaceae

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

Sow in early Feb. in FR. lt C. Radicles begin to emerge in 38d. D=L. 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 CO, store the seeds dry at 70° to after-ripen.

One month before the last frost, 40(1m) - 70, lt C. In more southern states with summer rains, no pretreatment is necessary.

Older seeds can be stored dry 40°

Best germination results from seeds collected the fall before sowing and after-ripened.

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

Store seeds dry 40°. Higher germination rates with 2 yo seeds than 4-5 yo.

At least 2 months before your last frost date, soak in water 24h; sow, in deep pots in very well draining soil, vIC, outside 40(2m). Cotyledon leaves emerge around 19d after radicles at 60-70° daytime.

M *Fraxinus anomala* (Singleleaf Ash) - Oleaceae

Samaras ... can remain viable in leaf litter or humus for several years. <https://www.fs.usda.gov/database/feis/plants/shrub/fraano/all.html>

70(2m) - 40(3m), C.

Half of radicles emerged in the moist vermiculite in the fridge from 1-3m, about 1 every week or two.

Larval host plant of the two-tailed swallowtail. raisingbutterflies.org

M *Gutierrezia sarothrae* (Broom Snakeweed) - Asteraceae

Store dry 60-70.

Surface sow heavily in spring. Mist or bottom water. Cover with glass or plastic.

It is easy to germinate seeds collected the previous fall under a dome, using artificial lights. The seeds germinate in 7d at 70°. Cotyledons in 3 more days.

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

Cold stratification for 4 months is necessary, 40(4m). I have had excellent germination when I start treatments in Nov-Dec. I treat the seeds with liquid smoke, sow in cells, vIC, and put outside. They germinate about 1 week into April (FR, 5,690'). The seedlings are very small.

M *Jamesia americana* (Five-petal Cliffbush, Waxflower) - Hydrangeaceae

Store dry 40. Fertility about 18% after 6 years.

60-70(L)

Cotyledon leaves in 26d. Tiny seedlings.

E *Krascheninnikovia lanata* (Winterfat) - Amaranthaceae

Viability poor after 2y. About 25% in 3 yo seeds.

In February, (5,690'), sow in cells, in germination mix, 1/4" C. Put the flat outside. Radicles in 29d.

Cotyledons in 53d. Germinate cold and tolerate prolonged cold.

Philadelphus microphyllus (Littleleaf Mock Orange) - Hydrangeaceae

Store clean seeds 40 dry. Viability still strong at 5y.

Add extra drainage material to mix. Sow in cells/pots, vIC, 40(45d) outside.

Seedlings are very small.

Easy to germinate but difficult to calibrate water needs in pots outdoors.

Physocarpus monogynus (Mountain Ninebark) - Rosaceae

Collect seeds in Aug. in the Front Range.

40(45-60d)

Sow seeds mid-March (5,690', FR), vIC outside. Sow in cells or very small pots or the seedlings will be too wet. 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.

M *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%.

80% pushed up cotyledons by April-May (5-6 months) when sown mid Nov., C and put outside.

OR

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.

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

D *Prunus virginiana* var. *demissa* (Chokecherry) - Rosaceae

Immediately after collection and cleaning (no drying necessary), sow in situ, C.

All sources seem to agree 3-4 months of cold stratification is necessary and that germination can take a long time.

Plant well before high temperatures. wildflower.org

Purshia stansburiana (Cliffrose) - Rosaceae

Native to the western slope. More difficult than *P. tridentata* to grow in gardens on eastern slope.

Seeds have long feathery styles.

"Nearly all propagation is by seed, which benefits first from a one month moist and cool (35-41F) period before germination. " Jim Borland, *Aquilegia_2020_44.2_Spring.pdf*, p15.

E *Purshia tridentata* (Antelope Bitterbrush) - Rosaceae

Seeds are pyramid-shaped nutlets.

If dry seeds are black, they do not germinate. Use the tan seeds.

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.

Advancing seedlings is more difficult than germinating them.

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.

D *Rhus trilobata* var. *trilobata* (Skunkbush) - Anacardiaceae

Dioecious.

