



Landowner's Guide to Storing 'Ōhi'a Seeds



Please do not collect 'ōhi'a seeds in the forest!

It could be harmful to these natural populations of trees, and even worse, it increases the likelihood that you will spread Rapid 'Ōhi'a Death.

How to store 'ōhi'a seeds from your own land:



1. Collect ripe, healthy seeds



2. Extract and clean the seeds



3. Germinate some seeds



4. Dry the seeds for storage

5. Package the seeds for storage

6. Store the seeds

7. Test seeds from time to time

8. Prepare stored seeds for sowing

9. Sow the seeds & grow 'ōhi'a!

Read on for details on each step

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Lyon Arboretum Seed Conservation Laboratory

1. Collect ripe, healthy seeds and capsules

Do not collect 'ōhi'a seeds from forests on public lands! Land managers may already be collecting 'ōhi'a seeds, so additional collection could harm these natural populations of trees. Even worse, unauthorized collections increase the likelihood that you will spread Rapid 'Ōhi'a Death. If you are a home/landowner with 'ōhi'a trees on your own property, follow these guidelines to create your own mini-seed bank to preserve the genetic diversity of your trees.

Unripe seeds do not store well. 'Ōhi'a seeds are ripe when capsules are dry, brown, and cracking open. Collect seeds or capsules. If you find a cluster where capsules are brown, you can collect the entire cluster and ripen the remaining capsules (see step 2). Remember, viable seeds are alive. Keep them in a cool, dry, ventilated place (when collecting, use breathable paper bags, or only use plastic bags temporarily) and away from direct sun. To prevent mold, they should not be wet. Process seeds as soon as possible.

Important Notes on Rapid 'Ōhi'a Death (ROD):

Even when collecting from your own land, it is necessary to follow sanitation protocols. ROD is caused by a fungus with sticky spores found in and on soil and 'ōhi'a wood, which may lay dormant for months or even years. It has not been detected outside of Hawai'i Island, but following sanitation protocols – even on neighbor islands – is the best way to prevent spread. Be sure to thoroughly clean your tools and shoes using 70% isopropyl alcohol, and wash your clothes before hiking anywhere. If you drive into 'ōhi'a forest, wash the tires and undercarriage of your vehicle afterwards. **Most importantly, avoid wounding 'ōhi'a trees**, which creates an entry point for the ROD fungus. Pinching off seed capsules is very low risk, as long as you don't create a larger wound by peeling off bark. Visit rapidohiadeath.org to learn more. If your land is potentially affected by ROD, try to collect only seeds (which have not been found to host ROD spores), so as not to move woody material (stems and capsules) that could potentially host spores. Carefully shake or tap capsules facing downward into your collection bag, and most ripe seeds will fall out of ripe capsules.

2. Process, extract, and clean the seeds

Place the cluster of capsules face down on a clean tray in a dry area, away from sun and wind, for up to a week. Within this time, most capsules will open and release seeds (even mature open capsules may release more seeds). You may want to use a toothpick or needle to gently remove any seeds that are still stuck inside any of the capsules. Remove any large pieces of capsules/stems by hand. Use a sieve or kitchen strainer to separate seeds from smaller debris (standard sieve sizes 18 or 20 work well to catch most debris). Try to end up with relatively clean seeds – this will reduce storage space and reduce the likelihood of storing any plant pathogens.

3. Germinate some of the seeds

This is to make sure the seeds are viable. 'Ōhi'a seeds have a low rate of germination – around 20% is average, even for fresh seeds – so keep this in mind. Luckily 'ōhi'a produce small seeds in large amounts. We suggest using ¼ or ½ teaspoon of seeds as a standard amount for testing. Sow 'ōhi'a seeds on a layer of moist sphagnum moss over a well-draining potting mix. Place in a location with plenty of indirect light. Mist or use a spray bottle at least daily – do not let the moss dry out. No germination treatments are necessary, and viable 'ōhi'a seeds usually germinate within six weeks. Make note of the amount you sowed and how many seeds germinate. Healthy seedlings will be ready to transplant into individual pots when there are 4-6 true leaves, and saplings can be transplanted into the ground in 1-2 years.

