Propagation protocol for

BAREROOT BIGTOOTH AND QUAKING ASPEN USING SEEDS

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KEY WORDS
seed cleaning, germination, long-term seed storage, *Populus grandidentata, P. tremuloides,* Salicaceae

NOMENCLATURE
USDA NRCS (2002)

Figure 1. 1+0 aspen seedlings emerging through oat straw mulch.

Photo by Ronald P Walter

At Penn Nursery, we annually grow 18 000 bigtooth (*Populus grandidentata* Michx.) and 28 000 quaking (*P. tremuloides* Michx.) aspen (Salicaceae) as 1+0 bareroot seedlings (Figure 1). Our protocol has evolved over the past 20 y and now yields us 1-y-old seedlings that are 46 cm (18 in) tall with a stem diameter of 8 mm (0.3 in) about 2.5 cm (1 in) above soil line. We feel the secret to our success is in seed collecting and cleaning and in controlling moisture, leaf spot, and weeds.

SEED COLLECTION, CLEANING, AND STORAGE

In our area, seed capsules begin opening in late April to mid May. We strive to collect capsules when they are just beginning to show cotton and the seed coats are a light brown color. Capsules are placed into 0.9-m-wide x 1.7-m-long x 10-cm-deep (3 ft x 5.5 ft x 4 in) wooden frames with flyscreen attached to the bottom and covered with another frame with 1 cm (0.375 in) square wire screen (hardware cloth) until the cotton is released. We then vacuum the cotton with a 5 horsepower shop vacuum as shown in Figure 2. The combination of hose length and depth of the hose in a passive vacuum drum provides us with relatively clean seeds (see Figure 3), similar to the technique of Dawes (2003). Once preliminary cleaning with the vacuum is complete, we pour the seeds into a #18 round test sieve (1 mm) with a #35 round test sieve (500 µm [0.5 mm]) beneath (Gilson Company Inc, PO Box 677, Worthington, Ohio 43085; telephone

Photos by Ronald P Walter

Figure 2. Wooden racks with either flyscreen (on the bottom) or 1 cm (0.375 in) hardware cloth (on the top) hold aspen capsules as they release cotton and seeds (A). Cotton and seeds are vacuumed from the wooden racks (B) using a 5-horsepower shop vacuum. The vacuum pulls the seeds into a passive shop vacuum canister that has been modified 2 ways: the motor has been removed and replaced with a connector pipe and the exit pipe has 2 openings (C). The seeds drop out in the passive canister and the cotton is vacuumed into the second shop vacuum with the motor (D).

800.444.1508; URL: http://www.globalgilson.com/), similar to the techniques reported by Moench (1999) and Dreesen (2003). For us, the larger screen allows the seeds to fall through but blocks the coarser debris while the smaller screen blocks the aspen seeds and allows the fines to pass through. At this point, seeds are ready for planting into bareroot beds.

Seeds that we plan to plant in the current year are placed in an airtight container and refrigerated at 1.5 °C (35 °F) for 1 to 3 wk. For long term storage, we freeze aspen seeds inside airtight, amber-colored glass vials at –20 °C (–5 °F). We have successfully kept aspen seeds for up to 5 y with this method—after deep freeze storage seed germination was still 90% to 95%.

FIELD BED PREPARATION AND PLANTING

The soils at Penn Nursery are a clay loam with a pH of 5.5. For the most part, we follow traditional bareroot culture. We add preplant fertilizer ($10N:20P_2O_5:20K_2O$ at 280 kg/ha [250 lb/ac]), till the soil to a fine crumbly texture, and then form raised beds 1.1 m (43 in) wide and 15 cm (6 in) high.

