Increasing Hardwood Seed Quality With Brush Machines

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Poor seed quality often adversely affects the cost and efficiency of producing hardwood seedlings. The lack of a good method to husk and de-wing seeds and break up clusters prevents many nurseries from upgrading hardwood seeds. Trials with a laboratory model brush machine showed that seed quality for several species of hardwoods could be improved. Tree Planters' Notes 43(2):33-35; 1992.

Many hardwood seeds are winged or in clusters or fruits that make conditioning and mechanical planting difficult to impossible. Planting such seeds mechanically results in poorly regulated bed densities; planting them by hand can be prohibitively expensive. The USDA Forest Service's National Tree Seed Laboratory in Dry Branch, Georgia, tested a laboratory model brush machine to determine if it could de-wing yellow-poplar and ash, break up dusters of ash and maple, and hull winterfat seeds.

Materials

A brush machine is basically a wire cylinder with brushes inside it that rub the seeds against the inside of the cylinder (figure 1-3). The wire cylinder is oval in cross section, so that the seeds can roll and come under the brushes, and the wire in the cylinder is

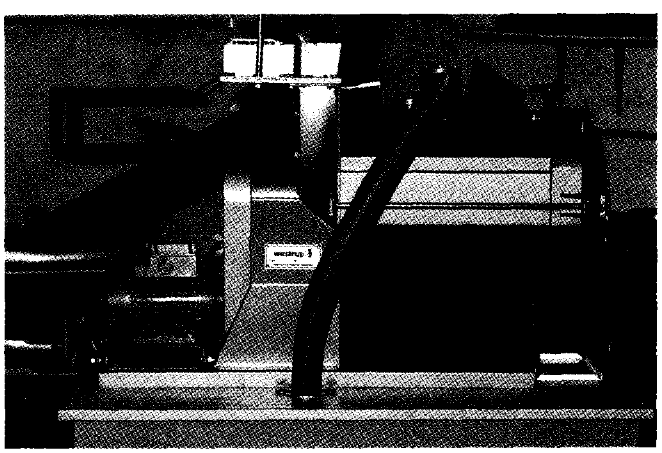

Figure 1—*Laboratory model of brush machine. Seeds are fed in on the top (see figure 2) and discharged on the right.*

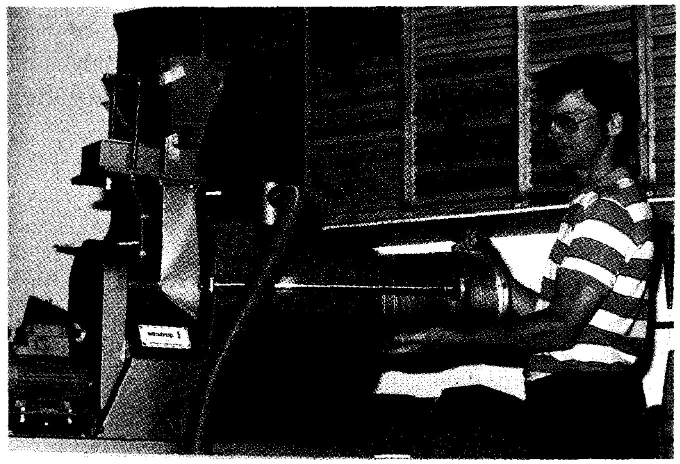

Figure 2—*The seeds are rubbed by brushes against a wire cylinder called a shell. Here, the shell is being removed from the machine for cleaning.*

