Quality Hardwood Seed Production

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Abstract

The current market demand has brought about an increase in the number of hardwood tree and shrub seedlings that are being grown by the forest nurseryman. High quality seed is a necessary element for the nursery manager who wishes to efficiently produce quality hardwood tree and shrub seedlings. First-hand experience recommendations are given in regards to collection, cleaning, and upgrading of hardwood tree and shrub seed, to produce quality seed, necessary for propagation of quality seedlings.

Introduction

As the demand for hardwood seedlings continues, so does the demand for seed. Although different outlets for seed is available, proper collection, cleaning, and storage is necessary for the procurement of quality seed. As nursery managers continue to grow larger amounts of hardwood seedlings one would expect a demand for increased hardwood seed quality. Improved collection and storage techniques by the industry has provided improved benefits to seed quality, but is the industry capable of a higher level of seed quality in which the value added is greater than the added cost? Many nurserymen have shown a complacent view to current seed quality. Are they satisfied with current industry standards? Do they believe that upgrading is cost prohibitive, or will provide little or no benefit? For whatever reason, there has been very little push for increase in seed quality from the forest nursery industry.

This presentation is divided into two categories of oaks and other hardwood tree and shrub seed. Each category provides information on collection, cleaning, storage, and upgrading. Information given is based on current practices at Louisiana Forest Seed Company, Inc. (LFS) applied from internal and external research.

Oaks

Collections of acorns begin when the acorns begin to fall, which is when the acorn has reached maturity. From experience, generally the first ten percent of the acorns to fall from a tree are unsound or of low quality. The float test method still proves to be the most reliable and cost efficient method for removal of unsound acorns, leaves, and other trash. A blower cleaner is useful in removing initial amounts of trash material and insect damaged acorns, although the float test is still necessary. It is recommended that acorns be floated on the day of collection, which not only removes unsound acorns, but also provides moisture

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for sound acorns (Bonner.) Maintaining moisture of collected acorns is important, and common sense is the best tool for preventing desiccation. Do not collect acorns from a sidewalk or parking lot, keep collected acorns out of direct sunlight, and place in proper packaging and storage as soon as possible.

Although storage is generally the next step taken in the procurement of acorns, LFS adds an additional step to the process. All acorns are sized prior to placement in cold storage. Each size is designated by a number such as "12," rather than termed "small," "medium," or "large." A number "12" size for one species will be roughly the same size for a different species, but a "medium" size designation is a generic term which may not have any size correlation between two different species, much less across many species. With a number designation, the nursery manager is able to correlate a certain size plate for the planter with a specific number size across several different species of acorns. Other benefits to sizing of acorns for the nursery manager include a more accurate seed per pound count (Table 1), a more uniform spacing and bed density, and size competition has been noted for some species.

After sizing, acorns are bagged for storage in fifty and ten-pound bags. Bags are a polyweave construction with a 4 mil polyethylene liner inside the polyweave bag for red oak species, and a 2 mil polyethylene bag for white oak species. A 4 mil polyethylene liner is recommended for red oak species because it allows gas exchange while preventing desiccation (Bonner.) The use of 2 mil polyethylene liners is recommended for white oaks because evidence suggests the need for greater aeration (Rink and Williams.) Most red oak species can be successfully stored for several years with the right moisture content, packaging, and storage facilities.

LFS believes quality cold storage facilities play an integral part in the storage of acorns and other hardwood seed. A good quality cold storage facility will have a small range in temperature fluctuation. Acorns will be more prone to sprout the higher the rise in temperature from the suggested storage temperature of 1 to 3 °C (34 to 37 °F) (Bonner.) Temperature fluctuation on large coolers can be further abnegated with two compressor units. With two units, while one is in a defrost mode, the other unit may be cooling. It is also important to incorporate shelving in the cold storage facility that will allow air circulation. Open weave shelving provides greater air circulation than a fully closed bottom shelving.

The nursery manager should be aware that availability of acorns will vary from year to year, and therefore consider the option of planting stored acorns. An avenue for the nurseryman is to plant red oaks in the fall as one would plant white oaks. This technique may be a viable option for water oak (*Quercus nigra*), which is difficult to germinate after the spring sowing.