Collect the seeds when they strip easily from the rachis.

Remove the red flesh and store 40 dry.

Sand, boil soak, 40(3m) - sow 65-70°, C.

OR

Sulfuric acid 10% soak for 7 hrs., rinse, 24h tepid water soak - 3/6/24 40(2m). 50% success. (will try sanding and HCl 10% for safety.)

Ribes spp.

Collect the fruits when they have colored and are still soft. Dried raisins are hard to clean. The seeds should be tan to brown, not green.

Sow soon after cleaning either in situ or in pots put outside.

Stored seeds require pretreatments. For older seeds (ex. 5 yo), a soak in 3% peroxide for 15 minutes followed by a water soak for 24 hours helps.

Sow stored, pretreated seeds in early winter.

E Ribes americanum (American Black Currant) - Grossulariaceae

Collect the seeds in fall when the fruits are black and still soft. Soak and clean. If the fruit has dried, and it is hard to clean the seeds, soak more days. If necessary, use an immersion blender after soaking to remove the dried fleshy material.

Sow fresh seeds in the fall soon after cleaning the seeds.

OR

Store the seeds dry at 40 or 70°. Viability decreases with storage.

At the first of the year, peroxide 3% soak for 15 min. Rub seeds in the peroxide if they do not sink.

Rinse. Soak in water for 24h. Fresh seeds probably don't need any treatment other than cold strat.

Sow the seeds in deep cells/pots or in situ. Med C. Place outside or in the fridge for 4-5m cold stratification. Winter sowing is easier if you get 40° or a bit below for 4-5m.

Cotyledons begin to emerge 2 weeks after the last frost date.

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

E Ribes aureum (Golden Currant) - Grossulariaceae

When the fruit is soft ripe (Aug. at 5,690'), collect the berries. Soak and ferment for a few days. Clean the seeds. Store dry at 40°.

At the first of the year, peroxide 3% soak for 15 min. Fresh seeds probably don't need any treatment other than cold strat. Rub seeds in the peroxide if they do not sink.

Rinse. Soak in water for 24h. Sow the seeds in deep cells/pots, med C. Put outside for a 4 month cold stratification.

Cotyledons start to emerge around the last frost date.

E Ribes cereum (Wax Currant) - Grossulariaceae

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

Sow fresh and put outside. OR

Store dry 40°.

At the first of the year, peroxide 3% soak for 15 min. Rub seeds in the peroxide if they do not sink.

Rinse. Soak in water for 24h. 40(4m) outside, med C. Germination rate 63% with 5 yo seeds.

Germination rate without peroxide soak 40% with 2 yo seeds.

E *Ribes leptantha* (Trumpet Gooseberry) - Grossulariaceae

Follow directions for *Ribes cereum*.

E *Robinia neomexicana* (New Mexico Locust) - Fabaceae

Southern CO and escapes cultivation in northern CO; thorny stem, root sprouts

Nick on the humped side away from the hilum, bubble leach or soak and rinse 3d, sow, C, 70/55 - develops long radicle quickly, use a deep, self pruning pot.

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, C.

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

Rubus deliciosus (Boulder Raspberry) - Rosaceae

Collect fruits in mid summer. Promptly soak and clean the seeds. Store dry 70 to after-ripen.

Winter sow, C. Radicles emerge in about 120d when held at 40, moist. When the cold stratification was accomplished outdoors, the germination rate increased for me (44% vs 28%). About 10d after the switch from 40° to 60-70°, cotyledons begin to show. Germination might continue for some years.

D *Sambucus racemosa* (Red Elderberry) - Adoxaceae

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

Start in mid Nov. Sand the small seeds, peroxide 3% soak 30 min, rinse, water soak 24 hours.

70(3m) - 40(3m) - 70L.

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

E *Shepherdia argentea* (Silver Buffaloberry) - Elaeagnaceae

Dioecious.

Viability 6-9% at 12 yo.

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

D *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.

TREES

Acer grandidentatum* var. *grandidentatum (Big-tooth Maple) - Sapindaceae

Collect seeds in fall.

