Preparing Wild **Hickories** and **Walnuts** for Storage, Sale, or Planting

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Purpose and Acknowledgements

This handbook was created to help guide farmers and others through the process of collecting and preparing wild harvested nuts for storage, sale, cracking, or planting. The work was supported by the USDA National Institute of Food and Agriculture through the Northeast Sustainable Agriculture Research and Education (SARE) program under subaward number ONE24-463-AWD00001359.

This handbook is intended to complement the Northeast Nutweb, an online tool designed to connect nut growers and consumers across the region. Any nut or tree nut product producer can create a free listing to reach interested buyers. More infomation is available at: http://www.nynga.org/Nutweb.htm

Black Squirrel Farms is working to create non-timber value from native nut trees. We developed this handbook to help others figure out how to do this, too! Thank you for joining us.

Intro

IF YOU CAN FIND GOOD NUTS, THEY CAN BE PLANTED OR EATEN.

This handbook is designed to support beginners and small operators working to prepare wild harvested nuts for storage, sale, cracking or planting. It includes examples of gathering, hulling, and drying practices at various scales being successfully applied by people in the US Northeast. This handbook is organized by process, with sections for:

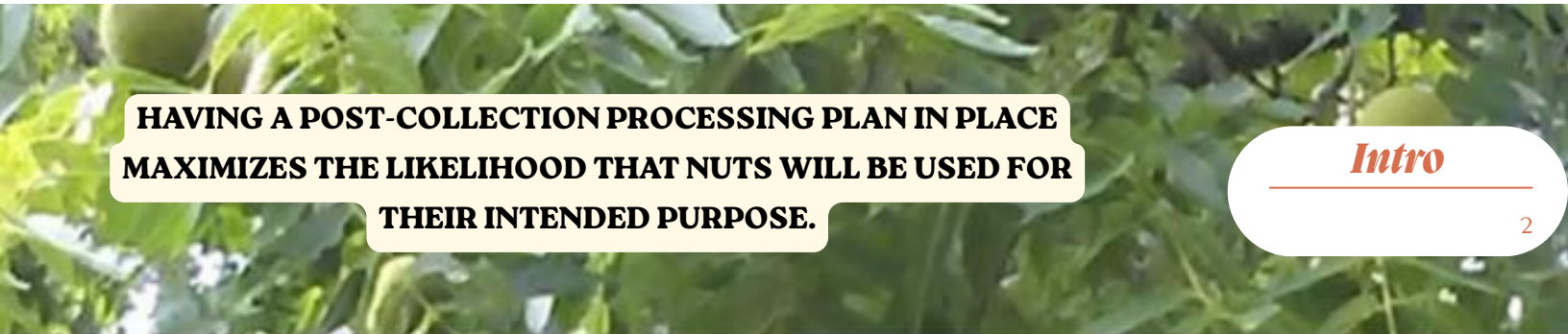
1. GATHERING
2. HULLING/HUSKING
3. FLOAT TESTING
4. DRYING
5. STORAGE
6. TREE SEED LABELING (FOR SALE)

Each section includes an overview of the **process, tools,** and **approaches** applicable for work on different scales, and a list of related notes, considerations, species-specific process adaptations and anecdotes. The many ways in which nuts may be used after they are stored is beyond the scope of this guide.

It is very helpful to know your trees, your intended use, and your processing steps before you begin. Deciding whether the nuts will be eaten or planted is necessary because there are differences in how nuts for seed and nuts for food are handled post-collection.

- Nuts destined for consumption should be stored cool and dry.
- Nuts destined for planting should be stored cool and moist.

Risk of rodent predation is important to consider and manage in advance. High-grading throughout multiple processing steps will result in a higher concentration of quality nuts when the processing is complete. While there are some general best practices applicable to all nuts, any processing approach may require tweaking based on species, region, or individual trees. This guide focuses on black walnuts, butternuts, thin-husk hickories (yellowbud and pignut) and thick-husk hickories (shagbark and shellbark).



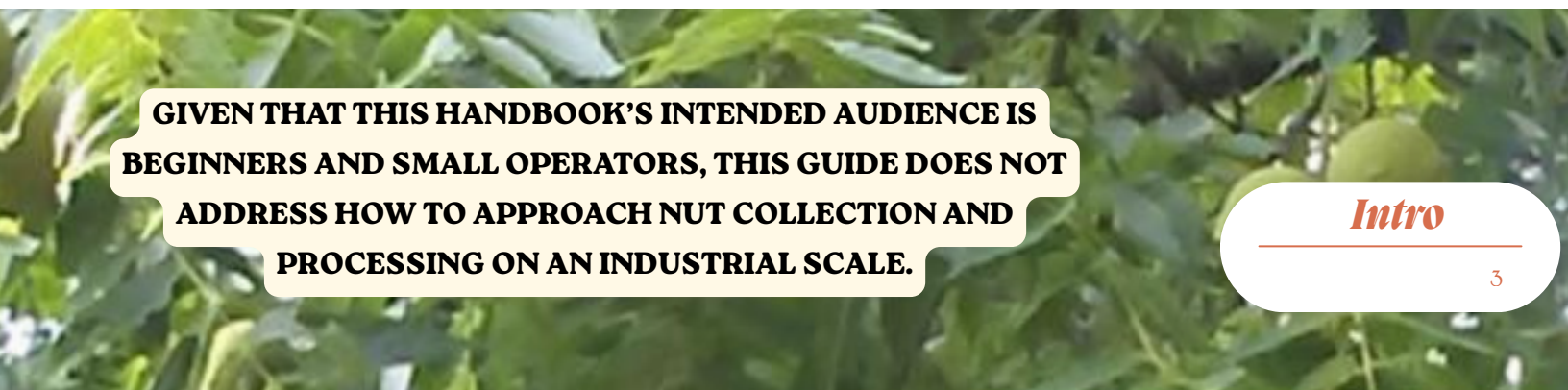
HAVING A POST-COLLECTION PROCESSING PLAN IN PLACE MAXIMIZES THE LIKELIHOOD THAT NUTS WILL BE USED FOR THEIR INTENDED PURPOSE.

Understanding the scale of the effort in adavnce is crucial. The scales of effort addressed are as follows:

Personal scale processing is appropriate for nuts from 1-9 trees. This can range from collecting and processing a few nuts for the first time, to hundreds of pounds of in-shell nuts, enough to eat a daily handful throughout the winter. Tool and process options at this scale may vary, but they all share key characteristics: they are cost-effective, readily accessible, and safe to operate with minimal or no training.

Farmstand scale processing is appropriate for nuts from 10-99 trees. At this scale, tools and equipment can handle much larger quantities of nuts but are often more expensive, require skilled operation, and may require some creativity and fabrication. At this scale, you may be using techniques or technologies recommended for either personal or cooperative scale. This scale is likely a appropriate for farmers pre-processing nuts to send to a co-op for additional processing.

Co-op scale processing is appropriate for nuts from 100+ trees. This quantity of nuts often means that collection involves many farmers, land stewards, and gatherers. Equipment at this scale can be significantly more expensive and extensive pre-planning will be needed. Whether you are purchasing, retrofitting or repurposing existing equipment, or importing more efficient equipment from abroad, purchasing and maintaining the equipment as well as designing efficient processes for your operation requires significant investment.



