

A Multiple-Compartment Tree Seed Tumbler-Drier

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A tumbler-drier that has several compartments so a number of seedlots can be dried at one time is described. Seeds can be conveniently removed for monitoring moisture content during drying.

For several years, we have been conducting laboratory and nursery tests of a modified stratification procedure for *Abies* seeds. This stratification treatment, which substantially improves germination of *Abies* and other dormant species, involves stratifying seeds (2° C) in a fully imbibed state for 1 month and then partially drying the seeds and stratifying for several more months (1). Laboratory drying was accomplished by spreading the seeds on screens or filter paper and occasionally stirring the seeds to expose wet surfaces to the air. Then, the seeds were weighed to monitor changes in their fresh weight. Since this process was labor intensive and slow, requiring about 8 to 10 hours, it was unsuitable for operational use.

We needed a device that would permit maximum exposure of all seed surfaces to the air without requiring external heating. The

machine had to be able to handle a number of different lots, although not necessarily large quantities of each lot. It was also essential that seed containers be easily removable so that seed moisture content could be monitored during drying.

Description

The machine that evolved resembles a small "Ferris wheel" (fig. 1). Two parallel plywood disks, 915 millimeters (36 in) in diameter and spaced 356 millimeters (14 in) apart by plywood struts, are rotated on a central metal shaft. Fourteen 150-millimeter (6-in) circular holes, cut in opposing pairs in the large disks, support the ends of the 14 wire-mesh seed cylinders. Each

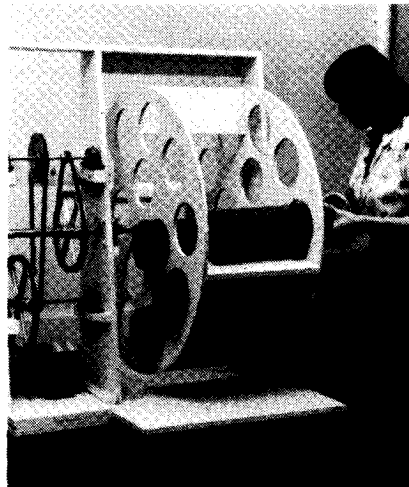


Figure 1—Cylinders, each of which holds approximately 2 kilograms of seeds when half full, are easily removed from or inserted between the plywood disks. The series of reduction pulleys and motors are visible on the left.

cylinder is closed at one end and is lined with a removable sleeve made of fine plastic screen. The open end of each cylinder is bent outward to form a 12-millimeter (1/2-in) lip for securing the cylinder lid. The lid is fashioned from a circle of wire mesh glued to a liner of fine-celled polyurethane foam, the same diameter as the outer edge of the cylinder lip (figs. 2 and 3). Two spring-clip paper fasteners are used to attach the lid to the cylinder lip.

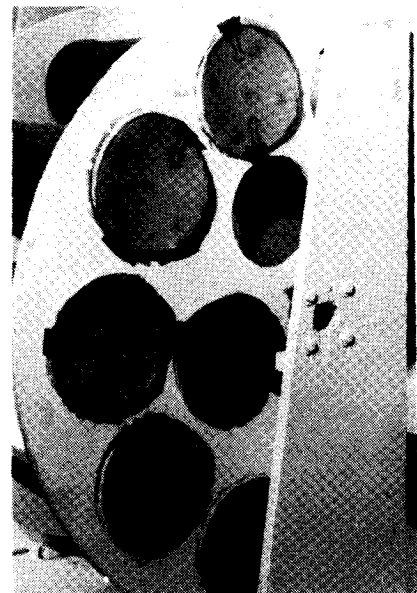


Figure 2—Lids are secured to the lips of the cylinders with spring-clip paper fasteners. The foam liner provides a seal to prevent seed spillage.

The solid steel shaft through the center of the large disks is driven by a 1/3-horsepower electric motor, with speed reduction through

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several pulleys (table 1, fig. 1) to approximately 10 to 12 revolutions per minute. A tumbling action is achieved and the seeds roll gently within the cylinders. Modifications to the drive mechanism are possible, but at least a $\frac{1}{3}$ -horsepower motor is required to overcome the inertia of a fully loaded tumbler. If necessary, drying can be accelerated with a large room fan oriented to blow air across the cylinders as they rotate.