Soak 24h. Remove some of the wing or not.

Sow in deep cells/pots in a well draining mix, C, OT.

Cotyledons in 100d.

Celtis occidentalis (Western Hackberry) - Cannabaceae

Store cleaned seeds 40 dry to retain some viability for 5 years.

At 5690', mid-February, water soak 24h, remove seed coat - 40(13w) - sow, 1/2" C

Germination rate 71%.

Quercus gambelii (Gambel Oak) - Fagaceae

This oak species is a member of the white oak group. It is recalcitrant, i.e. the seeds cannot be stored dry. Seeds should be sown as soon as they are collected. Cover the pot with hardware cloth or critters will pull the seeds from the pots and eat the radicle. Seeds can be maintained for a week or so in moist sphagnum. Refrigeration may extend that grace period. A radicle begins to emerge in about a week after they fall from the tree.

WOODY VINES

Parthenocissus quinquefolia (Virginia Creeper) - Vitaceae

Introduced to CO from eastern states. This may be invasive in CO!

"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

Seeds stored clean at 40° dry germinated 45%, 2 weeks before seeds stored in their fruit, 25%. Cover the seeds 1/4".

The easiest way to propagate is by hardwood or semi-hardwood cuttings, or by layering in the fall. wildflower.org

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 can take several 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 Prairie Moon seeds.

Carex hystericina (Bottlebrush Sedge) - Cyperaceae
40(60d) - prairiemoon.com.
40(60d) - prairielegacyinc.com. The perigynia are on Prairie Legacy seeds. Scarify.
C, 70. Indoor light work well.

Carex inops (Sun Sedge) - Cyperaceae
Sun Sedge has an eliasome! Seeds are collected and dispersed by ants as soon as they are ripe.
Collect into a zipper plastic bag. Sow ASAP. Med C. OT.

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.” www.fs.fed.us/rm/pubs_npn.rngr.net/renderNPNProtocolDetails?selectedProtocolIds=cyperaceae-carex

RUSHES

Juncus interior (Inland Rush) - Juncaceae
Mid Nov, sow several seeds in a 2.5” pot, vIC, out. Leaves emerge in spring.

GRASSES

Storing

Grass seeds can sit on a shelf at 70° until you sow them that year. They will remain viable for 2-3 years when stored at 70°. For long term storage, refrigerate them at 40°. Put the seeds in plastic or glass jars or in paper envelopes inside plastic or metal boxes. Grass seeds are viable for many years when kept in the refrigerator.

Sowing

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.

Planting

Spring-summer planting of grass plants 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.

Achnatherum hymenoides (see *Eriocoma hymenoides*)

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

Warm season.

Store seeds 40 dry. 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 40 dry.

Seeds do not require cold treatment to germinate. They germinate in the fall and overwinter as seedlings. fs.fed.gov/database

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

E *Bothriochloa torreyana* (Silver Bluestem) - Poaceae

(syn. *Bothriochloa laguroides* var. *torreyana*)

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.

Self seed vigorously. Somewhat rhizomatous as well. Can overpower small gardens.

Store seeds 40 dry.

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 40 dry.

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.

Bromus pubescens (Hairy Woodland Brome) - Poaceae

Viable at least 6y at 40 dry.

70-90°/40-45°, med C. Germinate in 13 days.

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

syn. *Bouteloua dactyloides*

Warm season.

Dioecious. Fruits look a bit like a bur, but they are not prickly.

Purchased seeds primed with KNO₃ sown after the last frost day, germinate in less than 3w.

Cold stratify unprimed seeds for 6-8w, "Sow strat'd seed from April to September, preferably in clay loam.... Keep moist until established. Seed requires light for germination. Old seed germinates better than young seed." wildflower.org

Germination percentages with unprimed seeds are very low.

70-90, lt C.

E *Deschampsia caespitosa* (Tufted Hairgrass) - Poaceae

Cool season.

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

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

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

Cool season. Partial shade to sun.

Avoid roadside seed collection. Seeding with cultivars raised for forage is common along roads.

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 plugs 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 1 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*.

