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Carry-Over of Loblolly Pine Seeds on Cutover Forest Sites

James P. Barnett and John M. McGilvray

Principal silviculturist and biological technician, USDA Forest Service
Southern Forest Experiment Station, Pineville, LA

The role of carry-over seed in the natural regeneration of loblolly pine (Pinus taeda L.) was investigated in central Louisiana. Three lots of loblolly pine seeds were sown on two forest sites (dry and moist) and at two seasons (fall and spring). Observations indicated that all viable seeds germinated by April. No viable ungerminated seeds were found to remain on the forest floor after the first growing season. These data suggest that no significant amounts of loblolly pine regeneration occurs from seeds carried over to the following year. Tree Planters' Notes 42(4):17-18; 1991.

The long-term survival of seeds on the ground or buried in the soil has been reported for many tree species (Baldwin 1942). However, little information is available for southern conifers. There are persistent but unsubstantiated reports of loblolly pine *(Pinus taeda* L.) seed carry-over from one year to the next. The number and viability of loblolly pine seeds remaining ungerminated at the end of the first year after natural seed fall or sowing is unknown. Wahlenberg (1960) reported that very few loblolly pine seeds remain viable on the forest floor through the second winter after seed fall. However, it has also been reported that under certain extreme conditions, such as different seasons and soil types, some seed may remain ungerminated for lengthy periods (Little and Somes 1959).

The results of this study further clarify the question of longevity of loblolly pine seeds. Specifically, the number and viability of loblolly pine seeds that lie ungerminated for extended periods were evaluated. The data are of particular interest given the resurgence of interest in natural regeneration (Barnett and Baker 1991) and the unclear role of southern pine seed carry-over in stand establishment.

Methods

Two sites on the Palustris Experimental Forest were used in this study. The sites were cutover areas with no trees and only light grass competition. The soil on the dry site was a well-drained sandy loam (Ruston soil series) and on the moister site, an imperfectly drained silty loam (Beauregard soil series).

Lots 1 and 2 were fresh seeds collected locally in central Louisiana, and lot 3 had been collected in Polk County, Texas, and stored for 10 years. Empty seeds were removed by water flotation before sowing. Seeds were sown on November 9, 1971, and February 11, 1972. The spring-sown seeds were stratified for 30 days; the fall-sown seeds were not. Standard laboratory germination tests were conducted to determine seed quality before and after field exposure (AOSA 1980).

For each site-season combination, short-term (1-year) germination rates were determined by counting germinants from an 1,000-seed sample. Long-term viability (greater than 1 year from sowing) was determined from a 3,000-seed sample. Each seedlot of 48,000 seeds was divided into 24 seedlots-12 with 1,000 (field germination tests) and 12 with 3,000 (long-term germination tests) seeds. Each group of 12 sublots provided seeds for the two sites, two seasons of sowing, and three replications. Plots were arrayed according to a randomized split-plot design for each phase of the study. Seeds from each sublot were sown on mineral soil in spots 1 by 1.5 feet in size and were protected from predators with screen-wire baskets.

The number of sound seeds remaining after 1 year was determined by counting the germinated seed about twice weekly in the early spring during peak germination, and at lesser intervals at other times. Seedlings were removed when counted. For the longer term study, field plots were sampled in later December (more than 1 year after sowing), by lifting the top half inch of soil from each 3,000 seed plot and sifting to obtain ungerminated seeds. By sowing such a large number of seeds, we tried to ensure that enough would be available to test germination of ungerminated seeds after various periods in the field. The design of the study provided for statistical evaluation by analysis of variance; however, insufficient quantities of seed remained after the first spring to quantify long-term (> 1 year) carry-over.

Results and Discussion

The results of this study indicate that loblolly pine seed carry-over on the forest floor is essentially non-existent after the first spring. An initial germination test of all seedlots conducted in the laboratory indicated over 90% of seeds were viable before field sowing. Cumulative field viability after sowing ranged from 75 to 92%, with statistically significant (P = 0.05) differences due to seedlots (table 1) but not the time of sowing and site. Seeds from the stored seeds (lot 3) sowed in the spring germinated less relative to the other lots on the dry site.

Overall field germination was high, averaging 85% across the sites (table 1). Germination was essentially complete in April after both fall (November) and spring (February) sowing. No ungerminated seeds were present for the periodic summer and fall sampling from the 3,000-seed plots, although there were many seedcoats from germinated seeds. There was no additional germination on the 1,000-seed plots during summer or fall. These results indicate that long-term survival of seeds is not a typical feature in the life history of loblolly native to central Louisiana. These findings are similar to those of Little and Somes (1959) from Maryland, which showed that few loblolly pine seeds from natural seed fall remain viable through a second winter. Based on these results, it seems highly unlikely that natural regeneration from seeds remaining on the forest floor for more than a year contributes significantly to reproduction of loblolly pine.

Table 1—*Percent germination for three seedlots sown in the field germination test on two dates and two sites.*

	% Germination for fall sowing		% Germination for spring sowing		
Seedlot	Dry site	Moist site	Dry site	Moist site	Overall average
1	86 a	89 a	90 a	92 a	89
2	84 a	84 a	83 a	88 a	85
3	89 a	86 a	75 b	81 b	82
Avg.	86	86	82	87	85

Germination results through April 1972 (2 and 5 months after sowing). Germination values within columns followed by the same letter are not statistically different at the 0.05 level.

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