Best drying occurs when each cylinder is no more than half filled with wet seeds. Using all cylinders, 12 to 18 kilograms (25 to 40 lb) can be dried from 40- to 30-percent moisture content in less than 4 hours. Thus far, we have found no evidence of damage from the tumbling action. Although the device was designed for a specific seed-drying application, it could be used as a general seed drier. For example, it could be used to

adjust the moisture content of freshly harvested seeds before they are placed in cold storage.

All materials are inexpensive and readily available, and the apparatus can easily be constructed in a short time (table 1). The three main advantages of this unit are: (1) the multiple compartments, which allow several seedlots to be dried at one time (a special consideration in processing seed orchard collections); (2) the inner

Table 1—Parts list for multiple-compartment tumbler-drier

Part	Number	Material	Size	
			Imperial	Metric
Upright supports	3	$\frac{3}{4}$ -in (19-mm) plywood	$4\frac{1}{2} \times 12 \times 42$	115 × 305 × 1,070
Large disks	2	$\frac{5}{8}$ -in (14-mm) plywood	36 diameter	915 diameter
Disk spacers (struts)	4	$\frac{3}{4}$ -in (19-mm) plywood	15 × 6	380 × 152
Base	1	$\frac{3}{4}$ -in (19-mm) plywood	35 × 37 $\frac{1}{2}$	900 × 950
Top brace	1	$\frac{3}{4}$ -in (19-mm) plywood	4 $\frac{1}{2}$ × 37 $\frac{1}{2}$	115 × 950
Cylinders	14	$\frac{1}{8}$ -in (3-mm) wire mesh	6 × 18	150 × 460
Cylinder liners	14	Fine mesh plastic screen	6 × 18	150 × 460
Cylinder lids	14	$\frac{1}{8}$ -in (3-mm) wire mesh		
		$\frac{1}{2}$ -in (13-mm) polyurethane	6 × $\frac{1}{2}$	150 × 10
Spring clips	28		1 $\frac{1}{4}$	
Shaft	1	Steel (solid core)	1 × 30	25 × 760
Shaft	2	Steel (solid core)	$\frac{1}{2}$ × 13 $\frac{1}{4}$	12 × 335
Pulleys	1	Metal	1 $\frac{3}{8}$ × $\frac{1}{2}$	35 × 12
	1	Metal	1-9/16 × $\frac{1}{2}$	40 × 12
	1	Metal	2 × $\frac{1}{2}$	50 × 12
	1	Metal	6 × $\frac{1}{2}$	150 × 12
	1	Metal	9 $\frac{7}{8}$ × 1	250 × 25
	1	Metal	11 $\frac{7}{8}$ × $\frac{1}{2}$	300 × 12
V belt	1	Rubber	38	965
	1	Rubber	40	1,015
	1	Rubber	48	1,220
Bearings	4	Pillow bearings	$\frac{1}{2}$	12
	2	Pillow bearings	1	25
Electric motor	1	$\frac{1}{3}$ hp, 115 V, 6.4 amp 1,725 r/min		
Wheels	4	Caster type	3	75

sleeves, which can be quickly removed from (and returned to) the cylinders for weighing (fig. 3), thus permitting changes in seed moisture content of the entire lot to be monitored without the need for taking subsamples; and (3) the drying at ambient temperature, which removes the possibility of accidental overheating.

Further details and mechanical drawings can be obtained from the senior author at British Columbia Ministry of Forests, Research Branch, 4300 North Road, Victoria, BC V8Z 5J3.

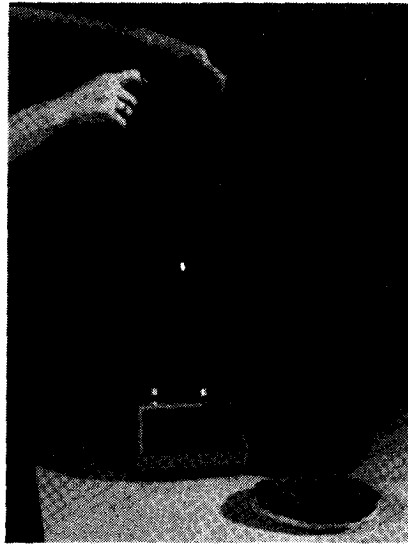


Figure 3—Cylinders are lined with lightweight, plastic screen sleeves (closed at one end), which can be easily removed for weighing. Seed moisture content is monitored by frequent checks of seed fresh weight.

Literature Cited

1. Edwards, D. G. W. A new prechilling method for true fir seeds Proceedings of the Intermountain Nurseryman's Association/Western Forest Nursery Association Combined Meeting Idaho 1980: 58-66: 1981.