

“How to Figure out How to Grow Things”: A General Guide

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General thoughts:

The common garden project requires the germination of a wide range of woody species native to Northeastern North America. Woody plants are often more complicated to grow from seed than herbaceous annuals, but with planning and an understanding of basic techniques, it is entirely possible to manage.

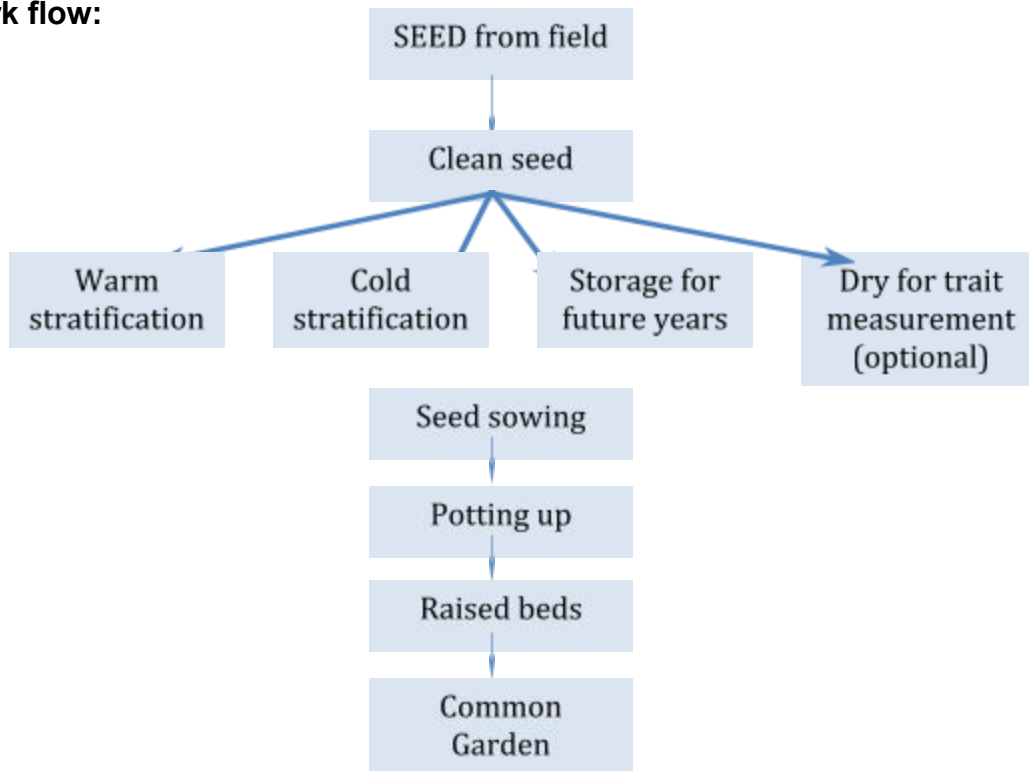
As Jack Alexander of the Dana Greenhouses wisely put it, when collecting, cleaning, stratifying, and germinating seeds, it's important to keep in mind how these plants would naturally propagate themselves. For example, many of these seeds are dispersed in the fall, are kept moist and cold on the forest floor through the winter, and then germinate in the spring. Since we are collecting those seeds just before they disperse, we must take on the roles of cleaning them, keeping them cold and moist in a refrigerator, and then providing warm germination conditions in the greenhouse.

The seeds for the common garden project can be intuitively sorted into several general categories. These categories include: dry vs. wet, tiny vs. large, and easy to store vs. non-viable after storage. Wet seeds, such as berries, maple samaras, and acorns/ other nuts often need to be cleaned quite promptly, and should not be left out to dry. While in the field, it is often useful to keep these fruits in a cooler. Many of these wet fruits tend to lose viability or enter deep dormancy with long-term storage, making it less useful to save these seeds for germination in future years. Seeds in the “wet” category also tend to overlap with the “large” category, being visible to the naked eye and easily handled.

Meanwhile, dry seeds, such as those occurring in *Spiraea* or ericaceous capsules, or birch catkins, benefit from being left out to dry before cleaning. These seeds can be identified as “ripe” on plants when the bracts or capsules surrounding them turn from wet green to dry brown and open to allow the seeds to easily dehisce. These seeds tend to be very tiny and difficult to handle. Since in nature they often are dried, they are much more tolerant of long-term storage.

