

First-summer survival rate high for fall- and spring-germinated longleaf pine

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In six studies, spring-germinated seedlings survived the first summer about as well as those germinated in the fall. Fall germinants are somewhat more drought resistant, but longleaf pine can safely be direct-seeded in either season.

Since direct seeding became operational, late fall has been the recommended time for sowing longleaf pine (*Pinus palustris* Mill.). Spring-germinated seedlings were believed overly sensitive to the early summer droughts that frequently occur in the west Gulf region (3). However, midwinter clipping by cottontail rabbits may destroy up to 50 percent of a fall-germinated stand (2). Initial studies showed that clipping losses could be avoided and longleaf established by spring sowing (1). Additional studies were made to gain a longer record on summer survival of spring- and fall-seeded longleaf pine. This note summarizes results of six studies covering six summers: the three studies reported by the author previously (1) are included.

Methods

All seedbeds were prepared by burning in the fall prior to sowing. The two seasons of sowing were compared on paired 0.1-acre plots: one plot was randomly selected for fall and the other for spring broadcasting. Repellent-treated seeds were sown in November and February at the rate of 15,000 per acre. Treatments were

replicated four times in the first three studies and ten times in each of the last three.

Plot stocking was estimated by counting seedlings on 16 milacre plots. Plots were inventoried in late May or early June, and again in November of the same year to determine summer survival. Differences associated with season of sowing were analyzed at the 5-percent level of significance by the "t" test of paired replicates.

Results and Discussion

In all studies, summer survival of yearling seedlings was high, ranging from 65 to 90 percent (table 1). Fallgerminated pine seedlings survived best in four installations, and spring seedlings excelled in two; but none of the differences was significant. Overall, survival averaged 79 and 74

percent for fall and spring seedlings, respectively.

Deviations in monthly rainfall from long-term averages during the critical months show that a fairly broad range of conditions was encountered in the six studies (table 2). Early summer rainfall deficits were greatest in 1961 and 1965, and in these years survival rate of spring seedlings compared least favorably with that of fall-germinated seedlings. Conversely, in 1969, when late summer precipitation was only 34 percent of normal, pines from spring sowing survived better than fall germinants. Spring seedling survival was the same for early and late summer droughts, but fall seedling survival dropped 19 percent when the dry period was late in the season.

None of the 6 years was severely dry, but prolonged droughts did occur and provided an adequate comparison of survival after fall and spring sowing. These results indicate that differences in survival are normally small although fall-germinated seedlings are probable more drought resistant.

Spring seeding of longleaf pine, then, seems entirely feasible. Fall sowing is still preferable, however, unless a severe winter is predicted. Experience has shown that when all other green vegetation is killed, seedling losses to predators are heavy. Therefore, when depredations of the new seedlings are apt to be high, when frost heaving might be substantial, or when fall operations are unex-

TABLE 1.—Summer survival of longleaf pine seedlings sown in fall and spring in six studies

Year study installed	Season of sowing	
	Fall	Spring
 Percent	
1964	84.4	69.2
1965	83.9	67.6
1967	83.6	86.8
1969	65.0	68.7
1970	76.0	72.1
1971	90.0	82.0
Weighted average	79.0	74.3

pectedly delayed. landowners should not hesitate to sow in February or early March.

Literature Cited

1. Campbell, T. E.
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1971. Cottontail rabbits clip young longleaf pine seedlings. USDA For. Serv. Res. Note SO-130.2 p. South. For. Exp. Stn., New Orleans, La.
3. Derr, H. J., and Mann, Jr., W. F.
1959. Guidelines for direct-seeding longleaf pine. USDA For. Serv. Occas. Pap. 171. 22 p. South. For. Exp. Stn., New Orleans, LA.

TABLE 2.—Deviations of monthly precipitation from 19-year means recorded on individual study areas

Month	Year of study					
	1964	1965	1967	1969	1970	1971
 Inches					
May	-2.25	-2.24	+ 3.45	+ 0.24	-0.34	+ 2.34
June	-2.59	-1.15	-2.37	-1.46	+ .59	-1.02
July	-1.72	-1.25	+ 2.76	+ .53	+ 2.03	-.38
August	-1.51	-1.27	+ 1.16	-3.26	-.85	-1.48
September	+ .62	+ 3.69	-3.25	-2.87	-1.62	+ .43
October	-2.40	-2.96	+ 3.30	-1.14	+ 6.76	-1.74
Total	-9.85	-5.18	+ 5.05	-7.96	+ 6.57	-1.85

Eraser fir seed storage and germination—some new data

by

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samples of this seed have been sent to the Department of Seed Investigations, New York State Agricultural Experiment Station, Geneva, N.Y. for testing. Results of their germination tests are shown in table 1.

Literature Cited:

1. Forest Service
1948. Woody-Plant Seed Manual. USDA Misc. Publ. 654. 416 p.
2. Speers, Charles F.
1967. Insect infestation distorts Fraser fir seed tests. Tree Planters' Notes 18: 19-21.

The tests indicate that Fraser fir with a 6 to 8 percent moisture content can be stored in closed containers for 13 years or more with little loss in germinative capacity.

The Woody-Plant Seed Manual (1) indicates that some species of true fir seed are rather perishable and cannot be stored at low temperatures in airtight containers for more than 3 or -1 years, while other species will retain their viability for as long as 5 years if stored at temperatures of 36°F or lower.

The data on Fraser fir, *Abies fraseri*, in the Seed Manual is minimal. This is probably due to "southern balsam's" formerly minor importance as a solely mountaintop-protection species. With the recent advent of a rapidly expanding million-dollar Christmas tree industry in the Southern Appalachians, and Fraser fir as the premium tree, increasing attention is being given to the investigation of some heretofore unrecorded characteristics of the species.

We started collecting Fraser fir seed in 1960 and have continued to collect cones in each year when there was a good crop. Following the 1960, 1965, and 1969 bumper crop years, we placed seed with a 6 to 8 percent moisture content (2) in tightly closed glass jars or polyethylene bags and stored it at 0°F. At intermittent intervals,

TABLE 1.—Germination of Fraser fir seed with a 6 to 8 percent moisture content after storage in tightly closed containers at 0°F.

Seed year	Germinative capacity				
	Initial	1967	1969	1971	1973
	Percent				
1960	58 ¹	52	47		47
1965	60	60	65		61
1969	67			61	65

¹Test conducted by the Eastern Tree Seed Laboratory, USDA Forest Service, Macon, Ga. All other tests conducted by the Department of Seed Investigations, New York State Agricultural Experiment Station, Geneva, N.Y.