Reprinted from the JOURNAL OF FORESTRY, Vol. 57, No. 8, August 1959

Loblolly Pine Seed Production and Seedling Crops in the Lower Coastal Plain of South Carolina

Studies at the Santee Experimental Forest show a consistently high annual yield of seed from 35- to 50-year old stands of loblolly pine (*Pinus taeda* L.). One study, begun in a 35-year-old stand, showed an annual seedfall for the next 10 years in excess of 200,000 viable seeds per acre in every year except one.[1] Two 50-year-old stands of loblolly each produced over 1.5 million sound seeds per acre during a 5-year period, with production ranging from 100,000 to 700,000 sound seeds per year.

In the face of such enormous seed production one might conclude that natural regeneration of loblolly pine in the Lower Coastal Plain of South Carolina presents no serious problem. In a sense this is true. However, a heavy annual loss of seed to birds, rodents, insects, fungi, and the elements complicates the picture.

In the two 50-year-old stands we found that in most years from 84 to 98 percent of the viable seed did not germinate or was lost to predators (Table 1). Even in the best year over half the seed was lost. Fortunately, there is generally enough seed to produce a good catch of seedlings, and in this study there were never less than 3,000 seedlings per acre at the end of the first growing season.

[1]Lotti, Thomas. Good seed production from a young stand of loblolly pine. U. S. Forest Serv. Southeast. Forest Expt. Sta. Res. Note 97, 2 pp. 1956.

TABLE 1.—COMPARISON OF SEEDFALL IN TWO 50-YEAR-OLD LOBLOLLY PINE STANDS, SANTEE EXPERIMENTAL FOREST

Seedbed treatment	Seed Year	Sound seed per acre	Protected quadrats		Unprotected quadrats	
			Germination	Seed losses	Germination	Seed losses
		Thousand	*—Percent—*		*—Percent—*	
Stand 1						
No special site preparation	1952	164	27	73	10	90
	1953	320	41	59	8	92
	1954	405	10	90	2	98
	1955	542	51	49	13	87
	1956	98	16	84	6	94
	Average	306	29	71	8	92
Stand 2						
Annual summer prescribed burn	1952	101	65	35	12	88
	1953	240	62	38	16	84
	1954	361	19	81	4	96
	1955	696	80	20	42	58
	1956	113	45	55	7	93
	Average	302	54	46	16	84

FIG. 1.—A seedtrap and a protected quadrat (right) located in Stand 1. Also shown is condition of seedbed about 60 days after fifth annual prescribed burn.

Briefly, the study reported on here began in 1951 on the Santee Experimental Forest in two neighboring 50-year-old loblolly pine stands. Stand 1, under management, had improvement cuts in 1946, 1951, and 1956. There was no seedbed preparation in this area except that hardwoods 2 inches d.b.h. and larger were poisoned to enlarge openings. Stand 2 remained uncut; however, from the start of the study in 1951, the area was subjected to annual prescribed burns in mid-August. As a consequence, much of the understory brush and the forest litter was eliminated, thereby creating an excellent seedbed.

Seedfall estimates were made by means of ten 1/4-milacre seedtraps randomly located in each area. Seedling counts were based on two 1/4-milacre quadrats located near each seedtrap (Fig. 1). One of each pair of quadrats was protected from rodent and bird depredations by means of a wooden frame imbedded in the soil and covered with 1/4-inch-mesh hardware cloth. Seedling counts were made at weekly intervals during the early growing season with a final count in the fall.

Within the framework of this study it is impossible to single out and fully evaluate each factor contributing to seed losses. However, there are some clues to the relative importance of certain factors. Easiest to assess are the losses from rodents and birds. They may be judged by comparing the difference in germination between the protected and the unprotected quadrats. In Stand 1 this comparison indicates an average loss of 21 percent of the viable seed to rodents and birds in 5 years. In Stand 2 the average loss was even greater, amounting to 38 percent of the

seed. This greater loss was probably caused by the more exposed position of the seed on the burned seedbed.

The importance of adequate moisture to germination and seedling survival is apparent but difficult to evaluate in this study. In the main, fewer seeds per seedling were needed on the moister, mineral soil of the burned seedbed and also in years of good rainfall, especially those lacking a dry period in the early growing season. For the 5-year period, for example, in the protected quadrats an average of only 5 viable seeds was needed to establish one seedling on the annually burned area of Stand 2.[2] In contrast an average of 10 seeds was needed on the unprepared seedbed of Stand 1.

A spring drought could appreciably raise seed requirements. This happened in March 1955 when only 0.25 inch of rain fell. In spite of ample rainfall, 3.80 inches or more, during the ensuing months of the growing season, the burned seedbed required 26 seeds per seedling and the unprepared area needed 51 seeds, or about 5 times above the average. On the other hand, there was no early spring drought in 1956. March rainfall amounted to 2.72 inches and in the following growing season ranged from 2.12 inches in May to 5.78 inches in September. Apparently the amount and distribution of this rainfall was particularly suited to seed germination and survival, since only 3 seeds were needed per seedling in Stand 2 and 8 seeds in Stand 1. Assuming that insect and disease losses were relatively the same in 1955 and 1956, these comparisons emphasize the importance of moisture to seed germination under field conditions. To pinpoint it further, as we have for rodents and birds, is beyond the limits of available data.

In spite of the indicated heavy annual loss of seed, sufficient seedlings were produced in both stands to adequately restock the respective areas if the decisions had been made to harvest cut in any one of the years involved (Table 2). According to Trousdell[3] from 3,500 to 5,000 seedlings per acre are needed for a 90-percent stocking in the Coastal Plain. Therefore, high levels of stocking would have been quite certain in both areas.

From this study we have some evidence that many loblolly pine stands in the South Carolina Coastal Plain probably could be adequately regenerated without the benefit of residual seed trees, if cut after seedfall. Generally the risk of failure would increase with the depth of the litter and the density of the understory hardwoods and brush. This risk could be reduced with a program of prescribed burning in the years prior to harvest. Any additional cultural measures could be prescribed as needed.

TABLE 2.—ANNUAL SEEDLING CATCH AT END OF FIRST GROWING SEASON IN TWO 50-YEAR-OLD LOBLOLLY PINE STANDS, SANTEE EXPERIMENTAL FOREST

Seedbed treatment	Seed year	Protected quadrats Living seedlings[1]		Dead	Unprotected quadrats Living seedlings[1]		Dead
		M per acre	*Percent*[2]	*Percent*[2]	*M per acre*	*Percent*[2]	*Percent*[2]
Stand 1							
No special site preparation	1952	15	9	18	7	4	6
	1953	51	16	25	6	2	6
	1954	8	2	8	4	1	1
	1955	70	13	38	22	4	9
	1956	8	8	8	3	3	3
	Average	30	10	19	8	3	5
Stand 2							
Annual summer prescribed burn	1952	21	21	44	6	6	6
	1953	53	22	40	14	6	10
	1954	14	4	15	4	1	3
	1955	250	36	44	195	28	14
	1956	22	19	26	4	4	3
	Average	72	20	34	45	9	7

[1]The numbers of seedlings given are those living at the end of the first growing season following the specified seed year. For example, the 1952 seed year involves germination and survival during the 1953 growing season.
[2]Percent of sound seeds per acre.

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[2]Column 3, Tables 1 and 2.

[3]Trousdell, Kenneth B. Seed and seedbed requirements to regenerate loblolly pine. U. S. Forest Serv. Southeast. Forest Expt. Sta. Paper 8, 13 pp. 1950.