

Growing Difficult Hardwoods: Experiences at the George O. White State Forest Nursery

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Abstract: This paper will describe techniques for growing bareroot seedlings of some of the “trickier” species that nursery managers often times have limited success growing. In addition, some information is provided about hardwood seed management and how that has improved nursery successes.

Keywords: seed treatment, seed storage, sowing, bareroot

Seed Collection and Storage

At the George O. White State Forest Nursery (Missouri Department of Conservation, Licking, MO), most of our hardwood seed is collected locally and cleaned by our staff. We control how much we buy, when we buy it, and how much we pay for it. There is an old saying in the seed business that “in good seed years, you get good seed”; in our experience, we have found this to be very true. In years of abundance of a particular seed, we will often buy three, four, or five years’ worth of seed. We clean it, dry it, and store it. If the seed turns out to be a good seed lot (and it almost always does in good seed years), then we are set for years to come with the necessary seed for fall and spring plantings. We freezer-store (2 °F [-16.7 °C]) our seed in plastic bags, in cans. With this practice, when we need 75 pounds of flowering dogwood seed in the fall, we can go to our freezer and get it. There are no frantic phone calls to seed vendors or other nurseries. We have stored some seed for more than 20 years and still get excellent germination. When we do buy seed from vendors, we buy two or three years’ worth of seed; this helps take the pressure off of the nursery manager in future fall sowing seasons. In addition, if we needed 30 pounds of seed, we might buy 20 pounds from each of three vendors then plant 10 pounds of each and track them to determine which seed performed best for us. Another benefit of this method is if one seed lot failed, we only lost a third of the seed, not all of it.

Sycamore (*Platanus occidentalis*)

Sycamore is a species for which we can use old seed. For instance, sycamore seed balls were purchased for the George O. White Nursery in the fall of 1994 from which nearly 400 pounds of clean sycamore seed was processed. Seed out of those cans was used for the next 17

years until it was used up. The seed quality was excellent; in fact, it may have improved each year in storage (or perhaps we got better at germinating it over time). We typically sow sycamore seed in mid- to late-May. If we sow much earlier than this the seedlings get too big (we do not top clip our sycamore). The seed is sown right on the surface of the seedbeds. We raise the disks on our Love seeder so that they seed is not covered at all with any soil; the packing wheels press the seed into the seedbed. Immediately after sowing, we cover the seed with hydromulch and then begin watering. Normally, we water sycamore with overhead irrigation for about an hour in the morning and an hour in the afternoon. This is done seven days a week for at least two weeks, until we are sure the seed has germinated. Using this method of long-stored seed, surface sowing, hydromulching, and daily watering, we have not had a single season of failure on our sycamore crop and we typically grow about 150,000 sycamore seedlings per year.

River Birch (*Betula nigra*)

When sowing river birch, it is important that there be no wind since the seed can easily blow out of the funnel on the Love seeder. It is also important that the soil not be wet because the seed will stick to the rollers. If there is any debris in the seed lot (and there usually is), it will plug up the Love seeder. River birch seed must continuously be pushed out of the funnel; gravity has little to no effect on river birch seed. It is inevitable that the tubes will plug up and the tractor driver will have to stop. As with sycamore, river birch seed should be sown right on the soil surface and covered with hydromulch as quickly as possible. As with the sycamore, water it twice daily until it is up.

For river birch, we always plant one-year-old seed. In many years, it is about June 1 before current year seed is available. We prefer to sow river birch by the first week of May or even the end of April. So, in May 2012, we sowed seed from June 2011. In late May or June we got our 2012 seed that we will store and plant in 2013. This way we did not have to worry or wonder if we were going to get any seed and when. We store the river birch seed for the year in a plastic bag, in a seed can in our walk-in cooler at about 34 °F (1.1 °C). We do not attempt to dry and freeze it.

Buttonbush (*Cephalanthus occidentalis*)

We grow buttonbush much the same way as we do sycamore and river birch. Unlike river birch, however, buttonbush is very easy to sow. You must have patience with buttonbush; sycamore often germinates in seven to ten days, river birch slightly longer, but the buttonbush will take up to a month, with twice daily watering, to germinate.

Hazelnut (*Corylus americana*)

Hazelnut is an important species for us; we can sell 100,000 hazelnut seedlings a year if we can grow that many. We do not buy our hazelnut seed commercially, but collect it locally. The problem with hazelnut seed, however, is if you wait until it is ripe on the shrub, some critter has already eaten it. We collect ours in mid-August, while it is still very green. We then spread the green husks out on screen boxes, inside a building (we use our idle seedling coolers), and let the seed husks dry out and the seed ripen. This

protects it from some wildlife, although we have had squirrels and rats come into the cooler to eat hazelnuts. We have a dehumidifier in the cooler to assist in drying the husks and we stir the seed about once a week. It can get a lot of white surface mold, but this does not appear to hurt the seed. By late September or early October we run the dried husks through our HA400 brush machine to clean off the husks. We then hand sow the seed in late October. Over the last few years our germination has not been what it had been in previous years; this could be because of overly wet conditions in the winter.