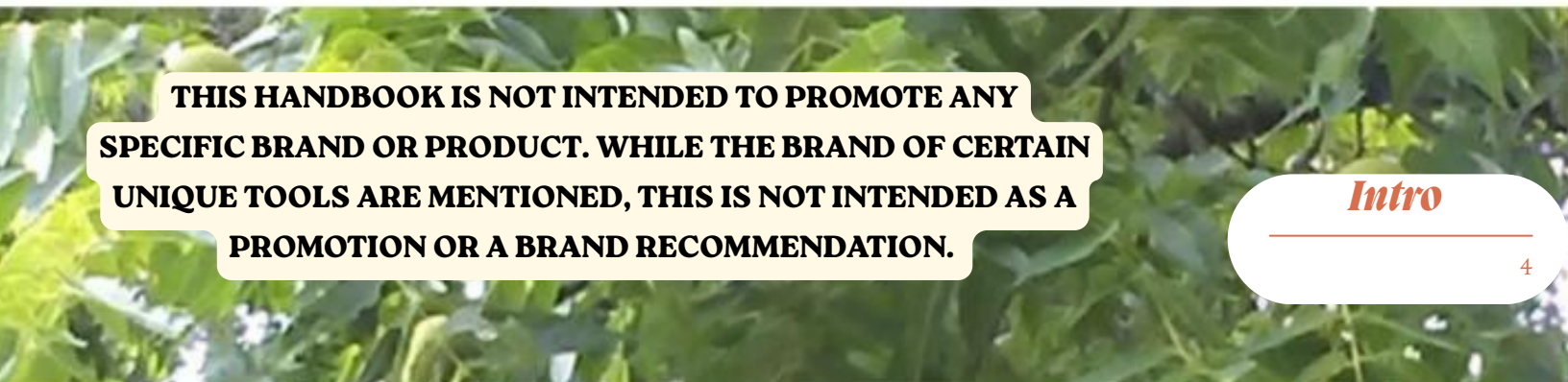
GIVEN THAT THIS HANDBOOK'S INTENDED AUDIENCE IS BEGINNERS AND SMALL OPERATORS, THIS GUIDE DOES NOT ADDRESS HOW TO APPROACH NUT COLLECTION AND PROCESSING ON AN INDUSTRIAL SCALE.

To process nuts without developing bottlenecks, it is helpful to have the equipment for all steps to be at roughly the same scale.

For example, hulling twice as many nuts as what the drying approach can handle risks having a portion of nuts gathered spoiling or curing improperly. Over-designing one step and under-designing another can create inefficiencies, though it may be part of the learning curve in your nut-processing journey. Depending on the processing equipment available to you at any particular time, this may also be temporarily unavoidable.

This handbook will not provide a "right answer." It has been developed in the spirit of knowledge-sharing and is intended to provide ideas and options, not detailed process implementation advice. An exhaustive set of detailed guidance applicable to every situation cannot be developed or anticipated. Also, detailed operational and safety considerations for most tools are easily accessible - as are Good Agricultural Practices (GAPs), a set of techniques to reduce food contamination risks, some of which are applicable to nut gathering and handling. Because, ultimately, solutions are designed and implemented at the discretion of the practitioner, so to are safety protocols and this guide assumes that practioners are motivated to and capable of safely implementing any new practices adopted. This field is full of creative solutions that are actively and rapidly evolving through a network of innovative and passionate individuals and organizations. Experimenting with various options, reaching out to those already involved, and sharing ideas, questions and results widely is highly encouraged.

At any scale, and with any experimentation, keep safety in mind, whether that is personal safety while conducting operations or food safety, much of which involves minimizing contamination and controlling microbial growth.



THIS HANDBOOK IS NOT INTENDED TO PROMOTE ANY SPECIFIC BRAND OR PRODUCT. WHILE THE BRAND OF CERTAIN UNIQUE TOOLS ARE MENTIONED, THIS IS NOT INTENDED AS A PROMOTION OR A BRAND RECOMMENDATION.

Gathering

Plan your nut harvest in advance.

Your nut harvest plan should include determining: the number of trees from which to gather nuts, the location of these trees, the accessibility of these trees, and an estimate of nuts likely to be harvested. All native hickories and walnuts have significant annual variability in yield. A heavily-loaded, mature black walnut can produce over 250 lbs of fruit in a single season, although the same tree is unlikely to do so two years in a row. In general, yard trees and field-edge trees tend to be more productive than forest or woodlot trees, as full sun exposure generally increases yield.

Ideally, an assessment of the parent trees would have been completed in advance. If the plan includes harvest from trees owned by someone else, be sure coordinate with the owner in advance to ensure access and to address any issues that may arise from gathering from these trees. It's easier to gather from trees whose dripline area has been recently mowed. Yard trees are often ideal for easy nut gathering.

When gathering nuts for seed, having a gathering plan is critical because the quality of the parent tree(s) directly influences the quality of the future seedlings.

Collect nuts as they ripen and fall.

In central NY, white walnuts (butternuts) start to fall in early September, black walnuts in late September, and hickories throughout October. Weather impacts nutfall, with a disproportionately high number falling after a period of strong wind or heavy rain. Nuts that fall before their season (e.g. August) are not good and should not be gathered. The earliest nuts to drop tend to have development-related quality issues. For black walnuts, this manifests as a higher percentage of "floaters" (see float test section for additional information). For shagbark hickory, this manifests as husks being more tightly closed and difficult to remove. While there is an increasing likelihood that thick-husk hickory nuts will just fall out of their husk when the nut hits the ground as the season progresses, how easily nuts separate varies by tree. Squirrel pressure varies by tree species and location, and can determine how frequently collection is necessary.

Be selective and collect the best.

How the best nuts look will vary from species to species. When collecting nuts for food, freshly fallen nuts often have higher quality. Freshly fallen black walnuts have firm, complete green husks. Shagbark hickory nuts that have been lying on the ground for a few days or a couple of weeks are often ones that the squirrels declined to eat for quality reasons. Holes in shells, which are generally insect holes, are always a problem and should not be gathered. **Insects in hulls may not be an issue.** Black walnut hulls can host walnut husk fly larvae and these larvae do not impact the quality of the nut (and, anecdotally, chickens love to eat them!). Black walnuts with extremely moldy hulls should not be gathered. Avoid gathering nuts from areas impacted by animal droppings. Irregular color, or irregularity in general, often signals a quality issue. One way to quickly develop a sense for what good and bad nuts look like on the ground is to gather a bunch of nuts with different appearances, crack them open and observe.

PERSONAL SCALE

Tools

- hands
- bucket
- nut roller

Considerations

- Hand collection offers the advantage of easy pre-sorting. Sorting and grading nuts is addressed in a later section.
- Ensure the nut roller is properly sized for the type of nuts being collected.
- **Collect for quality.** Rejecting bad nuts as soon as possible makes future processing steps easier.
- Steve Brayer of Triple Brook Farm (Southampton, MA), convinced the squirrels to work for him. He placed a bucket of sawdust near the tree of interest, and the squirrels would fill it with nuts. This works, he claimed, because squirrels look for the softest ground to bury their nuts into. After the nuts stopped falling, he would collect the nuts and replace his bucket, now full of corn, to keep the squirrels happy and thank them for their work.
- Anecdotally, for thin-husk hickories like yellowbud, raking up the material under a tree and then using a leaf blower to blow the raked material does a reasonable job of separating nuts from leaves and twigs.

Image: Nut roller
Image credit: Black Squirrel Farms

Image: Black walnut trees
Image credit: Don Woodward, Medina, NY

FARMSTAND SCALE

Tools

- nut roller
- bag-a-nut
- bulk bucket hauling

Considerations

- Be sure you beat the squirrels and just keep rolling. Avoid collecting bad nuts.
- You can buy multiple nut rollers and have a team working with you to collect.
- Use the nut rollers as to fill 5 gallon buckets but have a plan to how to manage many buckets full of nuts. Having a tractor or ATV pull a trailer with a larger container or multiple buckets can work well.
- Make sure you have the appropriately sized nut roller for the species you are collecting. You can still sort at this step. Avoid collecting bad nuts.

