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Comparison of a Drill-type Seeder and a Vacuum-Drum Precision Seeder in a Virginia Loblolly Pine Nursery

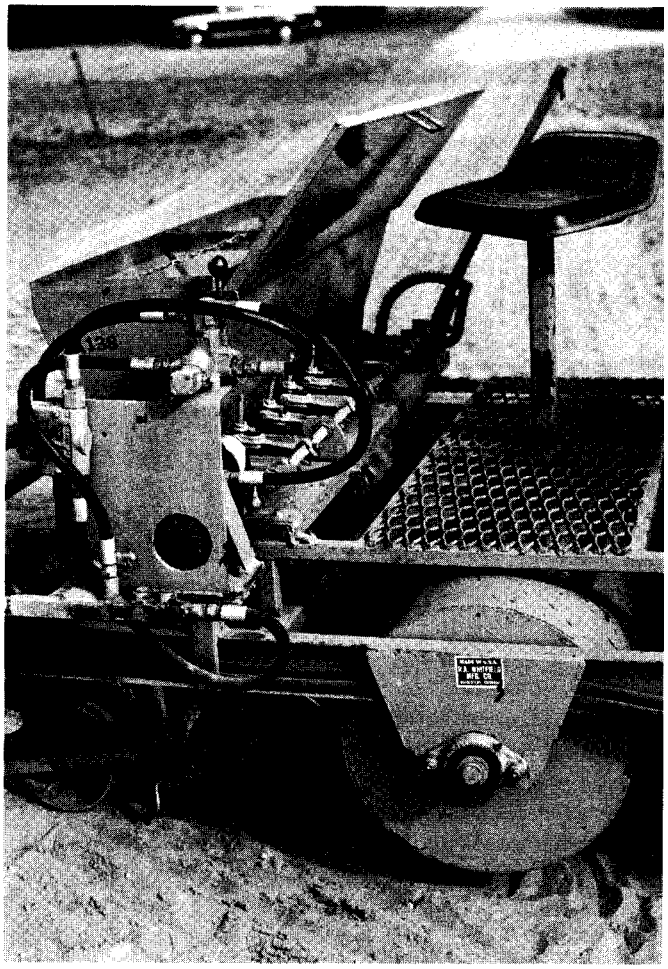
Laurie A. Chandler

Research and tree improvement forester, Virginia Department of Forestry
New Kent Forestry Center, Providence Forge, VA

*A 3-year study compared root collar diameter distribution and cull percentages of loblolly pine (*Pinus taeda *L.) sown with either a drill-type seeder (Whitfield) or a vacuum-drum precision seeder (Love). Seedbed densities were similar for each machine. Although the precision seeder distributed seed more evenly, no consistent improvement was seen in uniformity or cull percentage with its use.* Tree Planters' Notes 43(3):93-96: 1992.

The Virginia Department of Forestry has traditionally sown loblolly pine (*Pinus taeda* L.) with drill-type seeders, including Whitfield (figure 1) and Love-Oyjord models. Eight single drill rows are planted down the length of the nursery bed, with average seed spacing determined by setting and tractor speed. Unfortunately, with these machines, seeds tend to be dropped in clumps. Vacuum-drum precision seeders, on the other hand, distribute seeds more evenly by accurately placing them in a precise pattern, with less clumping (Boyer et al. 1985, Pryor and Vedder 1986). The Love precision seeder (figure 2) actually sows 8 double rows down the length of the nursery bed.

The precision seeder has both advantages and disadvantages when compared with drill-type seeders. The precision seeder is easier to calibrate and, of course, produces a much better pattern of seed distribution. On the other hand, it is slower to operate, requires more precise soil moisture conditions, needs frequent cleaning, and requires very clean, sized seed (Boyer et al. 1985, Murphy 1990, Pryor and Vedder 1986). Overall, the precision seeder would need to produce significantly more uniform seedlings to justify its purchase and the greater expense of operation.