Other Hardwood Tree and Shrub Seeds

Obtaining quality seed for nursery use begins with the collection stage. One must remember that seedsmen are not magicians. They can not take immature collected seed, pass it through a cleaner, and procure seed with 99% germination and purity. Care must be taken to collect seed at its fullest point of maturity. One case in point at LFS is collection of american sycamore (*Platanus occidentalis*.) In the past collection took place not long after the fruit turned brown in color, which Handbook 450 (Schopmeyer) regards as the stage in which collection may take place. Germination of seed collected at this stage is typically 10-30%. What Handbook 450 fails to mention, which Miscellaneous Publication 434 acknowledges is that germination can be enhanced by delaying collection as long as possible for seeds which hang on the tree for a considerable time after apparent ripening (Engstrom & Stoeckeler.) Therefore, LFS is able to increase germination from 10-30% to 60-80% by delaying collection of american sycamore until the point in time when the seed ball is about to shatter and disperse.

Only in a few circumstances can one break the rules and collect seed prior to maturity and reap some benefit. From personal experience, the *Crataegus* and *Viburnum* species can be collected while the fruit is still green, just slightly prior to maturity before the seed coat hardens, to provide speeder germination and reduce the stratification time period. The drawback to this procedure is that storability of the seed is sacrificed.

Is fresh collected seed better than stored seed? If there is not an upcoming crop, evidently the stored seed is better. Just because the seed is fresh does not make it any better than stored seed. Seed stored properly will maintain its viability with time. One should compare laboratory tests between the different collection years if possible. Ask questions, and if possible inspect the seed. There have been situations in which nurserymen have passed-up better quality seed because it was not the current crop year's seed. One should not make a hasty decision in regards to stored seed as a planting option.

Most all of the hardwood and shrub seed discussed in this section can be stored long term (beyond three years) in freezers (10°F/-12°C.) Seed stored under these conditions by LFS are packaged in 4 or 6 mil polyethylene liners within corrugated boxes. Moisture content of seed at time of storage is under 10%.

Many times short-term storage (one to 2.5 years) is adequate. In this situation storage in a cooler will be satisfactory. Containers used for storage will vary depending on the species. Species such as sweetgum (*Liquidambar styraciflua*,) american sycamore (*Platanus occidentalis*,) and yellow-poplar (*Liriondendron tulipifera*) can be either stored in a polyethylene liner within a corrugated box, or a plastic container with a lid. Flowering dogwood (*Cornus florida*,) common persimmon (*Diospyros virginiana*,) blackgum (*Nyssa sylvatica*,) (pulp removed on each) and elms (*Ulmus*) can be stored in a plastic container with a lid, or a polyweave sack without a polyethylene liner. Plastic ventilated trays or grass

sacks are used to store ginkgo (*Ginko biloba*,) redbay (*Persea borbonia*,) cherry laurel (*Prunus caroliniana*,) and cleyera (*Cleyera japonica*.) Hickory species are stored in polyweave sacks without polyethylene liners. Low moisture content for storage is beneficial in reducing mold.

Upgrading allows LFS to not only provide higher quality seed but to also reduce the amount of material the nurseryman must handle and store. Two of the species that LFS has had great success with are yellow-*poplar (Liriondendron tulipifera*,) and bald cypress (*Taxodium distichum*.)

For yellow-poplar, upgrading begins with removal of the wing material from the seed. This is accomplished with a brush machine. Once the wing of the seed is removed, it is much easier to remove empty seed and other trash material whether by an aspirator or gravity table. At LFS, the dewinged yellow-poplar seed is screen cleaned after being dewinged to remove sticks, wing material, some empty seed, and other trash material. Clean seed is then upgraded on a gravity table to further reduce the number of empty seed within the lot. One pass across the gravity table will not produce two distinctive lots of low and high quality seed. Several passes, each resulting in two to three different lots of varying seed quality, is necessary to produce a desirable end product. The end product will generally consist of two to three lots.

LFS is capable of procuring yellow-poplar with a full seed percentage of greater than 90%. Approximately 21 pounds of winged yellow-poplar is required to procure a pound of yellow-poplar with greater than 90% full seed. The resources required to produce a high quality lot of yellow-poplar pushes the cost up considerably. The vast majority of nurserymen will quickly say no to a price tag of $200.00 per pound for yellow-poplar with 90% plus full seed. Many, though, fail to look at the numbers before making their hasty decision (Table 2). The cost per full live seed is almost the same for the winged yellow-poplar as compared to the high-graded yellow-poplar. Also, high-graded, dewinged yellow-poplar reduces the amount of volume which the nurseryman must handle, there is greater control of bed density, and the seed is able to be planted in drills. High-grade yellow-poplar seed also opens a window for containerized planting.