Image: Bag-A-Nut harvester
Image credit: Jesse Marksohn, Yellowbud Farm

Pro tip!

If you pick up a nut and decide it is bad, don't drop it where you are likely to gather again, throw it out of your gathering area.

CO-OP SCALE

Tools

- tractor mounted nut collector
- a large team of people with nut rollers
- a network of people hand collecting

Considerations

- Follow tractor safety guidelines.
- This equipment is less common in the region than equipment designed for smaller scale. If mechanically harvesting, carefully remove any debris, rocks, or foreign objects before mechanical processing, or design a safe, pre-hulling step to accomplish this. Rocks can damage some hulling equipment.

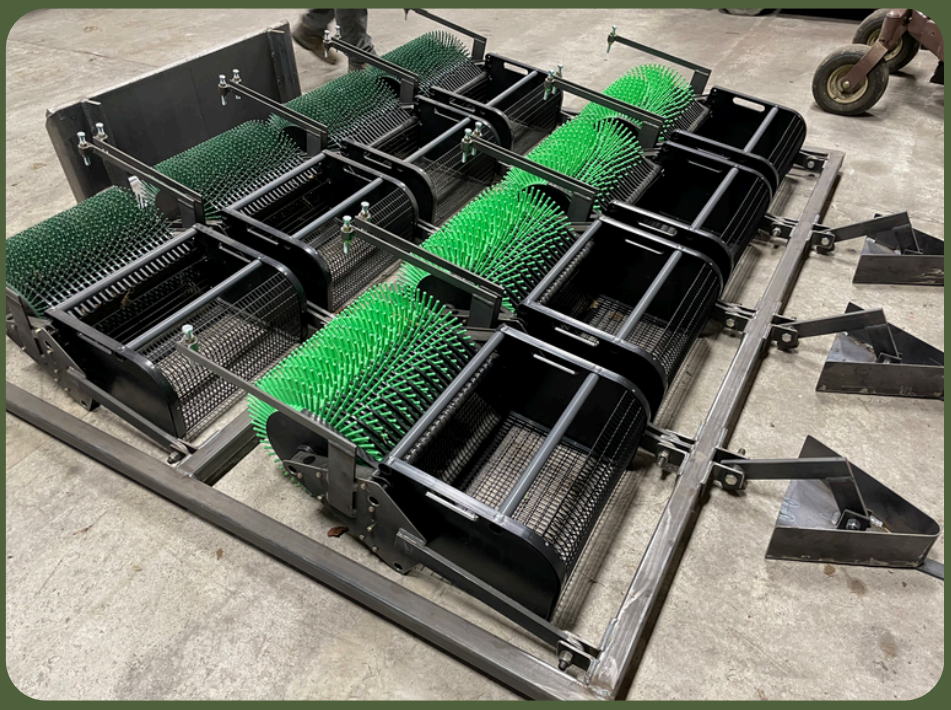


Image: Tractor mounted ground-nut collector based off the bag-a-nut.
Image Credit: Bob Stehli, Wintergreen Tree farm

Hulling/Husking

Abrasion and washing

Remove the outer hull/husk from the nut in any way you can. There are different ways to hull at every scale, but the unifying principle is the combination of abrasion and washing. Both are needed for a clean result. The **abrasion and washing** can be separate steps or combined depending on the technology you are using. Seed nuts do not need to be as clean as nuts that are intended for food.

We recommend wearing gloves when working with walnuts: black walnuts will stain your hands black and white walnuts (butternuts) leave a sticky residue.

If hulls will accumulate significantly, a hull management plan is needed. This plan could include spreading hulls in the woods, preserving them for drying for powder, composting them or some other solution. A clever hulling solution applied in Medina, NY is a tractor-mounted PTO-driven huller that leaves hulls in the field while aggregating in-shell black walnuts for washing. If the management plan for hulls involves drying for powder for supplements, greater vigilance regarding hull quality management and handling is merited and this is outside the scope of this handbook.

PERSONAL SCALE

Tools for black walnuts and butternuts

For hulling:

- **Good**: hands, gloves, the cut side of a thin log/straight stick, or the 'boot method.'
- **Better**: crank operated corn sheller.

For the wash:

- **Good**: drill attached paint stirrer in a bucket of water.
- **Better**: pressure washer and metal grate.

Tools for thick-husk hickories

- Thick-husk hickories often drop without their husk attached or with the easily removable by hand during gathering.
- If nuts with tightly closed husks are gathered, let them dry slightly so that the seams separate and then remove the husk by hand.

Tools for thin-husk hickories

- No hulling/husking needed if the intent is to use the nuts collected as seeds.
- Specific information about how to hull/husk thin-husk hickories at personal scale is not provided as significant use of these nuts for personal processing and consumption is not anticipated.

Image: Using a straight stick to smash the hulls off of black walnuts or butternuts. Remove as much material as you can before using water to further clean.

Image Credit: Feral Foraging Youtube- https://www.youtube.com/watch?v=pCOJEfQcyz4&t=853s

Considerations

- Removing hulls before using the paint stirrer method, and then using the paint stirrer as a method of cleaning rather than being the main abrasion as well as cleaning, is suggested. This will make the hulling process much faster, as well as make it much easier to dispose of the removed nut hulls.
- Some people run over nuts with their car to remove black walnut and butternut hulls. The ease and outcome of this abrasion-only step depends on the driveway, the nuts and the vehicle.
- For the stick method, find a log/straight stick about 4 feet long and 3 inches in diameter. Hit the nuts with the log.
- The 'boot method' for black walnuts and butternuts works well. Step on the whole nut to remove the hulls. Some put the nut on a rock before stepping on the whole nut. This could be an effective approach for a small amount of nuts. Because this step is abrasion-only, washing the nuts after hull removal is necessary for food nuts.

Image: Hand-crank operated corn sheller. It may be necessary to regulate the flow of nuts into the machine to avoid having the machine get locked up. The stick is intended to keep hands further away from the feed into a spinning grinding wheel.
Image Credit: Black Squirrel Farms

Image: Submerge hull-removed nuts in a bucket of water, then run a handdrill- operated paint stirrer in the bucket.
Image Credit: Feral Foraging

Youtube- https://www.youtube.com/watch?v=pCOJEfQcyz4&t=853s

FARMSTAND SCALE

Black walnuts and butternuts:

Hulling at farmstand scale gets tricky. At this scale, there is a need to balance keeping costs manageable with the need for increased capacity. Below are examples of creative farmstand level approaches, prioritizing efficiency and low-cost.

Abrade: PTO (tractor power take off), gas engine, or electric motor driven homemade abrader. Examples:

- The base of a lime spreader and a steel drum
- A converted hay conditioner with an oil tank on top.
- Many other examples of home-made hullers exist. We show some in the images.