D *Eriocoma hymenoides* (Indian Ricegrass) - Poaceae

syn. *Achnatherum hymenoides*

Cool season.

Sandpaper scarify, hot water soak or bubble for 3d. 40(45d). Sow heavily at 70° C.

Low germination rates.

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", OT. 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 octoflora* (Sixweeks Fescue) - Poaceae

Cool season.

Annual.

Viability about 15% at 5 years when stored 40 dry.

Sow 6 weeks before last frost date, vIC out

Cotyledons emerge around the last frost date.

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.

The seeds are miniature arrows that can penetrate clothing and pets. *Nassella viridula* (Green Needlegrass) blooms about 1-2 weeks later and has a similar appearance but is not skin penetrating.

Hesperostipa neomexicana (New Mexico Feather grass, NM Needlegrass) - Poaceae

Cool season.

Treat the same as *H. comata*. No scarification.

Hilaria jamesii (Galeta) - Poaceae

Warm season.

Viability strong at 4 years stored 40 dry.

Sow about 1m before the last frost date or through the summer, vIC. Germinate from 14d to 2m depending on the temperature.

E Koeleria macrantha (Junegrass) - Poaceae

Cool season.

Viability strong after 3 years storage 40 dry.

Mid March (in the FR, 5690'), sow pinches of seeds in cells, vIC. Put outside. Leaves emerge in 30-40d in cool temperatures.

E Muhlenbergia montana (Mountain Muhly) - Poaceae

Warm season.

Viable after 5 years storage 40° dry.

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.

Muhlenbergia multiflora (Blowout Grass) - Poaceae

Collect seeds in August.

Add extra drainage material to the germination mix.

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 May 1- June 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.
Careful! Rhizomatous and tends to form monocultures even in natural sites.

E *Schizachyrium scoparium* (Little Bluestem) - Poaceae

Warm season.

Sow mid April 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 40 dry.

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.

Viability good at 5 years stored 40 dry.

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 cryptandrus* (Sand Dropseed) - Poaceae

Warm season.

Viability good at 7 years stored 65 dry.

Sow 5-6w before your last frost date. Add extra drainage material such as expanded shale to the mix, lt C, put outside.

Leaves in 50d.

M-D *Sporobolus giganteus* (Giant Dropseed) - Poaceae

Warm season.

Clean gently to avoid damaging the caryopsis.

March-April: 40° (5-6w).

Add extra drainage material such as expanded shale to the mix, lt C, put outside.

E *Sporobolus heterolepsis* (Prairie Dropseed) - Poaceae

Warm season.

Viability good at 6 years stored 40 dry.

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 wetlands on the Pawnee National Grassland and elsewhere in eastern Colorado. It is often classified as a buffalo wallow plant.

It produces terrestrial or floating aquatic fronds up to 25mm (1 inch) in diameter resembling four-leaf clovers.

As the season progresses and water recedes, the fronds become smaller. Hard, brown sporocarps are produced on the drying soil. These bake, along with the plants, in the hot sun on scorching soil during the summer. The 4mm to 7mm long sporocarps contain male and female gametophytes in microspores and megaspores, respectively. The sporocarps are known to remain viable for at least 100 years based on herbarium specimens.

Trampling by cattle, antelope, or deer (instead of bison) serves to scarify the hard sporocarps thus releasing the gametophytes. The sporocarps are also eaten by waterfowl whose gizzards provide scarification.

When water is present, they produce floating fronds. 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, cut-in-half, or partially crush the sporocarps. (Sandpaper, pliers, nail clippers, etc.)

I prefer partially crushing the sporocarps and spreading the pieces around. Two or three sporocarps usually produce an abundance of plants.

[Fill a draining container with a loamy clay soil. Be sure the height of the container allows it to sit inside another non draining container which has sides higher than the draining container.]

Outdoors! Place the treated sporocarps on soil (mine is Nunn-Clay Loam) saturated in water with depths of water over the top of the soil ranging from 1 mm to 12 mm. Add water to the soil from bottom to neutralize any chlorination products. Slosh the water around gently to disperse the sporocarp pieces.

