



AGROFORESTRY NOTES

Plant Procurement for Agroforestry

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Introduction

Agroforestry practices, which can include alley cropping, forest farming, hedgerows, riparian forest buffers, silvopasture, and windbreaks, utilize a wide array of plant and livestock species. The success of these practices depends in part on the quality, productivity, and availability of the plants that are grown for these systems. While agroforestry implementation is increasing among farmers (Kellerman et al. 2025), accessing appropriate plant materials is a barrier to farmers and land managers implementing agroforestry (Ring and Schattman 2024).

Nurseries in the United States already grow a wide array of native and nonnative trees and shrubs that can be used in agroforestry systems, but a variety of challenges facing different niches of the nursery industry can make plants difficult to procure. For example, nurseries that primarily produce native plant species may deal with overburdened seed supply networks, a lack of regionally sourced native seed, and challenges related to collecting and cleaning native seed (Fargione et al. 2021). In other cases, some agroforestry customers may be seeking out clonally propagated plant materials with specific traits (for example, cold hardiness or reliable crop yields) that are adapted to and grown in their local region. Some customers may have difficulty finding large quantities of plant materials with improved genetics that have been thoroughly researched and recommended for production, are regionally sourced, and can be delivered on the desired timeline. Customers may also face challenges with nascent standards around pricing and quality for some species used in agroforestry, especially for species that are sold as roots or are grown and harvested in wild settings (Brainard et al. 2019, Davison et al. 2017).

This Agroforestry Note aims to provide information to farmers and land managers who implement agroforestry as well as natural resource professionals, agricultural advisors, and others who provide technical assistance on agroforestry. It is intended as a resource to help guide conversations between suppliers of plant materials and the farmers and land managers who want these plant materials.

Citation

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Banner photo: A healthy bareroot hybrid hazelnut at UMaine's Agroforestry Research and Demonstration Site in Orono, ME. USDA Forest Service photo by Alaina Ring.

Understanding nursery-specific terms and the language used to describe plants can facilitate productive and clear conversations between nurseries and customers (table 1). Gaining familiarity with some of the common terms used in the nursery industry can help customers identify the plant materials that will be most appropriate for the agroforestry practices implemented.

Table 1—Common horticultural terms

TERM	DEFINITION
Container grown	Plants sold in containers; potted plants. Containers can be made from a variety of materials, including plastic or fabric, and may be designed to serve a variety of purposes, including for growing in-ground or to promote the natural air pruning of root systems.
Bareroot	Plants sold with their roots free of soil.
Plug	Young plants grown and sold in individual cells, often as a tray.
Ball and burlap	Mature trees sold with their root ball and soil wrapped in burlap.
Liner	A young plant that is sold to a retail or wholesale nursery to be replanted (“lined out”) and grown into a more mature plant.
Whip	A young, slender, unbranched tree seedling, often sold bareroot and used in conservation and forestry plantings.
Rhizome	A horizontally growing, underground stem that puts out adventitious roots and shoots at different intervals.
Grafting or budding	When young plant material is taken from one plant and joined with another in a way that allows the two plants to form a union. The two species must be genetically similar enough to be compatible.
Bud/budwood or scion/scion wood	Young plant material, in the form of a shoot or a single bud, used for grafting onto a more mature rootstock.
Cuttings	Young plant material taken from the stem, root, or leaf that is put in water or a moist substrate so that adventitious roots can form.
Rootstock	A plant with a well-developed root system that a bud or scion is grafted onto; rootstock may influence characteristics such as size, cold hardiness, or drought tolerance.

TERM	DEFINITION
Interstock	Plant material used to bridge an incompatible union between the desired bud/scion and rootstock.
Genus	A taxonomic rank describing plants that have related characteristics.
Species	A taxonomic rank below genus describing plants that are able to interbreed. For example, the genus <i>Prunus</i> includes the species plums, cherries, peaches, apricots, almonds, and nectarines.
Subspecies	One rank below species, describing distinct populations that vary morphologically but can still successfully interbreed. There must be at least two populations ranked below a species to use the term.
Variety	A rank below species describing an uncultivated plant that shows distinct botanical characteristics that have been shaped by nature.
Cultivar	A rank below species describing a cultivated plant that has been intentionally bred to express distinct botanical characteristics.
Provenance	Refers to the area where a seed or plant originated. Provenance can influence plant mortality and vigor, with local ecotypes preferred over nonlocal.
Root flare	The area at the base of a tree where the trunk widens and “flares” outwards. These supportive roots at the base of the tree should be visible (no mounding of soil or mulch) and free of girdling roots growing around the trunk.
Girdling/circling roots	Roots growing around the base of the trunk (rather than out from it) that cut off the flow of water and nutrients. Often occurs due to improper planting techniques (e.g., hole is too small or too deep) or when trees remain in nursery containers for too long.

Nursery Stock Types: Bareroot, Container Grown, Ball and Burlap, and Plugs

Nursery stock is a term used to refer to the wide variety of plant species grown at a nursery. Nursery stock types include bareroot, container, ball and burlap, and plugs. Each stock type has advantages and disadvantages, so customers should assess what is most appropriate for their specific project. Nursery stock comes in a variety of sizes, which may be measured by the size of the container the plant is grown in, caliper (diameter of stem in inches), or height. Age is also used to describe nursery stock and determine pricing. Plants can be grown from seeds, roots, rhizomes, or vegetative/stem cuttings. Nurseries often buy young plants, commonly referred to as liners, to be grown out into larger stock types.

