First-Year Performance of Loblolly Pine Seedlings Stored in Open-Ended Bundles Compared to Kraft Bags

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The Bottom Line…

VDOF loblolly pine seedlings stored in the nursery cooler for 30 days in open-ended bundles and multi-walled kraft/polyethylene bags performed equally in terms of first-year survival and height growth.

Abstract

A study was installed at three locations in the spring of 2020 to compare packaging and storage of loblolly pine seedlings in open-ended bundles and multi-walled kraft/polyethylene bags. After one growing season, there was no statistically significant difference in either survival or height growth due to storage method. The observed differences could be explained by random variation. Overall, survival averaged just under 96% and heights average 1.3 feet.

Background

The Virginia Department of Forestry nurseries have traditionally packaged loblolly pine seedlings in open-ended bundles wrapped in paper and closed with plastic straps on either end (Figures 1 and 2). The roots are first dipped in a clay slurry and the seedlings are placed so that the roots are sealed inside the bundle and the tops protrude on the ends. This method has been proven effective for storing seedlings for 30 days or more with excellent survival and early growth after planting. However, this creates a logistics issue in terms of procuring, handling, and mixing the clay slurry, and, in recent years, the strapping guns used to seal the bundles have suffered frequent failures due to fouling by the clay.

Other forest nurseries around the South utilize lined kraft paper bags for packaging seedlings (Figures 1 and 3). The seedlings are either dipped in water or placed directly into the bags after lifting with no root treatment, and the bags are sealed using plastic straps similar to those used at VDOF. This eliminates the resources spent on the clay dip and removes the risk of clay interfering with the performance of the strapping guns. It is important to avoid having excess water pooling in the bags in order to minimize the risk of developing mold or drowning root tips.

A 1970 VDOF study (https://dof.virginia.gov/wp-content/uploads/report-0045.pdf) compared kraft bags available then to the bundle system and found no statistically significant differences in

survival. But improvements in the ensuing 50 years in seedling genetics, root treatments, and storage conditions (seedlings in 1970 were stored in unheated sheds) have raised renewed interest in this comparison.

Figure 1. Loblolly pine seedlings packaged in the traditional open-ended bundle (left) and a multi-walled kraft/polyethylene bag (right – shown prior to closure with plastic straps).

Figure 2. Loblolly pine seedlings packaged in the traditional open-ended bundle.

Figure 3. Loblolly pine seedlings packaged in multi-walled kraft/polyethylene bag (shown after closure with plastic straps.)

Methods

In order to compare the performance of VDOF loblolly pine seedlings packaged and stored using these two approaches, a study was installed in the spring of 2020. Seedlings from the Garland Gray nursery's "Virginia's Best" genotype were lifted on March 6, 2020 and counted/sorted following standard protocols. Lots of 1000 trees were then packaged using one of four approaches: 1) the traditional open-ended bundles containing seedlings root-dipped in a clay slurry (the method traditionally used by VDOF nurseries); 2) bags containing seedlings root-dipped in the clay slurry; 3) bags with seedling roots sprayed with water; or 4) bags with seedling roots left untreated after lifting (i.e., placed into the bags directly without any root treatment).

After thirty days in storage, seedlings were randomly selected for the study plots from each of the four treatment groups. Four replications of 10-tree plots were planted at three sites – Dragon Run State Forest (DRSF), the Garland Gray Forestry Center (GGFC), and a Weyerhaeuser property Flood Tract (Flood) located just east of Appomattox, VA, between April 6 and 8, 2020. The seedlings were planted by research staff using a dibble bar. Weather conditions at each site during planting were overcast with good soil moisture and rain either occurring or in the forecast.

Survival and seeding heights were measured after the 2020 growing season. Averages were calculated for each plot and the treatments were compared using analysis of variance.

Results

Regardless of packaging method or location, seedlings performed the same in terms of first-year survival and height growth (Table 1). There were no statistically significant differences among treatments. These results agree with those from the study fifty years ago. Overall, survival (Figure 4) averages just under 96% and heights (Figure 5) average 1.3 feet.

There were significant differences in height among the three locations – which is to be expected based on the contrasting local soil and weather conditions. The Coastal Plain site at Dragon Run produced the best growth followed by the Piedmont site in Appomattox. Seedlings on the deep well-drained sand at Garland Gray grew considerably less.

Table 1. First-year seedling survival and average height by location and averaged across locations for the study of bagged vs bundled methods of storing loblolly pine seedlings.