4. Dry the seeds to the correct moisture level for storage

Under warm, humid conditions in Hawai`i, most stored seeds deteriorate rapidly. Air drying will not suffice for good storage life. For a home/landowner who wants to store seeds on a small scale, we can suggest several simple methods for seed drying:

a) Drying in a self-defrosting home refrigerator

This is an easy method if you have a self-defrosting refrigerator – if ice does not build up in your refrigerator, you probably have one. The self-defrosting unit keeps the air inside the refrigerator dry at levels adequate for seed drying. However, units may vary, especially if you open the door daily and keep moist items (produce, liquids) inside, so you may want to check the % relative humidity first (see below).

Spread the seeds in a thin layer in a shallow container with an airtight lid, but leave the lid off. Place the container into the refrigerator and leave it a month or so for the seeds to dry. When you are ready to store the seeds, open the refrigerator door and immediately put the lid on the container so moisture does not condense on the seeds. Take the container out and let it come to room temperature before opening it. Once it has come to room temperature, you can open it and pack the seeds for storage.

b) Room temperature drying in plastic containers

You can also dry seeds inside airtight plastic containers. Spread the seeds into a shallow container in a thin layer, then put the container into an airtight plastic container with a drying agent. For seeds to be stored at room temperature, we recommend using silica gel. See Appendix for more detail on silica gel. For seeds to be refrigerated or frozen (which will extend seed longevity), we recommend calcium chloride, sold at Longs and hardware stores under the brand name “Damp Rid.” Mix the calcium chloride with a little water until it is the texture of soggy shave ice (it will get hot when you add the water). Fill a cup about halfway with the slurry and put the cup into the airtight container. Do not let the slurry touch the seeds directly. The calcium chloride will remove moisture from the air inside the container.

Store the remaining calcium chloride in an airtight container, so it does not dissolve. As needed, pour off excess moisture from the slurry, or add more crystals. You can also recharge the slurry by heating it in a glass container until most of the water is driven off. A microwave oven works well – do not let the liquid boil. You can dispose of used calcium chloride solution by pouring it down the drain. Calcium chloride is not poisonous (it is an ingredient of canned tomatoes), but will corrode metals and cause skin irritation.

Place the airtight drying container in a cool place, away from the sun. Check the container from time to time to see whether the silica gel or calcium chloride needs replenishing. Allow the seeds to dry for about a month, then pack them for storage.

Monitoring % relative humidity

Seed banks use a device called a hygrometer to monitor relative humidity inside a drying unit. You can purchase these (at a range of prices) from scientific supply companies as well as on Amazon. Another option is to use a dry box with built in hygrometer, also sold online for photographic equipment storage. For a low-cost alternative you can get Standard Humidity Indicator Cards from gaylord.com, item # 62031. See Appendix below for technical notes on seed drying.

5. Package the seeds for storage

After you dry the seeds, you need to pack them in airtight containers. Otherwise, the seeds will absorb moisture from the air and undo the results of step 4. Many containers are not as airtight as you might think - we recommend using containers with rubber gaskets. If you have many small containers of seeds, you can put them into larger gasketed containers. (Exception: If you use a self-defrosting refrigerator for both drying and storing the seeds, airtightness might not matter so much, see step 4a.)

Keep seeds labeled with the species, date of collection, and any other info important to you. If you are going to store the seeds for more than a few years, consider getting archival labels, or enclosing a piece of paper with the label information written in pencil inside the storage container.

6. Store the seeds

‘Ōhi‘a seeds store best when kept at low temperatures. In seed banks, the preferred method for long-term storage is freezing to ~0°F, which is the temperature in a home freezer. For year to year storage, many store the seeds ~39°F, the temperature inside a home refrigerator. On a lower budget, dried seeds can be stored at room temperature inside airtight containers, but cold storage is better if available. If the freezer or refrigerator fails, it is not a disaster. Changing temperatures during storage will not harm the seeds, but when they are warm, they will age much faster than when they are cold. When the temperature drops, they will go back to aging slowly.