Wash: Cement mixer

Image: This electrically-powered standalone black walnut huller, designed and built by David Eberly in Yates County, NY, combines the abrasion and washing steps. A batch of black walnuts is added into the barrel shown and a garden hose continually supplies water into the barrel as it rotates, which provides the washing. The abrasion is delivered by black walnuts in the barrel bouncing off the rebar bars and each other. How to load and unload the machine has been carefully considered and cleverly designed.
Image Credit: Black Squirrel Farms

Thick-husk hickories:

In the US Northeast, shellbark hickory is unlikely to be available to an individual collector at larger than personal scale, therefore no larger-scale approaches are discussed. Shagbark hickory, which grows abundantly in the region, will often just fall out of the husk when hiting the ground and can be collected without a hulling/husking step required. For shagbark hickory nuts that are in the husk when collected, allow the nuts to dry in a location which receives ongoing airflow but is safe from predators. Most husks will split into quarters, making a by-hand hull removal approach manageable. Very tightly closed shagbark hickory hulls which do not split after some drying time are likely better discarded and should represent only a small fraction of nuts collected.

Image 1: PTO driven walnut huller made out of an old lime spreader and steel drum.

Image Credit: Future Generations University https://www.youtube.com/watch?v=U3WcVQ_4fCU

Image 2: Inside of the above machine.

Thin-husk hickories:

Thin-husk hickories hulling at a farmstand scale includes homemade machines such as the one in the image below.

Considerations

Thin husk hickories, unlike thick husk hickories, get harder to husk as they dry. As they dry, the husk will nearly fuse to the shell. For consumption, you must either husk these nuts immediately before drying, or keep them moist and cool until ready to husk.

Image: *A custom-made huller for thin-husk hickories, using a 55-gallon drum and chicken plucker fingers on a rotating barrel. Image Credit: Samuel Thayer*

Additional images:

Image: Cement mixer used to wash nuts. Mix equal volumes of nuts and water in the cement mixer. Place a heavy-duty perforated bread tray, root tray, or other perforated receptacle that will catch clean walnuts when the cement mixer is dumped underneath the mixer. Nuts will still likely require rinsing with a hose prior to proceeding to the next step of a float test / disinfection. This takes roughly 20 minutes but depends on the volume of nuts you are washing at a time.
Image Credit: Black Squirrel Farms

Image: Cement mixer being used to wash walnuts.
Image Credit: Future Generations University
https://www.youtube.com/watch?v=U3WoVQ_4fCU

Image: Hay Conditioner turned 90 degrees with conveyor belt flaps to abbrade and an oil tank as a top.
Image Credit: John Kelsey

http://thescalepit.com/ContentBW/BWPNO1%20processing%20nuts.pdf

CO-OP SCALE

Tools for black walnuts and butternuts:

Kadıoğlu Agricultural Machinery (nutmec), in Turkey, makes an increasingly popular tool for hulling black walnuts which abrades and washes at the same time. Resmak, also in Turkey, makes a competing product. Domestically, Pecan Nut Busters makes an abrasion-only electric black walnut huller. Check for additional/newer options.

Tools for thick-husk hickory:

At the time of publication, co-op scale processing of thick-husk hickories has not been identfied in this region.

Tools for thin-husk hickory:

Abrade and wash: Success using machines sold overseas as pistachio peelers has been reported for husking thin-husk hickories.

Image: This machine and others like it are marketed overseas as pistachio peelers and work for thin-husked hickories such as yellowbud. They use a combination of water and abrasion to remove husks.
Image Credit: nutmec.com

CO-OP SCALE

Considerations

- Electrically powered and fuel powered machines are available.
- Electrically powered machines often require 220V service or higher.
- Different size models are available. Assume at least 3 months of lead time if purchasing an imported machine.
- Making a hull management plan in advance is helpful.

Image: Abrasion plus water works for black walnuts and butternuts. These nuts can tolerate a more robust abrasion solution and so this machine and others like it, marketed overseas as English walnut hullers, produce a well-cleaned black walnut. This machine was produced by Kadıoğlu Agricultural Machinery (in Turkey).
Image Credit: Black Squirrel Farms

Image: This huller is used by a Hammons hulling station. Hammons Products Company is an industrial scale black walnut processor located in Stockton, Missouri.
Image Credit: Hammons Black Walnut https://www.youtube.com/watch?v=Sq2KtpxL_yc

Float Test

Float testing is an important quality step that removes underdeveloped or impaired nuts from a batch of nuts being processed. Whether the nuts being processed are destined for eating or planting, the most healthy will taste the best and/or grow the best trees. Gathering and processing nuts brings lots of nut them together for an extended period of time, which is not a naturally occurring situation. Removing nuts with quality issues keeps the batch as healthy as possible for as long as possible.

Well developed nuts are more dense than nuts impacted by various quality issues. Conveniently, well developed freshly hulled black walnuts and butternuts sink in water while those that are poorly developed or impacted by mold and insect damage float. This makes water a useful tool for high-grading a batch of hulled nuts.

While high-grading via a water float test is helpful for any batch, using a water-based solution which includes some antimicrobial agent is even better.

While detailing the full range of sanitizers which could serve this purpose is beyond the scope of this handbook, using a dilute bleach solution is a common approach because bleach is affordable, accessible and effective. While additional research regarding the optimal bleach:water ratio and soak time would be helpful, a solution of 1 part bleach per 50 parts water seems reasonable by analogy to an Oklahoma State University Extension recommendation for surface sanitization of pecans, which recommends a 1000 ppm chlorine equivalent. Keep in mind that all household bleaches are not the same and could include anywhere from 5–8.25% sodium hypochlorite. Online bleach dilution calculators are available and the 1:50 ratio assumes a 5% product is used. A diluted solution of Sanidate 5.0, a BioSafe Systems product, has also been successfully used, diluted to the point where the diluted solution has between 60-80 PPM peracetic acid according to a PAA test strip capable of testing a range of 0 - 160 PPM. Use of any sanitizing product merits careful consideration of how to safely handle a potentially dangerous chemical. Chemicals which can kill microbes can also hurt people so developing, documenting, and following safe storage, handling, and disposal procedures is valuable and necessary.

The primary difference between personal, farmstand, and co-op scale float testing is the size of the vessel, the tools used for scooping out nuts that float, and the sanitizer selected. Because the techniques used for this process are not strongly dependent on scale, the example shown below discusses the process without specifically addressing smaller and larger scale solutions.

Pro tip!

If you don't know how your type of nuts will react to a float test, find some are responding differently (sink, float, partially float), then crack them open and look inside.

Tools

- Container for which it is easy to fill and empty the nuts and float fluid
- Tool to agitate the soaking nuts
- Water or appropriately diluted sanitizing fluid
- Tool to skim or otherwise remove floating nuts
- Personal safety equipment such as eye protection and long gloves

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Considerations

- Float testing must be done soon after hulling, as dried nuts can float regardless of quality.
- While float testing with only water is better than not float testing at all, float testing and concurrently sanitizing is suggested. Freshly hulled nuts should be as clean as possible before float-testing.
- Submerge nuts for at least two minutes and agitate them gently to encourage bad nuts to float to the top. Wear chemically resistant gloves and use a large spoon, scoop or other tool to remove and discard floaters.

Image: This image shows a nut being float-tested in a portable clothes washing machine repurposed to serve as a float-test container. The pumping action which would have washed clothes agitates the soaking nuts, helping the less dense nuts rise to the top for easy removal. In this case, a dilute solution of Sanidate 5.0 is being used as the float-test fluid.
Image Credit: Black Squirrel Farms

Image: This image shows floaters being scooped out so that they can be removed from the remainder of the batch.
Image Credit: Black Squirrel Farns

Drying

This section focuses on drying nuts for food. Controlled drying of hickory nuts or walnuts which will be used as seed is not necessary, so this step can be skipped for seed nuts.