	Survival				Height			
Location	Bundle	Bag Only	Bag + H2O	Bag + Clay	Bundle	Bag Only	Bag + H2O	Bag + Clay
DRSF	95%	98%	98%	98%	1.8	1.7	1.6	1.6
Flood	100%	100%	93%	98%	1.4	1.4	1.3	1.3
GGFC	95%	93%	98%	85%	0.9	0.8	0.8	0.8
Overall	97%	97%	96%	93%	1.3	1.3	1.2	1.2

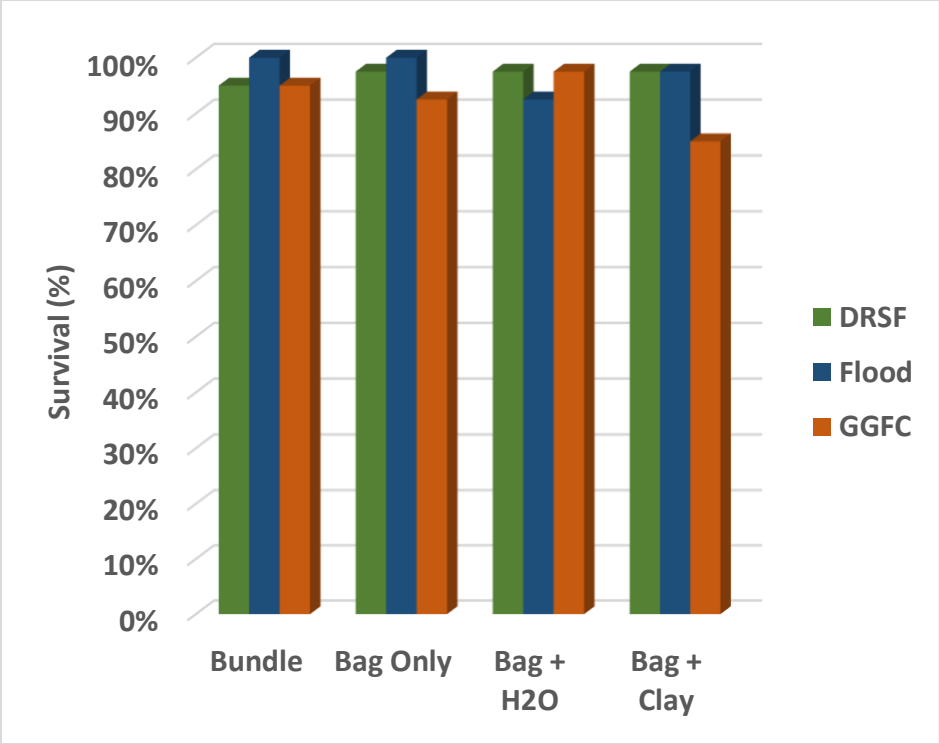

Figure 4. Average survival after one growing season in the study of bagged vs bundled methods of storing loblolly pine seedlings.

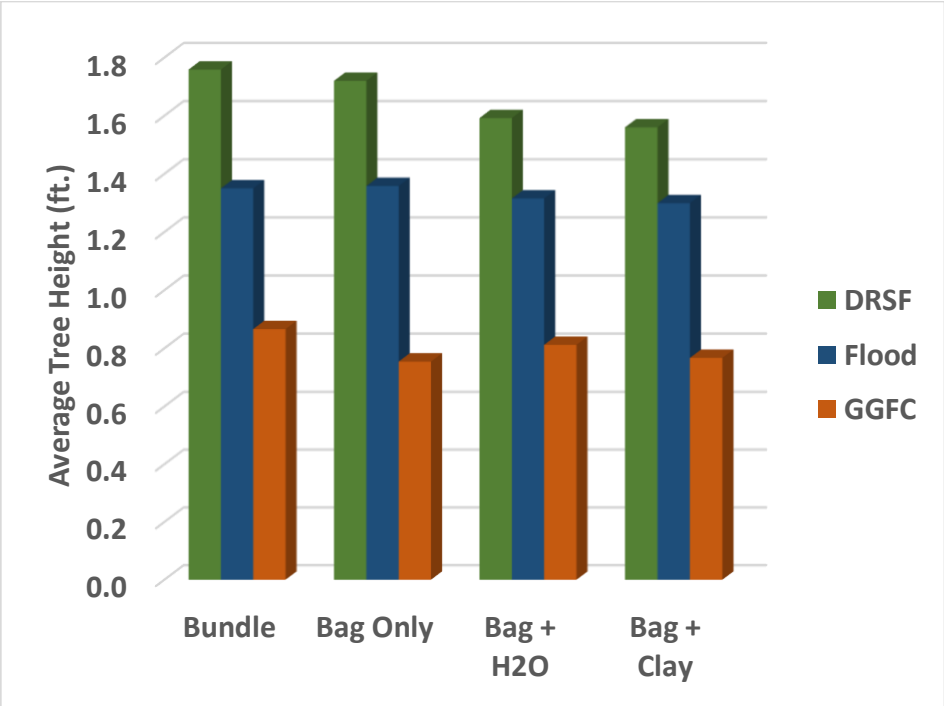

Figure 5. Average seedling height after one growing season in the study of bagged vs bundled methods of storing loblolly pine seedlings.