Bareroot nursery stock (fig. 1) is generally grown outdoors from seed or cuttings, “lifted” mechanically or dug by hand, and put into cold storage or “heeled in” to the soil as quickly as possible. Heeling in is a way of storing bareroot plants with their roots buried in a protected, cool, shady area, whereas cold storage often utilizes a refrigerated storage space. Bareroot seedlings are dug, or lifted, while they are still dormant (i.e., a period of time when the plant is alive but not growing). Seedlings are either dug and shipped during a short window in the spring or dug in late fall, placed in cold storage for the winter, and shipped early in the spring (Jauron 1999). Lifting and planting seedlings before they have come out of dormancy can reduce plant stress, but timing is crucial. As a seedling comes out of dormancy, buds will begin to break and the plant will begin to leaf out, pulling water and nutrients from the soil as photosynthesis begins. At this point, desiccation can occur if seedlings do not have access to water. This timeframe may shift from season to season based on weather conditions at the nursery. There may be a short window for a nursery to lift, pack, and ship seedlings, requiring customers to align planting with nursery schedules.

Specific notation, consisting of two numbers separated by a hyphen, is used for describing age classes of bareroot seedlings (Minnesota DNR, n.d.). The first is the number of years the seedling was in the bed where the seed was sown, and the second is the number of years the seedling was in the transplant bed. For example, a 2-2 seedling is 4 years old and spent 2 years in the first bed and 2 years in the bed it was transplanted to. Young, unbranched seedlings are sometimes referred to as whips. For more information on how to evaluate the health and quality of bareroot seedlings, including root health, root-to-canopy ratios, and grading standards, see “Additional Information.”



Figure 1—Two-year-old bareroot elderberry (*Sambucus* spp.) being planted at University of Maine Agroecology Lab's Agroforestry Research and Demonstration site in the spring. To align planting dates with other species in the alley cropping system, these plants were stored in the shade in buckets of damp wood shavings for a week. USDA Forest Service photo by Alaina Ring.

Container-grown stock (fig. 2) refers to plants that are potted and sold in containers. These containers can be made of different materials, such as plastic or biodegradable fabric, and can be designed to accommodate different growing methods, such as air pruning or being grown in- ground. Containers allow for more control over the plant’s growing conditions, since they are produced using specific ratios of substrates such as compost, peat, bark, and perlite and can be more easily moved than a field-bound plant. Container sizes are numbered, ranging from #1 (1 gallon) to #25 (27.6 gallons). Any trees or shrubs that are larger than a #25 container will be sold balled and burlapped. Container-grown nursery stock has a wider planting window than bareroot stock, can be easier to move and transplant, and protects roots during transportation. Though container-grown stock can be more convenient for some projects, the substrate that container-grown plants are grown in could possibly harbor pests and diseases, and plants come at a higher price point when compared to bareroot stock (table 2).