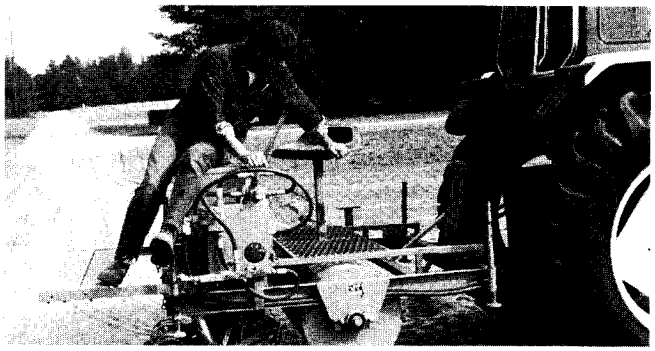


Figure 1—*The Whitfield drill-type sower used by the Virginia Department of Forestry sows single-drill rows with less precise seed spacing.*

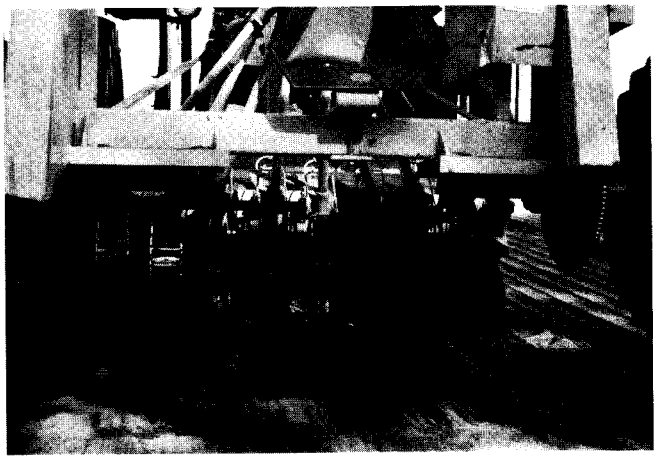


Figure 2—*The Love vacuum-drum precision sower used by the Virginia Department of Forestry sows double-drill rows with more precise seed spacing.*

In 1988, testing was begun to determine the effects of this new spacing pattern on root collar diameter distribution and cull percentage. Our nurseries cull loblolly pine at a diameter of 2.8 mm ($^7/_{64}$ inch). Other organizations have studied the effects of the precision seeder's improved spacing on seedling quality. Some have simply assumed that the improved seed spacing would translate into fewer culls (Pryor and Vedder 1986). Others have actually found an improvement with the use of the precision seeder (Vanderveer 1992, Boyer et al. 1985, Murphy 1990), although often at lower seedbed densities than we use operationally.

Our study, carried out during the 1988, 1989, and 1991 seasons, compared the Whitfield drill-type seeder with the Love vacuum-drum precision seeder.

Methods

All 3 years, loblolly pine seeds were sown in adjacent nursery beds with either a drill-type (Whitfield) or a vacuum-drum (Love) precision seeder. The same seedlot and seeding rate were used for both treatments in any given location. Seed purity was high and, in the 1989 and 1991 studies, sized seedlots were used. However, the germination of the seedlots involved was lower than normal, with germinations of 75, 87, 81, and 81% for the 1988, 1989 bulk, 1989 single-family, and 1991 lots, respectively. In each successive year, initial seedbed densities for both treatments decreased, reflecting an intentional trend toward lower stocking. In all years, the growing conditions in the locations chosen were very uniform. In 1988, the study involved just two adjacent beds at our Sussex County nursery. The 1989 and 1991 studies involved six adjacent beds in each of two locations, at our New Kent County nursery. In 1989, the two locations were sown with different seedlots, at each location–one bulk and one single-family lot. In 1991, as in 1988, only one bulk seedlot was used for all beds sown.