The metric most useful for nut drying is water activity (Aw, a measure of the amount of water available to support microbial growth). Water activity level and moisture content are not the same. Some substances hold a great deal of water, but the water is locked in place with molecular bonds, making it unavailable to support microbial growth. This is a state of high moisture content and low water activity. The inverse can happen, too. Some materials hold very little water but that water is easily accessible to support microbial growth or otherwise interact with the local environment. This is a state of high water activity but low moisture content. While moisture content is a commonly used agricultural moisture metric, water activity is the preferred nut drying metric because water activity level is more closely related to spoilage risk than moisture content. An Aw of 0.6 or less indicates a dryness level that will prevent the growth of almost all microorganisms, sufficient to prevent nut spoilage during storage. Building and publishing curves of the relationship between Aw and moisture content for in-shell wild nut varieties is an area where additional future work could add value.

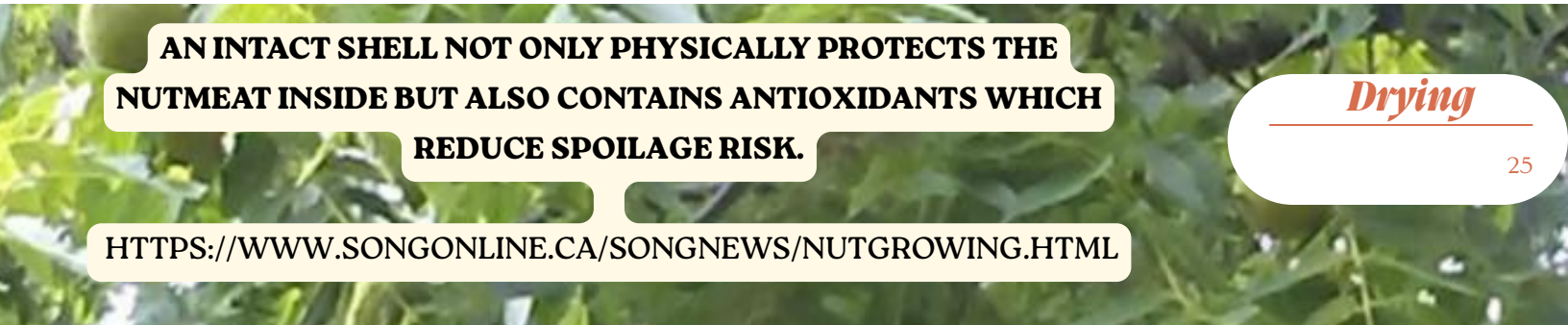
Water activity is usually measured in a lab, and equipment to measure this directly is not generally available to small-scale operations. Therefore, taking an approach that is known to result in nuts that are dry enough to retain quality during storage is suggested. Black Squirrel Farms has calibrated the drying process for wild black walnuts and found that by the time a freshly hulled, in-shell batch of black walnuts loses 20% of its original weight, the nuts are dry enough to retain their quality during proper storage.

Black Squirrel Farms has found that there are two stages of black walnut drying, an initial rapid phase and a slower secondary phase, with each phase resulting in a loss of about 10% of the freshly-hulled in-shell weight. If drying in ambient conditions, how long each phase takes depends on the weather. In general, if the weather is conducive to drying, the first phase may only take a couple of days. If weather conditions aren't conductive to drying, the first phase may take as many as five days. Similarly, the second phase of drying can take between two and four weeks. Forced air and heating can speed up the drying process with the caveat that too much heat can cause different quality issues and so a low heat / high airflow approach yields the best results. When black walnuts are dried too quickly using heat, the shell is likely to split open at the seam. If drying is continued, the shell will eventually close again but, while it is open, the nutmeat inside is much more vulnerable to organisms like molds than when the shell is closed and complete.

Drying black walnuts slowly enough that the shell does not split is preferred from a quality perspective. In general, drying with air temperatures 10-20 F above ambient will not cause splitting during drying. Putting a freshly hulled black walnut in a dehydrator, even on the lowest temperature setting, causes splitting.

Monitoring water weight loss during drying means that the freshly-hulled weight of every batch is needed and should be tracked. If a batch of freshly-hulled black walnut weighs 10 lbs that batch should be dried until it weighs 8 lbs and then it is ready for storage. Batches that almost, but not quite, lost 20% of their original weight have been observed. If those batches have been dried under the same conditions as batches that have lost 20%, they are given an additional week to dry, then stored. While these batches haven't been tested to see if thinner shells explain this discrepancy, thinner-shelled black walnuts may not have as much moisture to lose.

Although based on limited information, it appears that the approach being used at Black Squirrel Farms for wild black walnuts also works for butternuts. It is generally accepted that hickories require less drying than black walnuts. Therefore, it is assumed that a drying regimen that works for black walnuts would also work for hickories but that the absolute weight lost during drying would be less than 20%.



AN INTACT SHELL NOT ONLY PHYSICALLY PROTECTS THE NUTMEAT INSIDE BUT ALSO CONTAINS ANTIOXIDANTS WHICH REDUCE SPOILAGE RISK.

HTTPS://WWW.SONGONLINE.CA/SONGNEWS/NUTGROWING.HTML

Anecdotally.....

Moisture and spoilage risk are directly related. When black walnuts are freshly hulled, Black Squirrel Farms has found that restricting nuts drying in ambient conditions to layers three nuts deep for the initial drying phase is sufficient to prevent mold growth. Forced air solutions can prevent mold growth in containers of many shapes and sizes. Keep in mind that the air should be moving throughout the entire container in order to ensure adequate drying of the whole batch. Round containers are preferred over rectangular or irregular containers, because round containers are less prone to developing pockets of stagnant air and therefore uneven drying conditions. One way to address the irregularly distributed airflow is to stir the nuts periodically. The drying process should be visually monitored. If mold development is visually observed, the process being applied is inadequate.

Heated forced air is not necessary but is an option to reduce drying time, especially for larger operations that may be drying-space constrained. How much heat to apply and when to apply it during the drying process should be considered within the context of the design and objectives of specific operations and efforts.

PERSONAL SCALE

Tools

Sheet trays, grape bins, homemade racks, plastic sheets, commercial dishwasher flatware trays, etc.

Considerations

All solutions require protection from rodent predation.

If no forced air solution is being applied, restrict the depth of layers of drying nuts to a maximum 3 nuts deep with a level of airflow that would be at least comparable to a well-ventilated room. The more airflow, the better. This specific guidance is intended for black walnuts and butternuts; deeper layers may be fine for hickories.

Sheet trays work well. Spreading nuts out on a sheet of plastic on your garage floor is a great way to dry nuts, just make sure no rodents can access the nuts.

People use small onion sacks to both dry and store hickory nuts with success. Hickories tend to come off the tree drier. Black walnuts are prone to mold development in onion sacks unless at least partially dried beforehand.

Stacks of ventilated plastic bins work well for drying nuts fast enough to prevent mold development, provided bins are not overloaded and are exposed to sufficient airflow. A screened-in porch could be an ideal location for stacked bins.

Image: Homemade screened racks such as these can be made out of wood and hardware cloth and stacked.
Image credit: Akiva Silver

https://www.youtube.com/watch?v=5WbO_CGhpxU

Image: Another wood and hadware cloth frame made for drying nuts.
Image credit: Ellen Knapp

Image: Stacks of ventilated plastic bins. These particular bins have openings large enough for mice to access and so ideally should be individually mouse-proofed or located somewhere protected from predator access.
Image Credit: Black Squirrel Farms

FARMSTAND SCALE

Tools

- Hardware cloth on a large frame
- Large perforated containers
- No standard off-the-shelf farmstand scale tools have been identified and so the individual practitioners will need to rely on their creativity, circumstances, and understanding of the principles of the process required in order to design and implement a solution.