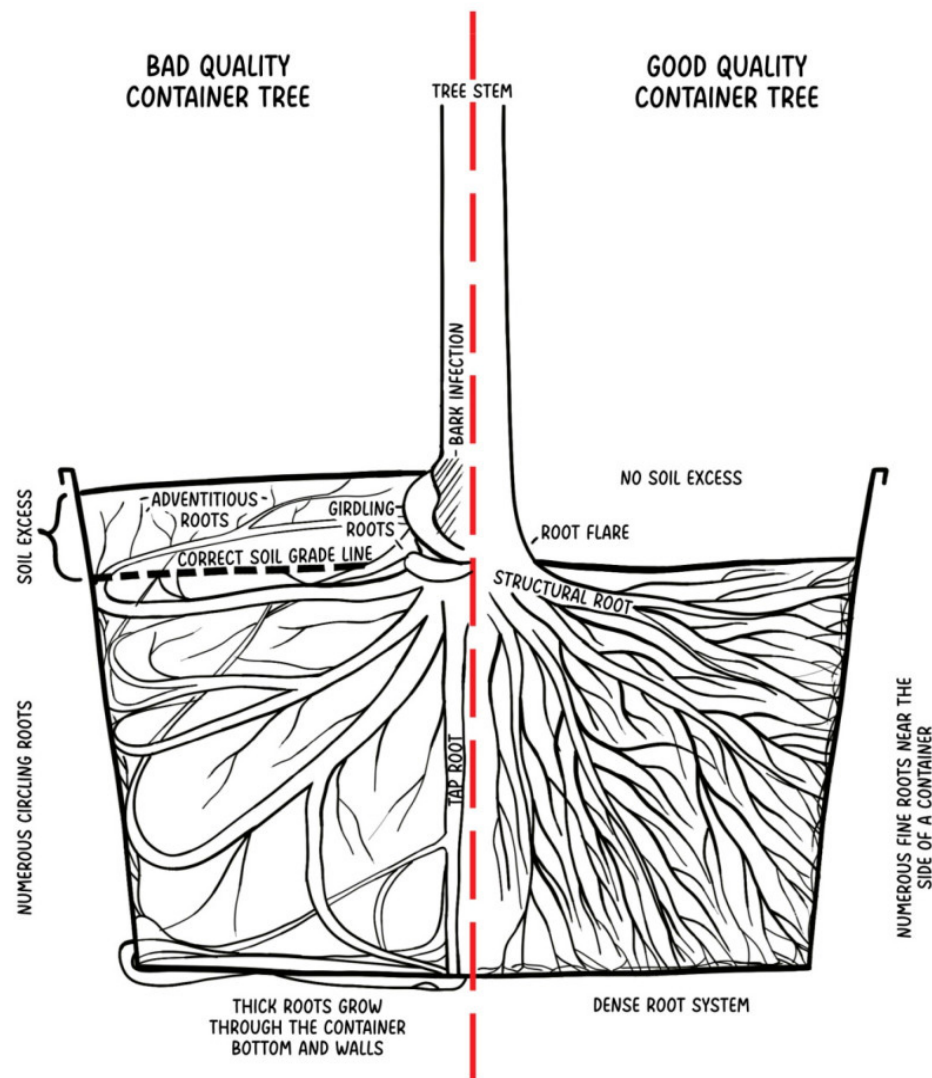


Figure 2—Quality comparison of container-grown trees based on soil and root conditions. Graphic courtesy of Korbik et al. (2025).

Table 2—Benefits and challenges of bareroot, container-grown (potted), and balled and burlapped stock

STOCK TYPE	BENEFITS	CHALLENGES
Bareroot ¹	Lower cost per stem Widest range of plant species/varieties available Reduced risk of spreading pests and disease	Limited transplanting window: plants must be dormant and the soil workable If not planted immediately, may be more challenging to store than potted plants Potential for root damage during digging and transport ¹
Container grown (potted) ¹	Wide transplanting window; can be planted anytime the ground is not frozen Easy to transport and store until time to plant Roots are protected during transportation	Resource-intensive production method (substrate mix, plastic, irrigation) Higher cost per stem Higher risk of phytosanitary concerns (pest and disease) ¹
Balled and burlapped	Wide transplanting window; can be planted anytime the ground is not frozen Healthy, mature plants can be established in challenging environmental conditions Roots are protected during transportation	May have a lower root-to-shoot ratio than bareroot plants Significantly higher cost per stem Transportation can be expensive and moving large plants may require heavy equipment

¹ Adapted from Caskey (2024).

Plugs (fig. 3) are young plants grown in individual cells. Typically, plugs are grown in seedling trays made of plastic or polystyrene foam. These small, young plants are then planted out into the landscape or transplanted into larger containers.



Figure 3—Example of a healthy root system (left) and a weak, sparse root system (right) on Ponderosa pine (*Pinus ponderosa*) plugs. The healthy root system is dense and fibrous but not so dense that it has become rootbound. USDA Forest Service photo by Jeremy Pinto.

Balled and burlapped (also referred to as “b&b”) nursery stock is the largest and most mature planting stock sold by nurseries. It is grown in-field, and size is designated by caliper measurement. These larger, more expensive trees are dug from the field and the root ball is wrapped in burlap for transport. Generally, the planting season for this stock type is much longer than for bareroot stock, though hot, dry seasons should still be avoided. Planting this type of nursery stock also requires large equipment and results in soil disturbance. The significantly higher cost of balled and burlapped nursery stock means that this stock type is often not a good fit for large-scale agroforestry plantings but may be appropriate for urban settings with challenging establishment conditions (table 2).

Plant Materials Used for Propagation

Grafting, budding, and rooting cuttings (fig. 4) are important techniques for clonally or vegetatively propagating plant materials to retain desirable characteristics. Cuttings of stem, root, or leaf material can be rooted in water or a moist substrate, often using plant hormone to stimulate growth. Grafting and budding are especially useful for plants that are difficult to root from cuttings.