Important resources:

- “lizzielist-working copy SM Sept 1 2014.xlsx”
 - in Google drive.
 - has instructions listed by species, gives most of the species-specific information you could want. This spreadsheet was compiled by volunteer Suzanne Mrozak.
- “Seed Collection Gantt Calendar.pdf”
 - exported from the Gantt chart on Teamwork. In the Common Garden folder.
 - Shows approximate time ranges of when seed may be ripe in the field.

Work flow:**Collecting seed:**

Another wise rule of thumb from Jack is that plants will tend to ripen a seed just before it ripens the surrounding fruit. This makes intuitive sense, because if a fruit is prematurely dislodged from a plant, if the seed is already mature, the plant's effort is not wasted. On the other hand, if a berry ripens to a tasty treat before the seeds are mature, the plant would have spent energy making a bird happy, but does not increase its reproductive fitness.

Storing a portion of the seed:

Often, a single plant will produce so much seed that it does not make sense to sow all of the collected seed. For example, *Spiraea* plants will produce thousands of seeds. These tiny seeds germinate very well, and end up making a carpet of small plants, when the maximum number of plants we may transplant up from a single parent each season is a dozen or so. If we instead save a portion of the seeds for next season, it is possible to germinate some in that next year, without having to re-collect the seed from the same plant in the field. Since it is impossible logistically to germinate all the plants we will ever need in a single year, it makes sense to have overlap between the multiple years we will be sowing seed.

Seed should be stored DRY-- in other words, do not put it into stratification mix when storing it. However, this does not mean the seeds should be dried in a drying oven-- that would kill them.

The seed stored from the 2015 growing season is stored in glassine envelopes in the refrigerator in the West Labs. The glassine envelopes are labeled clearly with the ID of the parent plant, the date the seed was collected, the date the seed was cleaned, and in most cases an approximate count of how many seeds are in the envelope.

When new seeds of these species are being cleaned and stratified in future years (generally in autumn), these seeds should be revisited, and placed in warm or cold stratification for planting in the following spring.

Stratifying seed:

Recipe:

- Mix together (by volume) 1 part sand, 1 part peat, 1 part perlite.
- Moisten with a spray bottle until the mix is evenly moist, but not so much that water drips out.
- Place enough of the moistened media in a plastic baggie to surround all the seeds you hope to stratify.
- New information I've learned: seeds actually respire/ breathe while they are in stratification. They need oxygen. The plastic bag should not be a freezer bag-- those don't allow for gas exchange. There should be enough empty space in the bag to leave a nice pocket of air.
- The bags should be opened and inspected on a set date each month: check for moisture, check for unexpected germination, and freshen the air in the bag.

Temperatures:

- Cold stratification= about 40 degrees F, or in a normal refrigerator.
- Warm stratification= about 70 degrees F, or at room temperature in the lab.

Seeds are stratified by placing them in a moist medium and keeping them at a specified temperature. Given infinite refrigerator space, it would be great to sow all the seeds and then stratify the entire container. However, we instead stratify in plastic bags, check occasionally to make sure the medium inside is still moist, and sow in the spring.

Many seeds have a stratification requirement to break dormancy. If seeds do not have dormancy, they could germinate as soon as they are dispersed. This works well for seeds that are dispersed in the springtime, at the beginning of the growing season. However, for seeds dispersed in the summer or fall, if they germinated, they could be killed at the seedling stage by the onset of winter.

Even though we have access to a greenhouse, it is still a bad idea to germinate our seeds in the fall. They will be fighting a losing battle against decreasing sunlight. It is much better to plant them after January, when sunlight will be increasing in the greenhouses, and they can get a good head start before they go outside in the spring time.

Therefore, even seeds that do not have a stratification requirement (for example DIELON or Diervilla lonicera), even though they could germinate in the fall, it is best to keep them in cold stratification through the fall and sow them later.

Still other seeds need to have a period of WARM stratification, before cold stratification. Warm stratification can occur at normal room temperature. Essentially, the goal is to keep the seeds moist and warm which helps the seed coat to break down, and avoid severe mold. The seeds that need this treatment typically take multiple years to germinate in the field. For example, *Ilex verticillata* seeds in the field would live through a winter, then go through warm stratification over a summer, then their cold stratification over a second winter. By skipping the "first winter" we can speed up their timeline. It's important to check on seeds in warm stratification more frequently, as they are more likely to dry out, but also because we have experienced some of these seeds germinating extremely early in warm stratification, as though they had very little dormancy to begin with. If seedlings start to grow in the stratification bags, they can often be tenderly saved, if the situation is noticed in a timely way.