Considerations

Place nuts no more than three layers deep unless you have a forced air solution or you rotate and stir your nuts. You may stack containers or hardware cloth frames.

Knowing that drying appears to happen in two stages can be useful for space constrained operations because a two-stage drying approach can be implemented at any scale. At a personal scale, this could look like drying in a flat layer on a plastic sheet on a garage floor for one week, then loading the nuts into an onion sack and hanging the onion sack for the remainder of the drying process. At a farmstand or coop scale, this could look like passively drying the nuts in stacked, ventilated bins for the first phase of drying and then using a forced air solution to speed up the second phase of drying in order to accomplish faster throughput during the harvest season.

Image: This creative solution uses the exhaust from a heated building to cost-effectively cure black walnuts in plastic grape bins. Effectively, this is a low-heat forced air solution proven to deliver a high-quality result more quickly than is possible using ambient conditions alone.
Image Credit: Marlene Stone, Akron, NY

Image: Stacked commercial dishwasher flatware trays, containing nuts no more than three layers deep, set up on a large fan to force air through the stack. This approach is sufficient to deter mold development but, as a solution which relies on ambient air conditions, does not reduce the length of time needed for nut drying. An empty tray on top is sufficient to protect nuts on lower trays from rodent predation.
Image Credit: Black Squirrel Farms

Image: Forced air dryers with a small heating element used by Black Squirrel Farms. Nuts were successfully dried in these after the initial 10% moisture was lost passively. Nuts are in the blue barrels and fans force the air heated by the heated element into the bottom of the barrels.
Image Credit: Black Squirrel Farms

CO-OP SCALE

Tools

- Commercial off-the-shelf nut dryer
- DIY dryer (large vessel + powerful fan + heat if needed)

Considerations

The larger the operation, the more likely that a forced air or a forced air plus heat solution will be needed for nut drying.

The smallest industrial-scale nut drying solutions can be an appropriate size for a co-op scale operations and so there is a selection of equipment available off the shelf, depending on the amount of budget available.

A DIY solution is usually the most cost-effective approach. An important consideration for a DIY solution is whether the forced air will require heat and, if so, how the heat will be generated and safely distributed.

Sometimes a smaller-scale solution, replicated, is the best larger-scale solution available.

A repurposed grain bin with a boiler fan makes a rodent proof forced air dryer and storage solution. Created by Levi Geyer of Fancy Twig Farm.
Image Credit: Jesse Markhsohn

This dryer, manufactured by AMB Rousset, is suitable for co-op scale nut drying and also requires a significantly greated financial commitment than a DIY solution.
Image Credit: https://www.amb-rousset.com/en/drying/

Storage

For food nuts, the objective is to preserve quality. For seeds, the objective is to preserve viability. To the degree possible, storage should protect nuts from mold, insects, rodents, and, for food nuts, from rancidity, changes in natural color, aroma, flavor, and general appearance.

Food nuts are stored dry. The degree to which they retain their quality over time depends on their initial quality, the duration of storage, the temperature of the storage and changes in moisture level during storage. Information generally or anecdotally available regarding the length of time that properly cured in-shell nuts will retain their quality is inconsistent. With recognition that uncertainty regarding best practice remains, the direct experience of the authors suggest that the table on the following page provides a reasonable initial assumption of food nut storage life. Freezing is a viable storage option for properly dried nuts. Freezing may damage food nuts which haven't been sufficiently dried. Storing nuts in the shell is recommended because an intact shell serves to protect the quality of the nuts during storage.

Table 5.—Storage life of walnut and pecan kernels with 3.5 to 4 percent moisture.

Temperature	Storage life (months)
80	3 to 3.5
70	4
47	6
40	10
36	12
25	25
20	30
0	72

Table Source: Heaton, E. K., and J. G. Woodroof. "Storage of Nuts for Food." Annual Report of the Northern Nut Growers Association, vol. 59, 1968, pp. 72–77.

Seed nuts should be kept cool and moist for the winter, then planted in the spring when the ground thaws. The intent is to replicate the winter conditions that would have existed had the seed been planted in the fall, a treatment that should encourage the seed to break dormancy when planted in the spring. Freezing is not recommended as a storage option for seed.

All nuts should be stored somewhere safe from rodent predation. Guidance on storage primarily depends on whether the nuts will be used for food or for seed. Both options are discussed in this section.

NUTS FOR FOOD

Tools for personal scale

- Onion sack
- Plastic bag
- Basement
- Garage
- Personal freezer
- Personal fridge

Tools for farmstand scale

- Chest cooler or freezer
- Dry, well-ventilated space

Tools for co-op scale

- Walk-in fridge or freezer
- Large container with humidity control

Image: At a personal scale, if the nuts are dry and can be hung somewhere outdoors where they are safe from rodent predation during the winter, an approach such as is shown above is an effective solution that doesn't require energy. Image Credit: Autumn Stoscheck, Eves Cidery

Image: A cool, dry indoor space can be a cost-effective solution for a couple months of nut storage that doesn't require the use of additional energy
Image Credit: Black Squirrel Farms

Image: A chest freezer is an effective and affordable way to store dried, ready-to-crack nuts for many months.
Image Credit: Black Squirrel Farms

Image: Dried black walnuts in onion sacks stacked on a plastic pallet inside a commercial walk-in cooler will retain their quality for long enough to support cracking throughout the year until the next harvest season starts.
Image Credit: Black Squirrel Farms

NUTS FOR PLANTING

Walnuts and hickory seeds require stratification before planting or they will not germinate. Stratification requires the nuts to be fully imbibed (~around 30% moisture content), so soaking the seed before stratification for 24 hours is recommended if the seed has dried at all. Nuts should be kept between 32 and 40 degrees for 90-120 days under high-moisture conditions for them to fully stratify. Several approaches that can be used to accomplish this.

Tools

- A high-humidity cool location protected from rodent predation

Personal scale

Bury the nuts in the ground in a **porous container,** using a shovel or other hand tools, and dig them back up in the spring. Alternatively, store the nuts in a container, like a coffee can or food storage bag, a cool environment such as a refrigerator or garage, and include damp moisture-retaining material, like peat moss, in the container.

Farmstand and Co-op scale

- Small scale approaches can be replicated at a larger scale or duplicated.
- Consider machinery to dig a hole to bury larger amounts of seed.
- Consider using a chest freezer converted to refrigerator temperatures to keep your nuts cool if you'd like to avoid burying.
- If using a walk-in cooler also used for other purposes, consider the humidity needs and implications of everything in the cooler.

Considerations

- Burying nuts just below soil level and mulching heavily works for many regional growers as a stratification solution. If using this method, ensure containers have drainage and some soil contact. A common practice at the personal scale is to cut the bottom off a 5 gallon bucket and to secure both the top and bottom with hardware cloth to prevent predation.

- If stratifying in the fridge, use non-porous containers and ensure nuts are moist but not waterlogged.

- Stratifying in a garage can work well at a personal scale in the northeast, but has a minor risk of incomplete stratification. It likely is more reliable is colder plant hardiness zones.

- A chest freezer can be converted to run at refrigerator temperatures using an inexpensive external digital temperature controller that controls how often the appliance runs. Chest freezers can be an extremely energy efficient cooling solution and chest freezers located in a garage in the winter can be an even more energy efficient solution.

