Direct seeding loblolly pine beneath hardwoods on dry sands

by
T. E. Campbell
-*Southern Forest Experiment* Station
USDA Forest Service Pineville. La.

A hardwood overstory enhances the establishment of loblolly pine on sandy, dry soils by direct seeding, but the risk of failure is still greater than on heavier soils.

Guidelines for direct seeding southern pines have cautioned repeatedly that sowing on dry. sandy soils is risky unless seeds are buried about '/--inch deep'. Surface layers desiccate so rapidly, even after a heavy rain, that moisture is inadequate for sustained germination' and first-year survival.

Most research on direct seeding the deep sands has been on treeless areas or on sites cleared with heavy machines in advance of sowing. Little or no work has been done beneath a hardwood canopy where conditions for pine establishment might be more favorable due to shading of the soil. This article summarizes four studies conducted in Louisiana from 1967 through 1970, in which nine treatments were tested under a hardwood overstory.

'Mann, W. F.. Jr. 1968. Ten years' experience with direct seeding in the South. J. Forestry 66111): 828-833.

2 Hodges. J. D.. and R. L. Scheer. 1962. Soil cover aids germination of pine seeds on sandy sites. Tree Planters Notes 54: 1.3.

Study Areas

The first study was on Alaga sand under a hardwood stand composed primarily of post oak *(Quercus stellata* Wangenh.). Stems averaged about 3 inches d.b.h. with about 50 square feet of basal area per acre. The other three studies were on a Lucy sand. These sites had stands of about 40 square feet of basal area, mostly of blackjack oak *(Q. marilandica* Muenchh.) and mockernut hickory *(Carya tornentosa* Nutt.). 4 to 6 inches d.b.h. Alaga and Lucy sands are among the most difficult soils to regenerate by any method. Alaga sand has little silt or clay in the upper 70 inches. while Lucy is almost pure sand to a depth of 40 inches.

Methods

The nine treatments tested (all on a fresh burn and consisting of different combinations of site preparation. sowing methods, and sowing seasons) were as follows:

A. February-spots-covered: Seed sown in February on spots with surface duff raked to expose mineral soil about 1 foot square and covered with about .5 inch of soil.

B. December-broadcast: Seeds broadcast in December on a fresh burn.

C. December-spots-covered: Same as A except December-sown.

D. November-broadcast-leaf corer: Seeds broadcast in November on a fresh burn: remaining leaf fall covered the seeds.

E. February-broadcast: Seeds broadcast in February on a fresh burn.

F. February-spots-riot covered: Same as A except seeds left uncovered.

G. February-furrows: Seeds sown in February about 3 feet apart in center of furrows plowed on 8foot centers.

H. February-grooves: Seeds sown in February at 3-foot intervals in shallow grooves made by dragging a log on 8-foot centers.

I. February-scarified: Seeds broadcast in February on seedbed scarified by pulling a treetop over a fresh burn.

Table 1 shows the treatments in each study.

Treatments in all four studies were tested on 0.1-acre plots, and each was replicated four times. Plots were burned before mechanical preparation or sowing to expose mineral soil and to prevent blowing leaves from smothering seeds and young seedlings. Loblolly seeds sown in February were stratified 60 days: those sown in November and

December were unstratified. All seedlots were coated with protective bird and rodent repellents before seeding. Sowing rates were: 20,000 per acre for broadcasting, 5,280 for row seeding in furrows and grooves, and 5,000 to 9,000 per acre for spotting.

In the first two studies, hardwoods on a randomly selected half of each plot were injected early in the season to determine the effect of release from shade on summer survival. Since control of the overstory had no influence. hardwoods were left intact in the last two studies.

In all except the second study, seeds and seedlings were checked frequently. starting after sowing and continuing to the first seedling inventory. Seedling counts for stocking estimates were made for all studies in May or June and at the end of the first growing season. Differences in stocking between treatments were tested by analysis of variance, and those differences described in the *Results* section are significant at the 5 percent level unless otherwise specified.

Results

In the first study. germination ranged from 11 to 46 percent (table 1). Sowing on raked spots in December and February and covering the seed were equally effective and better than broadcasting in the fall and late winter. Losses of new germinants prior to the initial inventory. attributed primarily to low soil moisture. ranged from 26 to 65 percent.

Only spots sown in February had a satisfactory initial seedling-to-seed ratio (tree percent)-22.9 percent. This treatment was no better than sowing on spots in December. but was superior to the other two treatments. Summer survival was comparable in all treatments. At the end of the first growing season, however. the tree percent on February-sown spots was more than double that in any other treatment. At age 1 year. three of the four treatments had marginal or satisfactory stands in terms of trees per acre. Plots broadcast in December had nearly twice as many seedlings as those spot-seeded in February, but the sowing rate was almost four times greater.

In the second study, no information was obtained on field germination and early seedling losses. Spot sowing and covering seeds with soil in February yielded the highest tree percent initially and after 1 year. Differences between the other three treatments were small aril nonsignificant. Seedling survival during the first summer was not affected by treatment. First-year stocking was satisfactory in three treatments. ranging front 1.560 to 1.980 per acre. Sowing spots in December and covering seeds resulted in only 390 seedlings per acre.

In the last two studies. differences in germination and initial and first year tree percents were small and nonsignificant. Although initial tree percents were substantially higher in the third than in the fourth study. summer survival was much lower so tree percents at age 1 year were comparable. Of the eight treatments in both studies. four gave satisfactory stocking after I year-broadcasting in February in both studies, spotting in February with seed covered, and broadcasting in February on a scarified seedbed.