The timelines for each stratifying sample can be difficult to keep track of-- when to change from warm to cold stratification? When to sow? I recommend writing these dates on each bag, and also keeping things organized by which month they will need attention (ex: all the bags of seeds that need to be sown in February could be kept in one labeled box in the refrigerator).

Sowing seed:

Once seeds are done with stratification, they should be sown in the greenhouse.

Seeds tend to be sown at specific depths. These depths are all listed on the spreadsheet compiled by Suzanne. The seeds don't need to be artificially oriented in any particular direction-- plant them in the position that they would naturally fall on the ground.

Seeds can be scattered with their stratification mix-- they do not need to be separated from the mix before sowing them.

We have used a single rectangular container to sow seeds-- these are referred to in the catalogue and in many of my notes as "601" containers, because 6 of them fit in 1 tray. Fine seed-starting mix (no extra nutrients required) should be packed gently but firmly into the container, leaving space at the top. Then scatter in the seeds, distribute them evenly across the container, and add more soil on top to bring them to the right planting depth. The final soil surface should NOT be flush with the top of the container-- leave 1/4 to 1/2 inch of space, so that when the trays are watered, seeds are not splashed out into nearby containers.

Seeds should be watered in gently soon after sowing. Water very gently, and never ever allow water to pool on the surface of the soil. To avoid this, you should pass the gentle stream of water quickly across the soil, without pausing. Pause with the stream of water OFF of the containers. Wait until water has soaked into the soil completely before doing another pass.

One new thing I've learned: seedlings can have issues with fungus, causing "damping off." I think this might have happened with some of the smaller unsuccessful seedlings in the spring of 2016. An expensive solution is mixing in *Trichoderma* powder to the media you are sowing the seeds in. The powder kills off

other fungus, and protects the seedlings. Store the powder in the freezer. At the Morris Arboretum, we use "Rootshield wettable powder." Something to try, if damping off continues to be a problem.

Transplanting to pots/ aka "potting up":

Once seedlings are hefty enough to be transplanted, they should be. Transplanting will give the seedlings access to more space and nutrients. I like to dig the seedlings out very gently, usually using a pencil to pry the seedling up from underneath. Then, hold the seedling at the correct height in its new container, and gently add soil around its dangling roots. Firm down the soil very slightly around the seedling. Watering the seedling for the first time will help the new soil settle around it.

Seedlings should be transplanted into coarser media, with more bark in it. Some mix equivalent to Fafard 52, with slow-release fertilizer added, is ideal. I added 3 tablespoons of slow release fertilizer beads and an extra scoop of perlite to every 5 gallons of media. Using the large red soil mixer is helpful-- ask the greenhouse staff how to use it, and please wear a dust mask when mixing media.

Greenhouse facilities:

Each time new or different greenhouse space is needed, a greenhouse space request form needs to be filled out and submitted to the greenhouse manager. Also, be in touch in person as much as possible to keep good communication lines open. The griffin catalogue of greenhouse supplies has dimensions for different types of trays and pots-- calculate the amount of greenhouse space needed using these dimensions, with a low and high estimate of space needed.

Labeling tags, spreadsheets, and documentation:

Every time anything is cleaned, stratified, sown, or transplanted, this data should be recorded in a Rite in the Rain notebook, to be transferred to a spreadsheet. See "SEED_Tracking Sheet 2014-2015" and "SEED Tracking Sheet 2015-2016." One good function of these sheets is that they keep track of seed quantities and germination, so hopefully we could get accurate information on viability/ germination rates. Some of the information recorded in these sheets may be superfluous, but generally, it is better to have more information on the process of growing these plants rather than less.

Every tray of seeds and every transplanted seedling should have a plastic tag with: the ID of the parent plant (ex: SPIALB06_WM), and a "W" or "Wolkovich" to identify the plant as one we are responsible for. On the back of each tag, I like to write the dates of sowing and transplanting. This is somewhat a redundancy, since that information should also be in the Rite in the Rain, but often ends up being useful, for example if seeds from SPIALB06_WM were actually sown on several different dates.

When plants are transplanted to the common garden, they should receive a unique identifier. This will make things so much easier. Good luck/ break a leg! Love, Jehane.