We generally sow aspen seeds during the first 2 wk of June; soil temperature must be at least 21 °C (70 °F). We use a Love/Øyjord Seeder (JF Love Company, Garfield, Washington) to drill seeds into our seedbeds—to ensure correct seedbed densities, we add kitty litter as a seed carrier. For us, Lasting Pride Kitty Litter® works well but any kitty litter that does not have a coarse texture would probably also work well. Because the kitty litter size must be similar to the seed size, we pass the litter through the same #18 and #35 soil sieves that we used to clean the seeds. By hand, we mix 35 g of seeds with 0.45 kg (1 lb) of sieved kitty litter. This is enough seeds to plant 30 m (100 ft) of bed. Seeds are drilled into 7 rows using our Love Seeder calibrated for 75 to 108 seedlings per m^2 (7 to 10 seedlings/ft^2). Drills are set to drop seeds without covering them. The drill rollers press seeds into the soil surface.

Once drilled, we cover the seedbeds with fresh, clean oat straw. The straw is applied by hand to a depth that covers the bed but still allows us to see soil. We place the same wooden screen racks (with the 1 cm hardware cloth) described above, screen-side down, on top of the straw to hold it in place. For the next 4 to 5 d it is extremely important that the soil surface be kept moist—any surface drying will kill the emerging seedlings. After 3 to 4 days, the first green leaves are visible (a 10X hand lens facilitates viewing the seedlings), and by the end of the first week we generally flip the wooden screen racks over. This leaves a 10-cm-tall (4-in) growing space and provides the young seedlings with shade. At this point, we continue watering to keep the soil moist. With the moist environment it is important to keep a close watch for leaf spot disease and apply fungicides accordingly.

FERTILIZATION TO MEET TARGET HEIGHT

By mid July, the seedlings are large enough that we can weed the beds without fatally disrupting the aspen crop. About the first of August we remove the wooden racks and begin nitrogen fertilization. We broadcast our fertilizers. Our first application is urea ($45N:0P_2O_5:0K_2O$) at 62 kg/ha (55 lb/ac). The following week we apply $10N:6P_2O_5:4K_2O$ at 280 kg/ha (250 lb/ac). If the crop needs some additional growth, we may apply another 280 kg/ha (250 lb/ac) 14 d later. By the end of August, seedlings are within the target height range of 25 to 46 cm (10 to 18 in). We allow the soil moisture to gradually decrease, and we find it okay to allow a slight wilting to occur. Seedlings harden with exposure to ambient temperatures.

HARVESTING, STORAGE, AND SHIPMENT

We harvest, or lift, our aspen seedlings the following spring using a Bärtschi–Fobro LLC (Grand Haven, Michigan) seedling lifter. Aspen is the first hardwood to be lifted and is immediately placed into refrigerated storage at 1 to 3 °C (34 to 38 °F). Seedlings are graded—acceptable seedlings have between 25 to 46 cm (10 to 18 in) of height with a stem diameter of 8 mm (0.3 in) 2.5 cm (1 in) above ground and a full, undamaged root system. The roots are covered in sphagnum peat moss and the seedlings bundled in a jelly-roll-type fashion and returned to refrigerated storage. Seedlings are either picked up by private buyers or are shipped by United Parcel Service.® Overnight delivery in Pennsylvania is achieved with either method.

COOPERATORS

Both bigtooth and quaking aspen are used in a number of plantings throughout Pennsylvania, including wildlife food and cover, surface mine restoration, and traditional forestry plantings. We cooperate with the Pennsylvania Game Commission nursery during the seed collection phase, relying on their personnel and their forest site (State Game Land #176 near State College) for a continual source of seeds of both species. As natural resource management agencies, both the Pennsylvania Game Commission and Department of Natural Resources grow bareroot aspen seedlings. The harvested seeds are shared equally between both agencies.

ACKNOWLEDGMENT

The original protocol for our aspen seed collection and sowing was pioneered by Samuel Bricker when he was nursery manager at Penn Nursery in the early 1980s, and put into production when he moved to our Greenwood Furnace Nurs-

Photos by Ronald P Walter

Figure 3. The mostly clean aspen seeds that collect in the passive shop vacuum are poured into a #18 round test sieve (top) where the coarse debris remains (middle) and the seeds pass through onto a #35 round test sieve (bottom). These sieves are the same as those used for soil sampling.

ery in 1986. When Greenwood closed in 1992, we assumed aspen production and use the protocol, slightly refined, today.

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