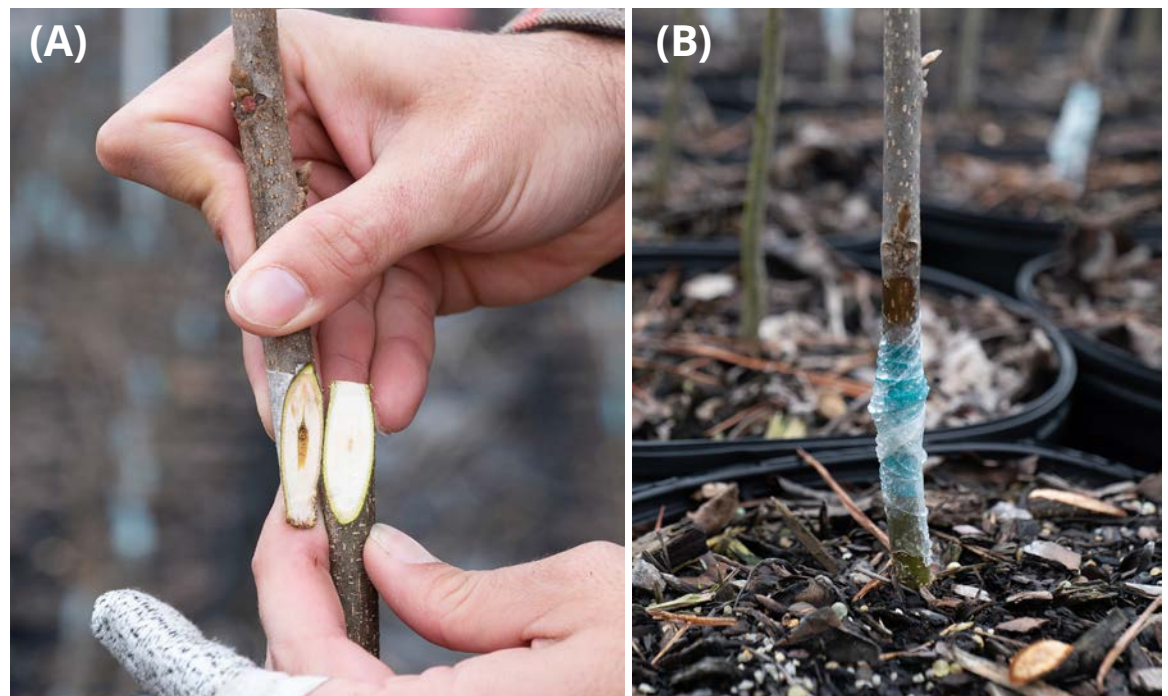


Figure 4—(A) The green layer under the bark is cambium, which is responsible for producing the plant tissues (xylem and phloem) that transport water and nutrients from root to shoot. (B) Scion wood and rootstock must be carefully joined in a way that aligns the cambium and creates a continuous connection. Grafting tape is used to create a secure and sterile connection between the rootstock and scion, trapping moisture and allowing the plant tissue to join together and grow as one. Courtesy photos by Olivia McClure, Louisiana State University AgCenter.

Budwood or scion wood (a new bud or shoot) is taken from a parent plant and grafted onto compatible rootstock to retain the parent plant’s characteristics. An important benefit of grafted material is a significant reduction in the time to flowering and fruiting (Kumar 2011). However, delayed graft failure can be hard to predict and can negatively impact plant health. Graft failure can be caused by rootstock/scion wood incompatibility, poor technique, and environmental conditions and can result in the loss of older and potentially expensive trees. Interstock can be used to overcome incompatibility between a rootstock and scion.

Rootstock alters scion phenotypes, influencing characteristics such as size, cold hardiness, or drought tolerance. Since rootstocks influence the size, yield, and hardiness of a mature tree, farmers can intentionally select trees of the appropriate size and growing habit for their operation. Grafting and budding budwood or scion wood onto rootstock is a highly skilled and labor-intensive activity that may occur over multiple growing seasons, which adds to the cost of production and lengthens procurement timelines.

Plants grown from seed can be used to establish an agroforestry planting. This approach may be useful for farmers or land managers who are looking for a lower cost way to establish their agroforestry practice or are interested in conserving native plant diversity. Growing plants from seed will usually produce plants that have some variability of key traits, though there are some species that retain the characteristics of their parent plant when grown from seed (“true to type” or “true from seed”). Using seed-grown plant material can increase the genetic diversity of the planting, which can have benefits for pest and disease challenges, create opportunities for genetic improvements, and avoid challenges with graft failure.

Seed can be sown directly at the site or brought to a nursery to grow out, usually into plugs. If seed supply for a specific plant is limited, some nurseries have seed increase programs, where plants are grown for the purpose of providing more seed. It can take multiple years to produce the desired quantity of seed for a planting, so communicating with nurseries early can help plan for seed availability (see Erickson and Halford (2020) for more information). When purchasing seed, it is useful to seek out sources that identify seed provenance (where the seed was collected) or collect seed from individuals that are already growing well at the planting site. Transparent and sustainable seed sourcing helps ensure a stable and enduring seed supply, especially for rare and threatened species.

The process of collecting, cleaning, storing, and propagating plants from seed can be intensive but rewarding. For more information on planning, sourcing, collection methods, cleaning, storage, and propagation protocols, see “Additional Information.”

Some plant species may be sold as roots or rhizomes. This includes forest-grown medicinal plants that are vegetatively propagated by their roots (fig. 5). When searching for and buying these plants, a variety of terms may be encountered, including rootlets or root crowns. Standards for the pricing, size, quality, and shipping of roots and rhizomes may be variable or nonexistent, and many of these plants can be difficult to find or are grown in limited quantities.

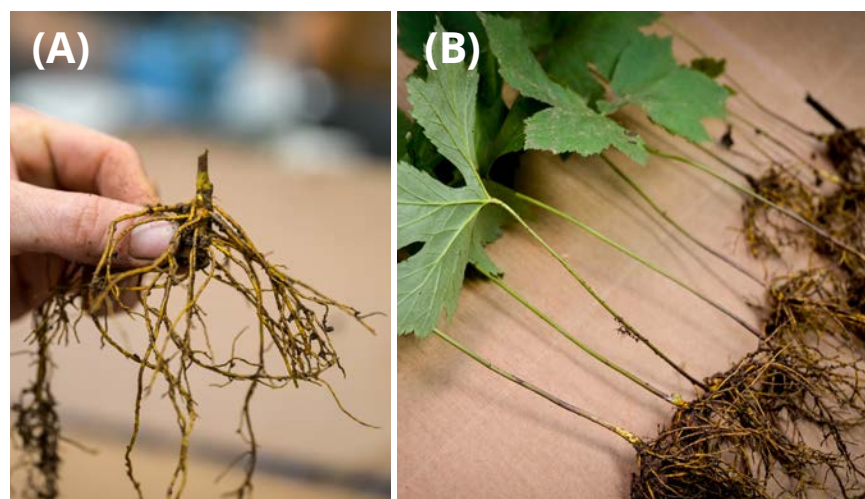


Figure 5— Vegetative propagules of goldenseal (*Hydrastis canadensis*) (A) are grown into mature plants with leaf and stem (B) at the Mountain Horticultural Crops Research and Extension Center in Mills River, NC. Courtesy photos by North Carolina State University.