Sporophylls containing microspores and megaspores are produced in one hour. When the sporocarp is scarified with a small nick, the sporophyll emerges appearing like a gelatinous, worm-like creature.

Germination of megaspores occurs in about 10 days. It may or may not help to lightly tip the container to spread the microspores around with the megaspores.

After 3 more days, fine grass-like growths 3-4 mm tall appear. These are the first leaves/fronds growing from the fertilized megaspore.

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

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

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

The small, rhizomatous “ferns” can be transplanted to a sunny, moist site. I grow mine at the end of a concrete splash pad below an outdoor faucet. It is easy to give them a drink when a hose is used or as needed. Mine thrive in full sun that they receive for at least half a day.

Have fun!” email from Rick Brune, 6/12/21; updated 9/5/25

[I had my best success following Rick’s directions when I put the container under indoor lights. As soon as the weather allowed I moved the container outside.]

Useful Resources:

pdf’s of Deno, Norman, Seed Germination Theory and Practice 2nd ed. and 2 supplements.
<https://rmc-nargs.org/deno-seed-germination/>

Native Plant Network: Reforestation, Nurseries & Genetic Resources
npn.rngr.net

USDA Woody Plant Seed Manual
https://www.fs.usda.gov/nsi/nsi_wpsm.html

Copeland, Lawrence O. and MacDonald, Miller, B., Seed Science and Technology, 4th ed., Kluwer Academic Publishers, 2001.

SEED COLLECTION DATES IN THE FRONT RANGE

MAY

Carex inops
Escobaria missouriensis
Lomatium orientale
Oxytropis sericeus
Vesper montanus
Viola nuttallii

JUNE

Astragalus drummondii (into July)
Astragalus parryi
Astragalus shortianus
Berlandiera lyrata (through Sept.)
Hesperostipa comata
Heterotheca villosa (through Aug.)
Hymenoxis hoopesii (into July)
Koeleria macrantha
Linum lewisii (June- August)
Mertensia lanceolata
Oxytropis sericea
Physaria bellii
Scutellaria brittonii

JULY

Agastache urticifolia
Allium textile
Amsonia tomentosa
Aquilegia chrysantha
Aquilegia coerulea
Argemone polyanthemus
Astragalus bisulcatus
Berberis repens
Cleome trachypleura into September
Delphinium ramosum
Elymus elymoides
Engelmannia peristenia
Ericoma hymenoides
Eriogonum umbellatum
Erysimum asperum, *E. capitatum*
Gaillardia aristata (into Sept.)
Geranium viscosissimum
Heliomeris multiflora
Iris missouriensis
Lithospermum incisum
Monarda fistulosa (into Sept.)
Oenothera harringtonii
Oenothera macrocarpa

Oreocarya virgata
Penstemon crandallii
Penstemon glaber var. *alpinis*
Penstemon grandiflorus
Penstemon virens
Ratibida columnifera
Rudbeckia hirta
Sedum lanceolatum
Sphaeralcea coccinea
Stanleya pinnata
Thelesperma megapotamica
Townsendia grandiflora
Zizia aptera into Aug.

AUGUST

Allium cernuum
Brickellia grandiflora
Campanula americana
Cleomella lutea
Cleomella serrulata
Mentzelia multiflora
M. nuda
M. decapetala

Penstemon barbatus
Rudbeckia laciniata
Tripterocalyx micranthus

SEPTEMBER

Artemisia frigida
Asclepias subverticillata
Asclepias tuberosa (into Oct.)
Brickellia grandiflora
Dalea purpurea
Gaillardia X grandiflora
Ipomopsis aggregata
Liatris punctata
Mirabilis lanceolata
Mirabilis liniaris
Oreochrysum parryi
Phacelia tanacetifolia
Panicum virgatum
Penstemon rostriflorus
Physalis longifolia
Xanthisma spinulosum

OCTOBER

Amsonia illustris
Bouteloua curtipendula

Brickellia eupatorioides
Gutierrezia sarothrae
Ericameria nauseosa var. *nauseosa*
Eriogonum effusum
Solidago mollis

NOVEMBER

Echinacea angustifolia through January