In 1988, 10 paired (20 plots) samples were lifted, at 20-foot intervals down the two beds. Each pair was 15.2 cm (6 inches) wide across both seedbeds (seedbeds are 4 feet across), for a total of ten .19-m^2 (2-square-foot) samples for each treatment. In 1989 and 1991, when more space was available, sample locations were randomly chosen. In 1989, 6 pairs (12 plots) at each location, with each seed lot represented in half of the plots of .19-m^2 samples were initially lifted, two in each of the 6 paired beds involved. Seedbed densities in the location sown with the bulk seedlot were much more representative of our typical stocking. Therefore, 4 additional pairs (8 plots) of .19-m^2 samples were lifted in each paired bed, bringing the total to six in each of the six paired beds for a total of 36 plots in that location. In 1991, 12 pairs (24 plots) of .19-m^2 samples were lifted, four in each of the 6 beds involved at each of the two locations, for a total of 48 plots across both locations. In all cases, each pair was lifted using a 15.2-cm-wide (6-inch-wide) gauge, going straight across two adjacent seedbeds, one sown with each type of seeder.

Samples were graded into eight root collar diameter classes with an increment of .79 mm, from a 1.59-mm ($^2/_{32}$-inch) class to a 7.14-mm ($^9/_{32}$-inch) class. The 1.59-mm diameter class, for instance, included all seedlings with a root collar diameter between 1.19 mm ($^3/_{64}$ inch) and 1.99 mm ($^5/_{64}$ inch). Culls were defined as those trees in the 1.59-mm ($^2/_{32}$ inch) or 2.38 mm ($^3/_{32}$-inch) classes (actual root collar diameter less than 2.8 mm or $^7/_{64}$ inch).

Results and Discussion

Seedbed densities were very similar each year between the two seeders (table 1) and, with the exception of the single-family lot in 1989, closely represented typical stocking for the nursery during the years involved. The 1989 single-family lot had a density much lower than desired.

The cull percent was not consistently improved with the use of the precision seeder. Cull percent with the precision seeder was actually .6 percentage points higher in 1988 and in the 1989 bulk seedlot and 2.9 and 1.1 points lower, respectively, in the 1989 single family seedlot and the 1991 study.

The 1988 study, a preliminary experiment, involved only two nursery seedbeds, each 61 m (200 feet) long. Average root collar diameter was slightly larger in the bed sown with the Whitfield seeder (table 1), even though bed densities were the same. This could well be a bed effect (a possible difference in fertility, speed of germination, depth of coverage, or another factor) rather than a seeder effect. In the 1989 bulk seedlot and the 1991 study, which involved 3 and 6 pairs of beds, respectively, average root collar diameters were the same. The 1989 single-family seedlot also involved 3 pairs of beds, but average diameter was slightly larger for the precision seeder. Perhaps the lower than normal bed densities found at this location improved the performance of the precision seeder.

Table 1—*Comparison of seedbed densities, mean root collar diameters, and cull percentages for the Whitefield drill-type and Love vacuum-drum precision seeders*

Seeder type	No. of samples	Seedling density		Mean diameter		Cull percent
		m^2	ft^2	mm	32nds inch*	
1988						
Drill	10	364	33.8	4.4	5.6	1.5
Precision	10	364	33.8	4.3	5.4	2.1
1989 bulk						
Drill	18	287	26.7	4.5	5.7	3.3
Precision	18	305	28.3	4.5	5.7	3.9
1989 single-family						
Drill	6	191	17.7	4.5	5.7	5.7
Precision	6	191	17.7	4.7	5.9	2.8
1991						
Drill	24	284	26.4	4.6	5.8	2.8
Precision	24	281	26.1	4.6	5.8	1.7

*Values are thirty-seconds of an inch, e.g., 5.9 is almost 5/32 inch.