When purchasing, consider the setting in which the plant was propagated—which could be a nursery, wild setting (wild or intentionally cultivated population), or forest farm—and ensure that harvesting and propagation are done sustainably. Understand common guidelines around responsible harvest of the species of interest when evaluating plant material sources (Rural Action et al. 2023). For examples, refer to “Additional Information.”

Plant Taxonomy and Nomenclature: Landrace, Variety, Cultivar, and Seedling

In addition to stock type, understanding terminology related to the genetic variation within a species, including what it means when a plant is described as a cultivar, variety, seedling, or landrace, can help customers make informed decisions about which plants to select. While cultivar and variety are sometimes used interchangeably, they do not mean the same thing.

Landrace is a term used to describe crop varieties that have evolved with limited human selection in specific geographic areas and are well adapted to the specific growing conditions present there (Casañas et al. 2017, Zeven 1998). Landraces do not grow “true to type” and are valued for their stable yields and high genetic diversity and breeding potential.

A variety is a descriptive term one taxonomic rank below subspecies, referring to naturally occurring variations of a plant within a species. For example, Carolina shagbark hickory is referred to as *Carya ovata* var. *australis*. Plant varieties occur in nature and seedlings will share characteristics with the parent plant (Haynes 2025).

Cultivars are plants that have been selected by humans and bred for specific traits (size, disease resistance, fruit or nut yield) and vegetatively/clonally propagated to retain those characteristics. Cultivars are given names; for example, the consistently bearing chestnut ‘Gideon’ is referred to as *Castanea mollissima* ‘Gideon’ (Revord et al. 2021). Cultivars are the result of mutations or breeding and hybridization between species of the same genus that are then intentionally selected and propagated. To retain key traits, cultivars are clonally/vegetatively propagated by cuttings, layering, grafting, or tissue culture rather than by seed (Haynes 2025).

One key benefit of using vegetatively propagated cultivars in an agroforestry planting is their predictable expression of key traits. On the other hand, if an agroforestry system utilizes genetically identical plants, there is a higher risk of widespread damage from weather variability, pests, or disease. Due to the intensive and long-term efforts that go into selection, breeding, and propagation of cultivars, they are more expensive. Nursery growers may not be allowed to propagate a plant in-house due to patents, and propagation techniques may limit the number of plants available on short notice.

Seedlings refer to plants grown from seed as opposed to clonal propagation. Since seeds are formed through sexual reproduction and contain some level of genetic variation, seedlings are not genetically identical to the parent plant. Depending on the species, the extent of differences in offspring will vary. Seedlings are more genetically diverse and generally cheaper than cultivars. In some plantings, especially those oriented toward conservation of native biodiversity, this is a desirable plant characteristic. However, wild-type seedlings may not consistently express key traits. When using plants grown from seed in a planting, it is good practice to consider seed provenance and to source seed from an ecoregion that is similar to the desired planting location.

Table 3 describes the tradeoffs between different nursery stock types during establishment, including differences in cost, the time it takes a plant to reach maturity, skills and effort necessary for planting, and general availability (which can vary greatly depending on the customer’s region and desired species).

Table 3—Establishment tradeoffs between some nursery stock types

TYPE OF PLANT MATERIAL	COST PER MATURE STEM	TIME UNTIL PLANT IS MATURE ¹	SKILL, EFFORT, AND EQUIPMENT REQUIRED FOR SUCCESSFUL ESTABLISHMENT	GENERAL AVAILABILITY
Seed	Low	Long	Medium to high	Moderate to good
Hardwood cutting: direct staking	Low	Medium to long	Low to medium	Moderate to good
Hardwood cutting: scions	Low	Short to medium	High	Low to moderate
Bareroot seedling	Medium	Short	Medium	Good
Potted plant	High	Short	Low to medium	Low
Ball and burlap	High	Short	High	Good

Source: Caskey (2024).

¹ “Time until plant is mature” refers to the time it takes a plant to mature and/or reach production age after planting and assumes high-quality material, proper planting, and effective maintenance.

What to Know Before Contacting a Nursery

Knowing certain details about what the farmer or land manager is looking for will set the stage for a productive initial conversation with a nursery manager. Useful information to have in hand before approaching a nursery includes basic information about physical growing conditions at the planting site, a general idea of which species will be used in the planting, the quantity of plant material needed, and the desired timeframe for delivery of plant material. Other factors will also influence plant selection, such as personal interest and affinity for certain plants, equipment available for maintenance and harvest, and capacity for future care. This note does not go into detail about species selection, but a variety of online tools and resources listed in “Additional Information” can help identify site conditions and guide decisions about which species will grow well at a particular site.