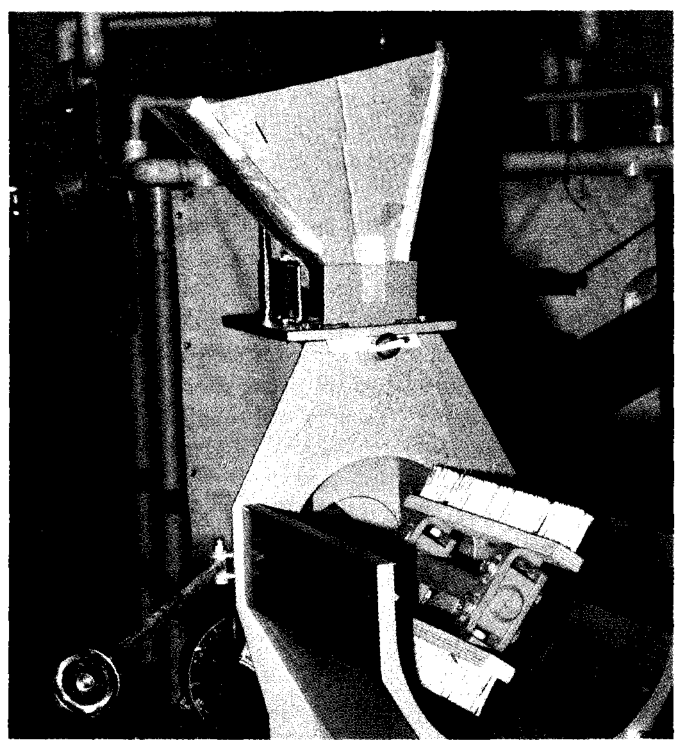

Figure 3—*These brushes rub the seeds against the inside of the shell shown in figure 2. The brushes come in several degrees of stiffness. The closeness of the brushes to the shell is called the tension and is adjustable.*

usually square instead of round, so that the cutting action of the brush is improved. Brushes vary in stiffness, with stiffer brushes providing more abrasion than softer ones. The space between brushes and cylinder is adjustable, as is the rate at which the brushes revolve. Stiffer brushes, higher brush tension (less clearance between brushes and the cylinder), and faster brush rotation give faster hulling but also greater chance for seed injury. Opening and closing the discharge gate regulates the length of time the seed remains in the machine. All brush machines should have good aspiration to control the dust produced by the hulling operation.

Seeds from white ash *(Fraxinus americana* L.), yellow-poplar *(Liriodendron tulipifera* L.), sycamore *(Platanus occidentalis* L.), and red maple *(Acer rubrum* L.) were acquired from trees in the middle Georgia area. Seeds from winterfat *(Ceratoides [Eurotia] lanata* (Pursh) Moq.), a range shrub, were supplied by the Lucky Peak Nursery in Boise, Idaho.

The potential of the brush machine to condition these seeds was tested with a laboratory model. Brushes of varying stiffness, different amounts of brush tension, varying speed, and multiple passes through the machine were evaluated.

Results

White Ash. The samaras of white ash were easily pulled apart by the machine, and the wings could be completely removed without any apparent damage to viability as evaluated by standard germination procedures (AOSA 1990) (table 1, figure 4). Neither brush tension nor the number of passes through the machine was highly critical, as seen by the apparently equal viabilities of single-pass samples and multiple-pass samples. Faster germination appeared to be associated with the more abrasive treatments. Probably this was the result of slight tearing of the seed coat, which would promote release of the germinating embryo.

Yellow-poplar. The dry cones of yellow-poplar were quickly broken apart in the machine. The wing was easily removed, making it possible to remove most of the empty seed on the specific-gravity table. Two lots of poplar seed were tested. One, collected from a parking lot gutter where it had weathered some, was de-winged in one pass. A second lot was not weathered and required two trips through the machine. The second trip was needed to completely remove the rib of the wing. Viability was not evaluated.

Red maple. The samaras of red maple could be separated out of the clusters but were easily damaged. Soft hair brushes had to be used to minimize damage. De-winging was not possible without some tearing of seed coats. Because the original viability of this seed lot was poor, the machine's effect on viability could not be evaluated accurately.

Sycamore. Dry sycamore fruit heads quickly shattered, and the hairs brushed cleanly from the seed in one pass. The aspiration feature of the brush machine did an excellent job of controlling the highly irritating dust of the sycamore. Because this seed lot was taken from a single isolated tree that did not produce any filled seed, viability could not be evaluated for this species.