Image: Nuts are stratified and stored in a buried 5 gallon bucket. The bucket is full of soil, sand, or another well draining medium. The top and bottom of the bucket have holes drilled or are removed and replaced with hardware cloth to allow drainage and moisture regulation.
Image Credit; Ammas's Forest Gardens

Considerations (continued)

Particularly when using nuts for seed, a correct identification of nut type is required. There is an abundance of resources available to assist with tree identification. The Peterson Field Guide to Eastern Trees has long been considered a definitive and reliable resource. Free, online plant identification tools which rely on pattern recognition from a digital photo are becoming increasingly useful. Of the tools available, iNaturalist stands out as a tool whose auto-identification capability is high quality and which has the side benefit of allowing users to contribute to an ever-growing citizen-scientist generated database of nature observations. Tree auto-identification results based on a digital photo should always be double-checked via some other approach.

The location of living members of some native tree species that are under significant disease threat is being tracked by researchers. At the time of this writing, this includes butternut. One of the tools being used to collect butternut tree location and condition information is called TreeSnap. The app is available for free and information shared becomes public. Butternut tree owners comfortable with publicly sharing information about their trees are encouraged to do so.

Tree Seed Labeling

Please note that we used New York State's labeling requirements (N.Y. Senate, AGM - Article 9 - Inspection and Sale of Seeds § 137) as an example of state-level tree seed labeling requirements. Be sure to check your own state's rules if you are not working in New York State. Not all states have specific requirements for tree seed labeling. In the absence of tree seed specific seed label requirements, consult your state's general seed labeling requirements or reach out to your state's regulatory authority.

NYS requirements- https://www.nysenate.gov/legislation/laws/AGM/137

Overview

If you collect and sell tree seed in New York State, whether by the pound at a farm stand, online, or as part of a restoration planting project, a label is required. The governing statute is New York Agriculture and Markets Law §137, which sets label requirements for all seed sold or transported for planting purposes in the state. Tree and shrub seeds have their own subsection (N.Y. Senate, AGM - Article 9 - Inspection and Sale of Seeds § 137) with requirements that differ slightly from other types of seeds, like vegetable seeds.

Tree and Shrub Seed Labeling Requirements (NY)

Tree seed labels should include these fields:

- **Kind and variety.** The species common name is sufficient for "kind." Include the botanical name as well — it's not legally required, but it eliminates ambiguity, especially for species with regional name variation (butternut vs. white walnut, for example). Variety should be listed if known. If seed was collected from unimproved wild stock, this field can be omitted or noted as "wild collected."
- **Percentage of pure seed by weight.** This is the proportion of the lot that is actually viable seed material, as opposed to empty hulls, shell fragments, and other inert matter. It's determined by a representative sample, either by the seller or a certified seed testing lab.
- **Germination rate.** The share of pure seed capable of producing a normal seedling under favorable conditions. This requires a germination test, discussed further in the following section. Unlike agricultural seeds, tree seeds are not subject to a mandatory "sell by" date tied to the test; however, germination rates decline over time, so retesting after one year is good practice.
- **Year of collection.** The calendar year in which the seed was harvested. This is distinct from the germination test date. For long-lived seed stored under proper conditions, a buyer may be purchasing seed collected one or more seasons prior — the collection year tells them the seed's age.

Tree and Shrub Seed Labeling Requirements (NY), continued

- **Collection locality.** The state and county where the seed was collected. This is one of the more ecologically meaningful fields on the label. Provenance — where a plant's seed originated — influences how well the resulting trees adapt to local climate, pests, and growing conditions. Buyers doing restoration planting, agroforestry establishment, or conservation work will specifically seek locally-sourced seed, and this field is their assurance. For seed collected in New York, list the county.

- **Seller name and address.**

- **The trade name and purpose of any seed treatment, if applied (fungicide coating, for example).** If the seed is untreated, a statement of “untreated"" or "no treatment applied" satisfies the disclosure requirement. Cleaning seeds or sanitizing them is not a treatment.

- **A hazard warning if any substance harmful to humans or vertebrates was applied. This most likely isn’t applicable because generally nuts for tree seed are not treated.**

Germination and purity rate testing:

While tree seed labels require a seed purity metric (percentage of pure seed by weight), this metric is less meaningful for large tree seeds than for other types of seed because contamination of the tree seeds with some other type of seed should be obvious. Using an assumed purity of 99% without commissioning a lab test to support this number should be fine for sellers of clean nut tree seed.

Tree seed labels are also required to include a germination rate. There are no associated methodology requirements, such as a mandated analysis approach, a required lab, a required lot size, or an expiration date on the test. The most credible approach is to have the work conducted by an expert. For example, the USDA's Forest Service operates a tree seed testing lab through which tree seed germination rate tests can be ordered. Test results can be used directly for germination rate reporting. Another acceptable approach is a cut test. This can be a practical cost-effective option if the individual performing the test has sufficient expertise. Here is how a cut test works:

Tools: A sharp knife, a nutcracker, good lighting

All scales: Take a sample of at least 25–50 nuts pulled from different parts of the lot. Crack each nut open and cut through the kernel. Look at the meat inside.

- A **viable** seed will be firm, with a white or cream-colored kernel and no off smell

- A **non-viable** seed will have a shriveled, beige, or watery kernel; rancid or foul odor and small holes or frass from insect damage

Keep a tally as you go. At the end, divide your viable count by the total tested and multiply by 100.

Tetrazolium (TZ) staining is another acceptable approach. This test is similar to a cut test but using chemical staining as a basis of identifying living tissue versus visual inspection.

No matter how germination rates are determined, tree seed sellers should maintain records of the tests and the test results. The intent of the germination rate label requirement is that seed sellers should communicate credible germination rate estimates with seed buyers.

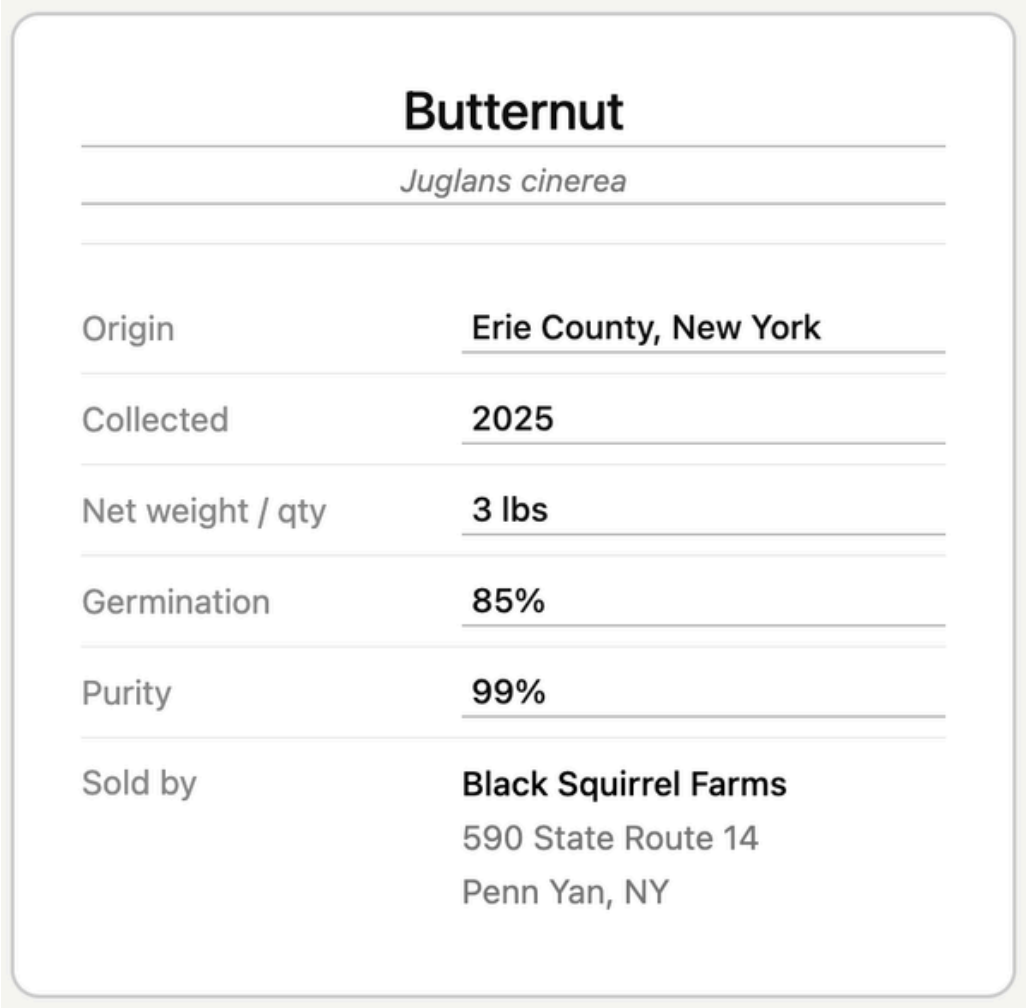
Consider sharing more information than required!