While the growers who own and manage nurseries have an intimate knowledge of the plants they grow and can be an excellent resource for customers selecting species, it is important to respect that their primary responsibility is to grow healthy and quality planting stock, not plan agroforestry systems. If extensive guidance from a nursery manager is desired, offering to pay them for their time and expertise can go a long way in fostering a good relationship with the nursery.

Basic information about physical growing conditions to have in hand when visiting a nursery:

- ☐ [USDA Plant Hardiness Zone](#) (USDA ARS 2023)
- ☐ Light and water availability
- ☐ Measurements of available space
- ☐ Soil type and drainage (see Soil Web Survey (USDA NRCS 2019))
- ☐ Soil pH
- ☐ Regionally specific pest and disease concerns
- ☐ Soil test results, if available
- ☐ Planting designs, if available

Species, Stock Type, and Quantity

Initial research into which species (or specific cultivars) and stock types are appropriate for an agroforestry planting can be done before approaching a nursery. Nurseries often have online catalogs of the plants they offer, as well as blog posts or frequently asked questions that can help answer common questions about the plants they carry.

Before approaching the nursery, it can be useful to use the nursery's catalogs or other inventory information to develop a list of desired plant materials for the agroforestry planting, along with any questions for the nursery. A key element of the species selection process includes choosing plant material that aligns with both the personal goals and interests of those who are managing the planting in addition to physical site conditions. Trees and shrubs, especially in an agroforestry system, are long-term investments that require regular upkeep and management by invested stewards. When selecting species, consider how a personal, cultural, or aesthetic relationship with certain plants influences their suitability for an agroforestry planting. For more resources to help guide species selection, see "Additional Information."

Useful information to have in hand about desired plant materials when visiting a nursery:

- ☐ Potential species listed in catalog that match site conditions
- ☐ Potential alternatives to desired species
- ☐ Number of plants desired
- ☐ Desired stock type
- ☐ Desired size or age
- ☐ Desired time until mature/productive (crop-oriented system)
- ☐ Questions about stock types, genetics, provenance, or other plant characteristics not detailed in the catalog

Maintaining Flexibility

While exploring which plant materials may be used in a planting, it is helpful to consider alternative species, stock types, or planting schedules. Planting timelines may need to be adjusted to accommodate nurseries' timelines for growing specific plants in the quantities needed for a planting. Stock type can influence planting timelines as well; for example, bareroot planting stock will need to be dug and planted while still dormant in late fall or early spring.

In many cases, especially when sources of regionally specific plant material are limited, a customer may need to have plants sourced from multiple nurseries. When plants are shipped or picked up from multiple nurseries, there may be a need to store plants near the planting site in order to align planting dates. Short-term storage solutions may be as simple as heeling in bareroot plants in a cool, shady spot or amassing container-grown plants in a single area where they can be easily cared for. Multiseason solutions include starting a short-term on-farm nursery, planting sequentially over multiple seasons, and working closely with a nursery grower to plan multiple years in advance.

Choosing a Nursery

A variety of public, private, and nonprofit entities operate nurseries. Most of the nursery industry is privately owned and oriented toward landscaping. Private nurseries sell plants at retail or wholesale prices. Some businesses sell exclusively wholesale, while others rely on a combination of retail and wholesale sales. Many garden centers are exclusively retail-oriented operations that do minimal growing onsite. State, conservation district, and Tribal nurseries can generally sell directly to private individuals (regulations may vary by region). Six U.S. Department of Agriculture, Forest Service nurseries supply plants primarily for National Forest System lands and are not able to directly sell plants to private individuals due to a legal commitment not to compete with the private nursery industry.

When searching for a nursery (or multiple nurseries) to work with, it may be beneficial to begin by looking locally. With advance notice, the appropriate growing conditions at a nursery, and a committed customer, nursery growers may be willing to accommodate requests for unfamiliar or specialty species. Keep in mind that some nurseries may specialize in specific stock types, such as bareroot seedlings, or serve a specific market niche, such as native plants or fruit-producing species.

To find nurseries that specialize in native plants, see the Forest Service's [National Reforestation & Restoration Directory](#), which is updated every 3 years. Local nonprofit organizations or businesses that support agroforestry adoption can be excellent resources for finding nurseries that supply plants for agroforestry in a specific region.

The following paragraphs describe factors to consider when researching which nursery (or nurseries) to work with for an agroforestry planting.

Nursery Specialty or Market Niche

Some nurseries may specialize in growing plants for a specific niche that requires specialized equipment, knowledge, or a specific growing method (fig. 6). For example, some nurseries specialize in growing healthy planting stock without the use of neonicotinoids or other pesticides, which may be an important consideration in agroforestry systems with medicinal plants or specific concerns about pollinator and wildlife health. In the case of rare or specialty crops, plants may only be available in limited quantities from a small number of nurseries. Procuring the desired plants for an agroforestry system may require working with multiple nursery growers and planning far in advance. Depending on desired stock type, this timeline could range from 6 months to 5 years. For more information, see “Growing Timelines.”