Once seeds have been dried, we recommend refrigerated storage for most home/landowner’s purposes. Frozen storage is also an option, and when properly done, will give better longevity than refrigeration for ‘ōhi‘a seeds, but seed preparation for storage is more involved than for refrigerated seeds. For short to medium-term storage (5-10 years), the advantage over refrigerated storage is small.

7. Germinate a sample from time to time

If you store the seeds for more than a few years, you may want to take some out to test from time to time (use methods in step 3). ‘Ōhi‘a seeds are long-lived in cold storage (and can store for decades if frozen), but even under ideal storage conditions, seeds will eventually deteriorate. Storage life also depends on maturity and other factors, and can vary by collection, even from the same tree at different times. When the first signs of reduced germination appear, it is time to replenish the seed supply.

8. Prepare stored seeds for sowing

Seeds that have been dried for storage may become damaged if they absorb water too fast, leading to poor germination or unhealthy seedlings. To prevent this, allow the stored seeds to pick up moisture by exposing them to open air for about a day before sowing them. If you have stored the seeds in a freezer or refrigerator, allow them to come to room temperature before opening the storage container, so that moisture will not condense on the seeds. If you do not use all of the seeds, reseal the container immediately. You do not have to re-dry the remaining seeds unless the volume of air in the container is much greater (>100x) than the volume of seeds.

9. Sow the seeds

You can now sow the seeds normally, see step 3 for recommendations.

Appendix

Notes on silica gel

Silica gel appropriate for seed drying is available locally in craft stores, where it is sold for drying flowers. It can also be purchased from scientific supply companies or from Southern Exposure Seed Exchange (southernexposure.com). While silica gel itself is inert, some forms raise safety issues. The main concern is over indicator silica gel that uses blue/pink cobalt chloride as a moisture indicator. Cobalt chloride is under investigation as a potential carcinogen when inhaled over long periods. This is most likely to be a problem with fine dusty forms of silica gel, rather than bead form. However, silica gel beads are also manufactured using non-toxic yellow iron or methyl violet indicators. The yellow-green indicator silica gel from Southern Exposure is well suited for seed storage. After silica gel has absorbed moisture, it can be re-dried for use again by baking or microwaving, follow this link for instructions:

<http://www.southernexposure.com/drying-seed-with-color-indicating-silica-gel-ezp-26.html>

For small quantities of seeds, the Eva-Dry Mini-Dehumidifier is a convenient device with a built-in electric dryer to recharge the silica gel by simply plugging it into an outlet overnight, and the silica itself always remains contained. Different sizes are available locally from Longs or online (eva-dry.com).

Technical notes on seed drying

Operators of seed banks and others who need to maximize seed storage life can improve seed longevity by controlling the moisture level of the stored seeds. Current theory suggests that seed storage life is maximized by drying seeds so that they are in equilibrium with 15-20% relative humidity at storage temperature. On a Gaylord humidity card, this is when the topmost block is in a transition from pink to blue. If you dry the seeds at one temperature, but store them at a different temperature, some adjustment needs to be made:

Drying temperature	Storage temperature		
	25°C/77°F (room)	5°C/41°F (refrigerator)	-18°C/0°F (freezer)
25°C/77°F (room temperature)	20%	33%	46%
5°C/41°F (refrigerator)	14%	20%	32%

At ~33% relative humidity, the top block of the Gaylord humidity card is pink, and the second block is in transition from pink to blue. At ~46% relative humidity, the top two blocks are pink and the third is in transition.

The relative humidity of the air inside a typical self-defrosting refrigerator in Hawai'i is about 20% if no moist items are kept inside, about 30% if there are moist items. The relative humidity inside the freezer is much higher.