People often make tree planting decisions based on surprisingly little information. Label requirements are the minimum amount of information that a label or package needs to communicate. Consider going above and beyond and including all the information that you might want to know if you were the customer and adding that to your label or packaging! It's optional and will likely be appreciated.

- **Net weight of pure seed -** most buyers want to know this.
- **An estimated number of seeds per pound**
- **Storage and stratification notes -** this is particularly helpful for most nut seeds because they require cold-moist stratification to germinate. This communicates to buyers what, if any, pretreatment of the seed is needed prior to planting.
- **Tree spacing requirements or considerations**
- **Planting or growing considerations -** ex: "shade intolerant", "sourced from a notably productive mother tree", "great for wildlife", "tolerates relatively dry soil", "could live 250+ yrs", "sourced from a mother tree, "wind pollinated", "requires a second tree for pollination", etc.
- **Lot number -** a simple internal code (e.g., JC-YT-2024-01) While this may not be useful to a buyer, using a lot number to link a label to your own collection and testing records is a best practice, especially if a quality question comes up later.

An Acceptable Label (example):

Below is a sample label for butternut (Juglans cinerea L.) collected in Erie County, New York.



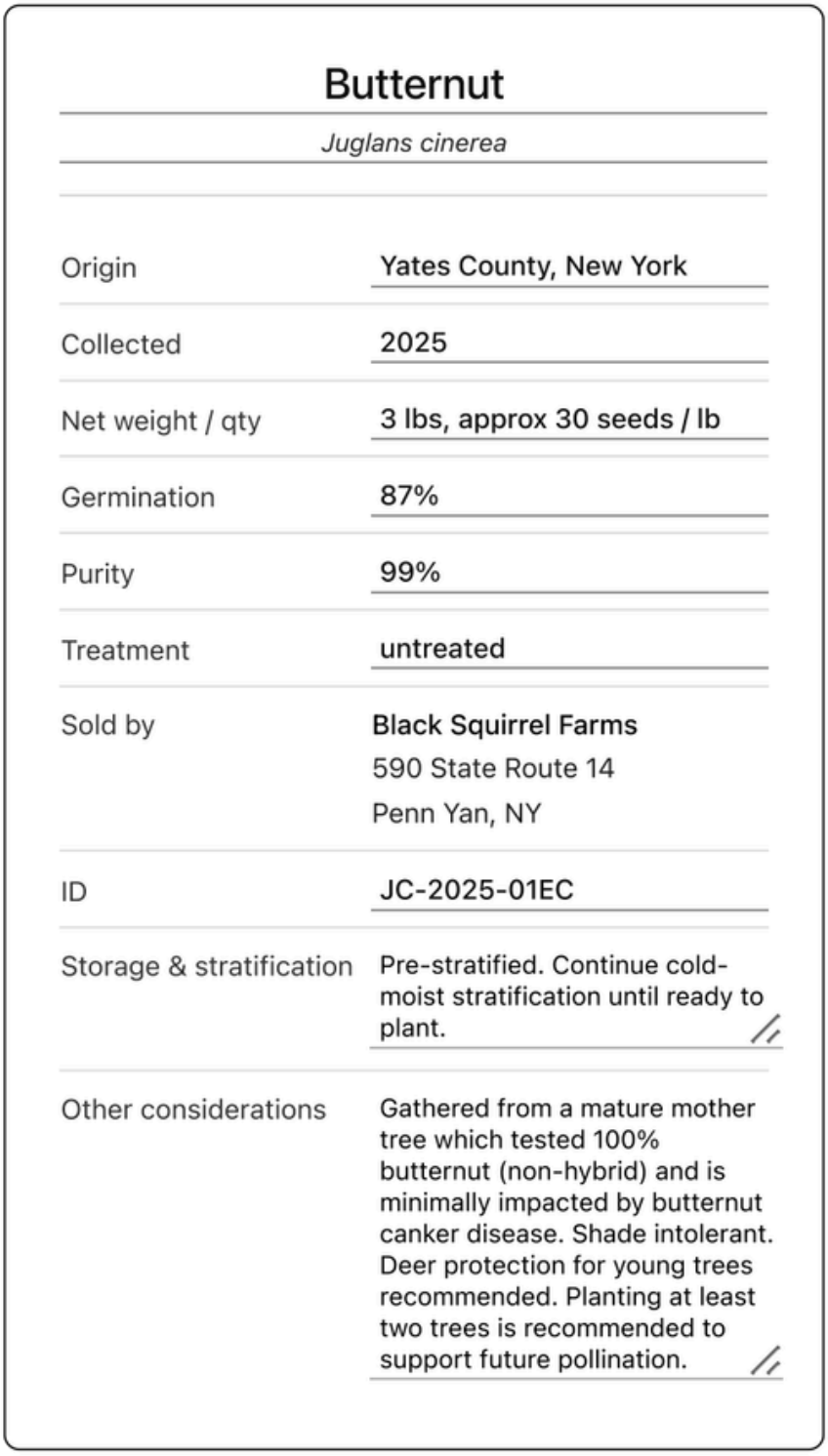
Butternut

Juglans cinerea

Origin	**Erie County, New York**
Collected	**2025**
Net weight / qty	**3 lbs**
Germination	**85%**
Purity	**99%**
Sold by	**Black Squirrel Farms** 590 State Route 14 Penn Yan, NY

A More Informative Label (example):

Below is a sample label for butternut (Juglans cinerea L.) collected in Erie County, New York.



Butternut

Juglans cinerea

Origin	Yates County, New York
Collected	2025
Net weight / qty	3 lbs, approx 30 seeds / lb
Germination	87%
Purity	99%
Treatment	untreated
Sold by	**Black Squirrel Farms** 590 State Route 14 Penn Yan, NY
ID	JC-2025-01EC
Storage & stratification	Pre-stratified. Continue cold-moist stratification until ready to plant.
Other considerations	Gathered from a mature mother tree which tested 100% butternut (non-hybrid) and is minimally impacted by butternut canker disease. Shade intolerant. Deer protection for young trees recommended. Planting at least two trees is recommended to support future pollination.

Happy harvesting!

Black Squirrel Farms
590 State Route 14
Penn Yan, NY 14527

www.blacksquirrelfarms.net