Figure 6—Nurseries often fill different niches within the nursery industry by specializing in certain species, growing methods, or growing at different scales. Both photos show plants grown under cover, but the growing methods, materials (containers, growing substrate), equipment, scale, and knowledge needed to successfully grow these crops are different. (A) Solomon's seal (*Polygonatum biflorum*), which thrives in the cool, damp shade of the forest understory, is grown in a shade house at the “Guaranteed from Seed” project at Warren Wilson College. (B) Thousands of Ponderosa pine (*Pinus ponderosa*) seedlings are grown at the Colorado State Forest Service Nursery for conservation and reforestation plantings. (A) Courtesy photo by Margaret Bloomquist, North Carolina State University; (B) USDA Forest Service photo by Anne Marsh.

Location

Consider how the location of the nursery may influence plant health as well as transportation logistics. In addition, choosing to work with a local or regional nursery can reduce transportation costs and logistics. Using plants sourced from a local nursery can also help reduce the phytosanitary concerns associated with moving plants (such as hitchhiking pests and diseases) between different locations. Shipping logistics and timing may be easier when sourcing bareroot plants from nurseries in the same general region as

the planting. Northern planting projects ordering nursery stock from southern nurseries may receive their plants before the ground is suitable for planting. Conversely, southern planting projects ordering from northern nurseries may have to wait longer than they would like to receive their plant materials in the spring.

Plants grown at a nursery located in a similar climate to the planting site will be better accustomed to local growing conditions. The [USDA Plant Hardiness Zone](#) (USDA ARS 2023) is a useful tool for determining which plants will do well in climatic conditions at a planting site.

Nursery Standards

It can be helpful to understand the practices nursery growers adhere to in order to ensure healthy planting stock. [American Standard for Nursery Stock](#) (AHIA 2025) provides a detailed description of common terminology used to describe the size and quality of planting stock and can be a helpful reference for learning how to choose healthy plants. For some plants used in agroforestry, standards around pricing, size, quality, or shipping protocols are newer or in development. For example, some forest farmers are working to better understand how characteristics of forest botanicals influence their productivity and adaptability to different sites (Rural Action et al. 2023). See the “Additional Information” section for resources on identifying healthy planting stock.

Pest and Disease Management

Phytosanitation refers to the procedures used to reduce and eliminate plant pathogens (pests and disease) at a nursery, including sanitation; the use of herbicides, pesticides, or fungicides; or quarantine. It includes preventing pathogens from entering the nursery, as well as making sure that plants leaving the nursery do not carry pathogens (Landis 2013). To reduce the possibility of spreading plant pests and disease, thoroughly inspect plants for existing issues before purchasing or consider quarantining new plants away from existing plants. Nursery growers are also able to disclose whether plants have been recently treated with pesticide, fungicide, or herbicides.

In some cases, certain plants may not be available nearby. Plants that are shipped across international borders require a phytosanitary certificate, which nursery stock customers can apply for through the [USDA Phytosanitary Certificate Issuance & Tracking System \(PCIT\)](#) (USDA APHIS, n.d.). Some plants may need to undergo a quarantine period when crossing international borders or State lines.

Best Practices for Plant Identification

In addition to health, proper identification of plant varieties or cultivars is key for agroforestry plantings, especially when working with uncommon or crop-producing plants. Proper recordkeeping can reduce possible mixups, and knowing where a plant comes from can help with making informed decisions about which plants are most appropriate for an agroforestry system.

When buying seed, consider asking questions about the seed source and seed testing. Seed testing for germination rates and weed seeds can help prevent future challenges with establishment and plant viability. By understanding seed source and collection methods, customers can help support a sustainable seed supply, especially for rare, at-risk, or wild plant populations.

Growing Timelines

It can take multiple seasons for nurseries to grow the desired quantity of plant material to the appropriate size for a planting. Some nurseries will grow plants “on spec,” often based on the previous year’s sales and customer input, while others will not grow plants without prior commitment from a customer. If the planting requires a specific size, stock type, or species of plant, plan ahead—far ahead. When contacting nurseries and building a planting timeline, consider how this may be influenced by the season; note when the growing season begins, when planting or grafting occurs, or when bareroot plants will be lifted from the field (fig. 7). Special orders may require 6 months to 2 years of prior notice, if not more.

Activity	Year 1					Year 2												Year 3		
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
Collect, clean, and store seeds																				
Treat seeds																				
Sow seeds Grow outdoors Harden off																				
Store over winter																				
Outplant																				

Figure 7—Example of a growing schedule for a container-grown serviceberry (*Amelanchier* spp.) seedling (a small plug approximately 10 cubic inches). Green bars correspond with months and years in which activities take place. Adapted from Jacobs and Wilkinson (2009), which includes timelines for other crops in addition to serviceberry.

A variety of factors can influence growing timelines. If a planting utilizes native plants grown from regionally sourced seed, that seed will need to be sourced or collected multiple seasons in advance of the planting. Specific cultivars of a species that must be propagated vegetatively require multiple seasons of growth to reach an appropriate size for planting. Due to the financial risk of investing time and money into growing plants for which there is little to no existing market demand, a nursery grower may need advance notice to ensure that the appropriate quantity is grown. This is especially true for nurseries that grow specific or uncommon species, such as native plant nurseries.