We have also been successful storing clean seed over for a year by putting it in plastic bags, in seed cans in our cooler for the year. But this rarely happens, as we usually cannot even find all the seed we need, much less have surplus.

Chokecherry (*Prunus virginiana*)

We have tried to grow chokecherry for about six years. We sow in fall and normally get excellent germination and early growth. However, a leaf disease hits the seedbeds by the first of June resulting in the seedlings' leaves falling off and the seedlings stop growing. We end up having to toss 25,000 five-or-six inch trees. Initially, we tried a mix of fungicides until 2010 when we sent samples of our diseased chokecherry to Michelle Cram (Plant Pathologist, USDA Forest Service, Region 8 Forest Health Protection) and found out that we did not have a leaf fungus, but a bacterial blight. Last year, we tried the bactericide, Kocide, but it did not have much success in controlling the leaf disease. We may be done growing this species.

Deciduous Holly (*Ilex decidua*)

It takes two years of seed in the ground to grow deciduous holly; there is no way around it. Seed sown the first of October 2012, won't germinate until April 2014! The other holly species – American holly (*I. opaca*) or winterberry (*I. verticillata*) take as long or even longer to germinate.

Spicebush (*Lindera benzoin*)

Spicebush is becoming a more popular species for us and we have been growing it for about seven or eight years. This is a small, shade-loving shrub. The bright red fruit contains a very thin shelled, delicate seed. Normal cleaning of the seed, such as we would do with plum, dogwoods, and other hard seeds will break the spicebush seed. It is cleaned in a macerator, but done very slowly. The employee that cleans this seed, must not be in a hurry. In the past, we just dried the berries, but cleaning the seed carefully has greatly increased our germination. We try to sow fresh seed each year, but have had success storing the seed for one year (not frozen, but cold stored). We have stored seed for more than one full year, but germination diminished greatly by year two. The newly emerged seedlings are susceptible to damping off disease, more so than most hardwoods. We have not had good germination from seed purchased from commercial vendors.

Acid Treating Seed

Acid treating can be an excellent way to make seed germinate. Hot water, cold and wet soak, or other forms of stratification or

scarification may work, but we have had great success using sulfuric acid. Below is a description of how we do it and some procedures for specific species.

It's important to use plastic containers and that the workers wear safety equipment. There should always be two workers doing this; never have an employee move seed out of the tubs alone. They can be alone to watch and stir, but only briefly. This helps to avoid accidents. We put the sulfuric acid about 10 to 12 inches (25 to 30 cm) deep in a large plastic trashcan. The seed is placed in a 5-gallon bucket with a lot of holes drilled into the bucket. The bucket is lowered into the acid. Employees track how much time the seed is in the acid and stir it occasionally using a wooden stir stick. Keep metal away from the acid! Once the target time has been reached, the bucket containing the seed is pulled out of the acid, allowed to drain, and then dumped onto screen boxes where the seed is thoroughly rinsed.

Kentucky Coffeetree (*Gymnocladus dioica*)

We soak Kentucky coffeetree seeds for two hours in the acid. This takes us many hours to complete, as we usually sow about 300 pounds and we can only treat about 20 pounds at a time in each of the two tubs we have acid in. We have found that it is best to treat Kentucky coffeetree seeds with acid, clean it very well with cold water, then sow it as soon as possible. It is important to not let the seed dry out because the seed coat can rehard. We treat enough for a bed, then hand sow that bed as soon as the seed is treated and before it dries.

Redbud (*Cercis canadensis*)

We soak redbud seed for 45 minutes in the acid. We surface dry the treated seed just enough to get it to feed through the Love seeder.

Aromatic Sumac (*Rhus aromatic*)

Unlike other species, we acid treat and sow aromatic sumac in the fall. We give the seed a 45-minute acid soak, dry it, and sow with our Love seeder, usually in late October. We were told that fall-sown aromatic sumac does not need acid treatment. We did that one fall and the seed germinated, but it was a very poor stand. The next fall, we acid treated seed from the same seedlot and had an excellent stand. Our advice is to not just fall sow it.

Other Species

We also acid treat false indigo (*Baptisia australis*) for 7 minutes and spring sow; black locust (*Robinia pseudoacacia*) for 45 minutes and late spring sow; and smooth sumac (*Rhus glabra*) for one hour and late spring sow.

Conclusions

When it comes to difficult-to-grow hardwoods, the difficulty is often a seed issue. Success can depend on proper seed handling and sowing at the correct time. There are certain patterns that must be followed to be successful. Shortcuts are not good. Seed is too expensive and the product we grow is too valuable to not follow a set procedure.