Discussion and Conclusions

Direct seeding deep, dry sands proved feasible under a hardwood canopy. Sowing on similar soils without a canopy has been unsuccessful in previous studies. The hardwood shade apparently improved germination and survival by retarding evaporation. Even with the canopy, however, these sites are more difficult to seed than heavier soils that retain surface moisture longer and are not as droughty during the summer.

In this series of studies. initial tree percents averaged about half of what is usually expected on a sandy loam or silt loam soil. Mortality was considerably higher than on heavier soils. averaging almost 50 percent. In the third study, however, mortality was nearly 70 percent. showing the heavy losses that can occur in a dry year. Despite this heavy mortality. two of the treatments were reasonably successful because favorable weather in the germination period resulted in relatively high initial tree percents.

Sowing seeds on spots in February and covering them lightly with soil yielded best overall tree percents. Leaving the seeds exposed was considerably less effective. It appears that covering 8 to 10 seeds on each of about 1.000 spots per acre is satisfactory for seeding these droughty sites. This technique, which conserves seeds but requires considerable labor, may be ideal for small landowners.

Broadcasting on a burned seedbed in February was also successful in the three studies in which it was included. This is the standard method of direct seeding loblolly pine. On adverse sites. however, the sowing rate should be minimum of 20.000 sound. stratified, repellent-treated seed per acre: in regions of low rain fall, it should be about 25,000 seeds.

Mechanical seedbed preparation slid not affect germination or survival and is not recommended for these dry sites. Since brush and grass are sparse beneath the hardwoods, no reduction of competition is required. Therefore. unless mechanical means can be used to coyer seeds, the cost is not justified.

Seedling-to-seed ratios achieved by some treatments in this series of studies shows that direct seeding droughtly sites in Louisiana is feasible. It should be recognized. however. that risks are high: even planted nursery stock has failed during dry ears. If direct seeding is attempted, it is imperative to maintain high sowing rates.

TABLE 1.—Initial and first-year tree percents and stockings in four studies

	Study number and treatment	Average field germination	Seedling-to-seed ratios in May	First summer survival	Seedling-to-seed ratios at age 1 yr.	Seedlings per acre at age 1 yr.
		Percent	*Percent*	*Percent*	*Percent*	*Number*
1	Feb.—spots-covered	46.5[1]a	22.9a	59.9a	13.5a	660
	Dec.—broadcast	12.2b	9.0bc	72.0a	5.6b	1,120
	Dec.—spots-covered	37.0a	16.7ab	34.7a	5.7b	310
	Nov.—broadcast-leaf cover	10.6b	5.8cd	67.5a	3.9b	790
2	Feb.—broadcast	—[2]	13.8b	64.6a	8.5b	1,700
	Feb.—spots-covered	—	37.3a	67.8a	25.4a	1,560
	Dec.—broadcast	—	13.3b	75.6a	9.9b	1,980
	Dec.—spots-covered	—	10.4b	61.2a	6.3b	390
3	Feb.—broadcast	32.9a	27.1a	26.9a	6.5a	1,300
	Feb.—spots-covered	45.5a	25.4a	32.7a	7.9a	710
	Feb.—spots-not covered	41.3a	22.5a	27.0a	6.4a	570
	Feb.—furrows	46.1a	23.0a	28.2a	6.3a	330
4	Feb.—broadcast	14.4a	10.0a	63.0a	6.2a	1,250
	Feb.—spots-not covered	16.7a	12.9a	46.1a	6.1a	480
	Feb.—grooves	14.8a	13.6a	56.1a	7.6a	400
	Feb.—scarified	19.3a	16.2a	49.6a	8.5a	1,700

[1]For individual studies, means followed by the same letter do not differ significantly at the 5-percent level.
[2]Germination data not obtained.

News & Reviews *(from p. 17)*

D.C. Logs Profile of Its Trees

The District of Columbia government has quietly undertaken the mammoth task of assigning individual numbers to 100,000 city trees and logging their lift histories inside a computer.

Nearly 2 years in the making. the project still is only halfway completed, with 48,000 trees inspected. numbered and recorded at D.C. computer headquarters.

Once in full operation, however, the complicated computer system will show at a moment's notice the quality of life among all the maples, elms and oak trees that line D.C. streets.

Total cost of the project is not yet available but officials said they would include at least $30,000 in salaries for designers of the computer program, $2.800 a year to lease two computer terminals and an underterminded amount for computer time and paper.

Actual surveying of the trees would be done anyway as part of the city's $1.5 million tree maintenance effort, officials said.

In the past. the city's tree and landscaping division-a branch of the Department of Highways and Traffic-has kept its records in file cabinets like most D.C. departments.

"With computers, we can speed up our record system considerably" the chief of the tree division said. He produced a computer printout indicating that Tree No. 17293-050100.15-000-which is a 10-year-old maple in the 500 block of Quackenbush Street NW-needed a trimming.

Praising Operation MISTRE (Management Information System for Street Trees) as "the only one of its kind in the country." he said he has received numerous inquiries from other U.S. cities asking about the project.

"it seems everyone wants a tree system of their own." he said.

A paper on Operation MISTRE was to be presented to tree experts from around the world at the International Shade Tree Conference in Atlanta. Ca. in August.

(from a report in The Washington Post. April 11. 1974)

Well- Traveled Seedlings Presented for N. 0. Park

Trees as well-traveled as famed jazzman Louis Armstrong will grace a large park to be named for