Pricing

Plants take significant amounts of time, water, nutrient inputs, specialized knowledge, and labor to produce. Plant material that takes multiple seasons to grow and/or requires highly skilled labor to produce or propagate will come at a higher cost. Timing may vary based on species, since some plants grow more slowly than others. Highly skilled tasks (such as grafting or tissue culture) incur higher production costs per stem. High-quality plants with the appropriate genetics for a planting can be valuable investments and it is helpful to budget accordingly. Conservation-grade seedlings take less time to produce and will often come at a lower price point.

A variety of factors may influence the price land managers are willing to pay for plant materials. Land managers with significant agroforestry experience and confidence in their species selection may be more interested in purchasing higher priced plant materials, since they know how these plants will function in those systems. Other influential factors can include available budget, age of the agroforestry system, marketability of agroforestry products, function of the tree(s) in the system, and agroforestry system type.

People who own and manage nurseries, technical assistance providers, farmers, and land managers all play important roles in achieving conservation, agroforestry, and other goals. The following strategies can help with building strong relationships among these partners, which can help agroforestry and other sectors thrive and grow.

Demonstrating Consistent Demand

Nurseries are high-risk businesses and managing uncertain demand for plants can be a significant challenge. Consistent sales can help stabilize plant supply, especially for specialty crops or native plants grown from seed.

Prioritizing Plant Procurement During the Planning Process

Specialty or difficult-to-grow species can take multiple seasons to reach the appropriate maturity for a planting. Prioritizing species selection and establishing a business relationship with regional nurseries in early stages of planning an agroforestry planting can help nurseries plan ahead.

Communicating With Other Agroforestry Practitioners

Create supportive networks. For example, regional agroforestry working groups or other farmer groups may allow both nurseries and customers to share information about the kinds of plant materials that are a good fit for agroforestry and how they are effectively meeting these needs.

Aggregating Demand for Plant Material

Work with other nursery customers with similar needs. For example, collaborate with others establishing agroforestry practices or using similar plants for other purposes in a region to aggregate plant orders, transport plant material, and access wholesale prices.

Considering Multiyear Establishment of Agroforestry Plantings

In some cases, rather than planting a large number of trees all at once, land managers may consider a series of smaller plantings. This can benefit both the nursery and the agroforestry system. Especially when planned in advance, an iterative planting can generate more consistent income sources for nurseries. Land managers can also learn about whether their interests and skills, as well as the site's biophysical conditions, match well with the plants in the agroforestry system they are creating.

Sharing Feedback With the Nursery Grower

Providing and receiving feedback is an important way to improve the plant procurement process and ultimately leads to healthy agroforestry plantings. Mutual education about agroforestry and the plants that make up an agroforestry system can be beneficial for both customers and nurseries. For example, when working with nurseries that are unfamiliar with agroforestry, sharing information about the importance of plant survival in a crop-producing system can help nursery growers understand the high financial consequences of plant mortality. In turn, nursery growers have extensive horticultural knowledge and can help customers implement best practices and maintain plant health.

Providing feedback can be a difficult task and must be underscored by a strong, trusting relationship between customers and nursery growers. To help facilitate these conversations, it is helpful to establish a designated time to provide feedback on sensitive topics, such as quality and health of planting stock. For example, some nurseries (especially those that rely primarily on contracts) may have annual meetings with their clients. During these meetings, customers can ask questions, and any challenges or concerns can be discussed in a personal, one-on-one setting. Land management professionals' role as an intermediary can be especially valuable when conveying information about nurseries to farmers and land managers or sharing information about regional trends in agroforestry plant material needs with nurseries.

Having clearly written procurement standards included in the initial bid or contract can be helpful to refer to during these conversations. Providing documentation (including photos) of any issues or plants that did not meet standards and/or were rejected at the planting site can be very useful. It is also useful to document positive examples; photos of plants that exemplify the quality and characteristics the farmer or land manager is looking for can be very useful. Nursery growers take pride in their plants and want to see them growing well.

Considering Formal Agreements to Guide the Relationship

Agreements between nurseries and customers can range in their formality, from word of mouth to a written contract that is signed by both parties. Nursery businesses benefit when there is a clear financial commitment to buying plants ahead of time, allowing nursery growers to plan inventory in advance and fulfill specialty requests.

Detailed purchase orders and growing contracts establish clear expectations about price, quality, size, and timelines for both parties. For examples of contracts and how to navigate the development of a formal purchasing agreement, see "Additional Information." When developing a formal agreement, it can be helpful to be flexible and communicative about potential risks; for example, consider potential alternative species, what might happen in the case of a severe weather event or other natural disaster, and the high financial risk of growing uncommon or specialty plant species. When building a long-term relationship with a nursery, consider building in time for face-to-face feedback to complement a formal purchasing agreement and outline clear standards for plant health.

Conclusion

Technical service providers, farmers, other land managers, and nurseries all play important roles in building the strong relationships that allow customers and technical assistance providers to provide valuable feedback on the health of their planting stock and select the most appropriate stock type and species for their agroforestry system. Familiarity with horticultural terminology, planning ahead, and understanding plant materials help build strong and successful relationships with nurseries. The desired plant material can take multiple seasons to grow, especially if it is an uncommon or rare species. Careful consideration of growing timelines can reduce the logistical burden of procuring plant material for both the nursery and customer.

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