The most valuable comparison of the seeders' relative worth, however, is the resulting seedling diameter distribution or uniformity. By distributing seed more evenly by accurate individual placement, the precision seeder is designed to produce a more narrow bell-shaped curve, with fewer very small or very large seedlings. This pattern was not consistently exhibited in this study. Overall, root collar diameter distributions were similar for the two different machines in all 3 years (figure 3). In the 1988 study, the distribution is shifted to the right for the drill-type seeder because of the slightly larger average root collar diameter achieved with that machine, but the curve shapes are similar. For the same reason, the 1989 single-family lot exhibits a shift to the right for the precision seeder, with similar curve shapes. In the 1989 bulk seedlot and the 1991 study, the curves for the two machines are practically identical.

Literature Cited

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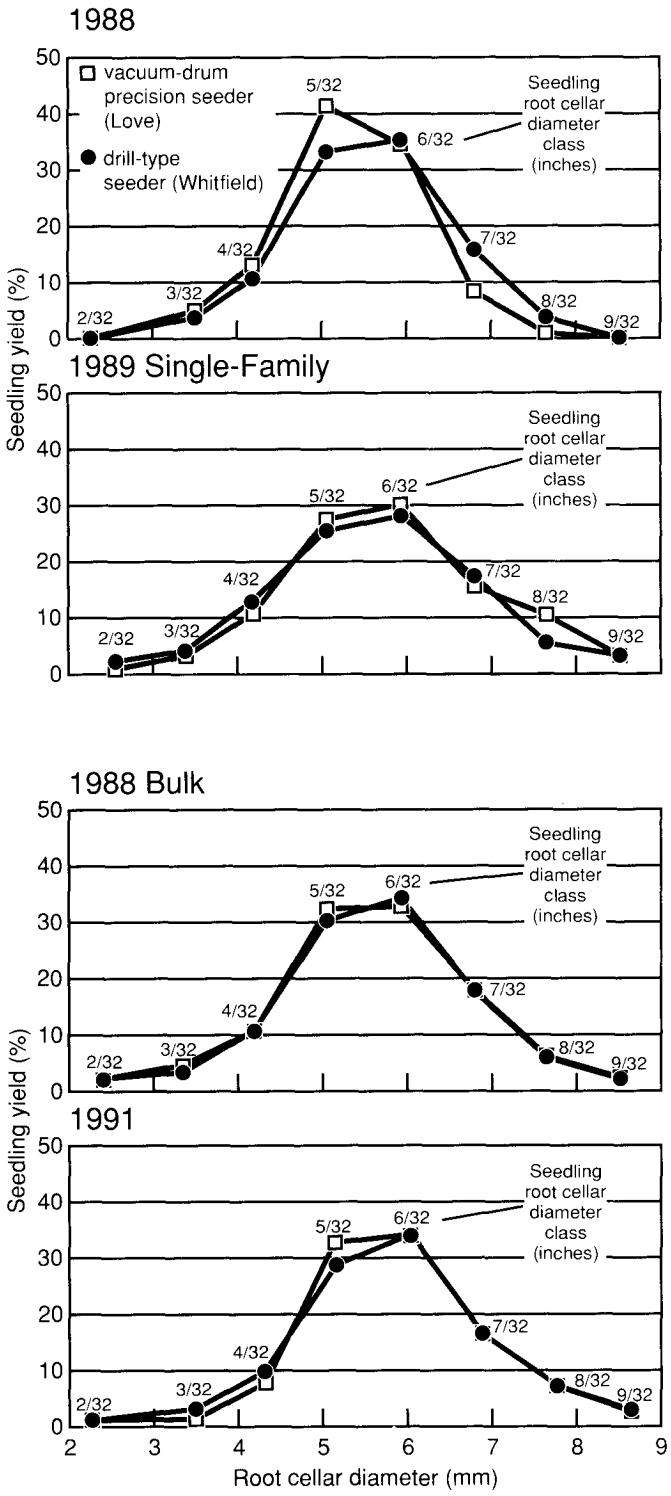

Figure 3—*Root collar diameter distributions for the 1988, 1989, and 1991 installations.*