Winterfat. The difficult seeds of this species were hulled very effectively by the brush machine. The seeds were removed from the bulky, clumping fruit with apparently minimal damage. A few seeds were broken, but x-ray and microscopic examination showed no damage to the intact seeds. The seed lot used in this trial was nonviable, and the effect of treatment on germination could not be evaluated.

Discussion

The results here show promise for improving the quality of hardwood seeds, thus enabling nursery managers to plant difficult seeds mechanically. This is made possible by the brush machine, which can break up seed clusters, remove wings, and hull seeds out of the fruits. White ash seeds, the only ones that could be tested for viability, showed very high viability, even with the harsher treatments.

Successful de-winging of yellow-poplar was accomplished by Bonner (1971) using a debearder. Springfield (1974) reported using a hammer mill to husk winterfat. The brush machine is expected to be superior to these two devices because it results in less mechanical injury to the seed. Because hulling operations involve tearing and cutting, some level of damage is expected, but it can be minimized by careful adjustment of the machine. Seeds of other species, such as grasses and tomatoes, can be husked or polished in brush machines without serious loss of viability. Careful use of the machines should also help improve trees and shrub seed quality. Further evaluations will be made as viable seeds of different species are made available to the laboratory.

Table 1—*White ash de-winging treatments with brush machines*

Sample no.	Brush type	Brush tension	Brush speed*	No. of passes	Germination percent 28 days	35 days
1	Unde-winged	Control sample	—	—	57	94
2	Soft	Not touching	¾ Full	1	67	93
3	Soft	Not touching	¾ Full	2	78	96
4	Soft	Not touching	¾ Full	3	93	95
5	Soft	Not touching	¾ Full	6	95	97
6	Soft	Just touching	Minimum	4	92	94
7	Soft	Just touching	¾ Full	1	91	95
8	Soft	Just touching	¾ Full	2	91	95
9	Soft	Just touching	¾ Full	3	92	93
10	Soft	Just touching	Full	1	72	90
11	Soft	Fairly tight	Full	1	90	93
12	Soft	Tight	¾ Full	1	85	98
13	Soft	Tight	¾ Full	2	83	94
14	Stiff	Fairly tight	Full	1	86	92
15	Stiff	Fairly tight	¾ Full	1	84	91
16	Stiff	Fairly tight	¾ Full	2	90	94
17	Stiff	Fairly tight	¾ Full	3	87	92

*Brush speed is how fast the brushes were turning. A speed of ¾ full = a speed control setting of ¾ of maximum speed. Minimum brush speed = a speed control setting of minimum.

Figure 4—*Seeds of white ash can be singularized and de-winged in the brush machine. Samaras in clusters (**left**): singularized samaras (**center**); samaras with wing removed (**right**).*

Sources

To the best of the author's knowledge, there are three suppliers of brush machines in the United States:

Carter-Day Company
500 73rd Avenue, NE
Minneapolis, MN 55432
telephone: (612) 571-1000

Westrup, Inc.
1400 Preston Road
Plano, TX 75093
telephone:(214) 985-7887

Hendrickson Enterprises
4050 NE Minnesota Avenue
Corvallis, OR 97330
telephone: (503) 757-8019

Literature Cited

Association of Official Seed Analysts. 1990. Rules for testing seeds. Journal of Seed Technology 12(3): 109 pp.

Bonner, F.T.; Switzer, G.L. 1971. Upgrading yellow-poplar seeds. Res. Note SO-129. New Orleans: USDA Forest Service, Southern Forest Experiment Station. 4 p.

Springfield, H.W. 1974. *Eurotia lanata* (Pursh) Moq.-Winterfat. In: Schopmeyer, C.S., tech. coord. Seeds of woody plants in the United States. Agric. Handb. 450. Washington, DC: USDA Forest Service: 399.