LFS has worked extensively with bald cypress to procure seed with germination and purity greater than 90%. Seed is collected from trees in the water rather than on dry land. LFS's experience is that seed from trees over the water will generally be of a higher quality relative to seed on dry land. An initial cut test is made on seed prior to collection in an area to insure the seed to be collected is of good quality. One must remember that cleaners and gravity tables are not miracle workers. It is very difficult, if not impossible, to start with low quality material and produce a high quality product. To produce a high quality product one must seek out high quality material to work with.

Collected bald cypress seed is then dried down so that it may be screen cleaned. The screen cleaner removes large, trash material such as sticks and small, lighter material such as needles. The bald cypress is also sized into three sizes with the screen cleaner. The sizing serves two purposes. A more accurate seed per pound count is available, which helps the nurseryman plant a more precise bed density. Also, sizing is beneficial in the upgrading step on the gravity table. As with the yellow-poplar, more than one pass on the gravity table is necessary for procuring high quality bald cypress. Three sizes, with two grades making up each size, were procured during the 1997 season. This process was successful in procuring bald cypress with greater than 90% germination and purity (Table 3).

A few other activities with other hardwood seed at LFS that are worth mentioning include dewinging green ash (*Fraxinus pennsylvanica*,) arizona ash (*Fraxinus velutina*,) white ash (*Fraxinus americana*,) and silverbell (*Halesia diptera*) to reduce the volume the nursery must handle and to allow upgrading. Sizing of flowering dogwood (*Cornus florida*) provides a more accurate seed per pound count and separates the large seeds, which may contain two embryos (this situation may result in a germination test result greater than 100%.) Due to the volume of drupes and other fruits which LFS processes a specific cooler is used to store these prior to cleaning. Also, certain species such as *Ilex*, which require maceration, foam considerably during cleaning. This problem can be alleviated with the use of an antifoaming agent (the same additive that is used in spray tanks for chemicals that foam,) without harm to the seed.

Summary

External factors play a big role in seed quality, and Mother Nature will have a different affect on each specie's seed quality from one year to the next. But with technology we are able to improve on the seed quality available to us. Improved seed quality should not be viewed as an additional cost only, but as an avenue for increased nursery efficiency and quality seedling production. As with any operation, a quality product requires quality materials, and the same is true for a seedling nursery.

Literature Cited

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Table 1
Sizing Data on Selected Species of Acorns

Specie	Screen Size / Seed per Pound								Weighted Avrg. Seed per lb.
	8	9	10	12	14	16	18	18+	
Quercus acutissima				107	71	48			76
Quercus alba			115	80	62				81
Quercus falcata v. pagodaefolia	305	232	169						261
Quercus laurifolia	380	235							366
Quercus lyrata				202	118	78	51		120
Quercus macrocarpa					75	56	39	23	32
Quercus michauxii					62	47	34		45
Quercus nigra	364	319	208						328
Quercus nuttallii			158	104	79	53			97
Quercus palustris	340	268	208	165					243
Quercus phellos	438	345	263						384
Quercus rubra				111	87	58			90
Quersus shumardii			158	106	75	59			97
Quercus virginiana	308		206	114					225

-Shaded size block for each respective specie indicates the most common size for that specie.

-Seed per pound will vary based on moisture content of acorns, origin of the specie, and year to year crop production.

Table 2
Liriondendron tulipifera -Yellow-poplar

Lot	Full Seed %	Live Seed %	Purity %	Seed per Pound	Live Seed per Pound	$/lb.	$ per Pound	Pounds Required For 100,000 Viable Seeds
Winged	10%	8%	80%	14,600	934	$10.00	$0.0107	107.0
Upgraded	93%	91%	98%	21,500	19,076	$200.00	$0.0105	5.2

Table 3
Taxodium distichum -Bald Cypress

Lot	Germ%	Purity %	Seed per Pound	Live Seed per Pound	$/lb.	$ per Pound	Pounds Required For 100,000 Viable Seeds
Regular	40%	50%	6,500	1,300	$5.00	$0.0038	77.9
Upgraded	85%	93%	6,500	5,138	$20.00	$0.0039	19.5