Reforestation of sand hills scrub oak sites with slash and longleaf pine

The verdict after six growing seasons: Plant longleaf

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Regeneration of pine species on the sandhills of the Carolinas and Georgia is difficult because of the inherent low fertility and droughty nature of acid, sandy soils. Further compounding the problem is the fact that much of the area supports scrub hardwoods and wiregrass, both of which are vigorous competitors for moisture and nutrients. The regeneration problem is extensive as there are millions of acres of such sites in these States. Provided that pines can be established on these dry sites, they have the capacity to produce pulpwood on reasonable rotations (1).

Reforestation of the major acreage of old-field sites on lands of the Atomic Energy Commission's Savannah River Project near Aiken, S.C. was accomplished before 1961 mainly by machine planting in prepared furrows. After this date, regeneration efforts were directed to problems of converting 28,000 acres of poor quality scrub oak lands to merchantable tree species.

In 1968, a study was installed to compare seeding versus planting of longleaf *(Pinus palustris* Mill.) and slash *(Pinus elliottii* Engelm.) pines on a sandhills site covered with scrub hardwood species at the AEC's Savannah River Plant.' This paper reports the results of the study after six growing seasons from 1968 to 1973.

Methods

Slash and longleaf pine regenerated by seeding and planting were the four species-regeneration combinations studied. The experiment was installed on a scrub-oak sandhills site in a randomized complete block design with six replications. Each block consisted of eight furrowed rows 50 feet long with five isolation rows between each block. Within each block, adjacent rows were randomly as signed to the four species-regeneration method combinations.

In February 1968-on the same day-1-0 seedlings and seeds of slash (stratified) and longleaf pine were planted using a machine planter and seeder. Seedlings were planted at 6' X 8' spacing and seeding was at a rate of one seed per foot in furrowed rows 8 feet apart.

Measurements of total height were taken on surviving seedlings after the second, fourth, and sixth growing seasons. Survival of planted seed lings was based on 16 seedlings per 100 linear feet of row, and survival of seeded seedlings was based on the number of living seedlings per 100 seed spots.

During June 1972, 4 years after establishment, hardwood control was imposed on three of the six blocks by injecting approximately 450 trees/ acre with an undiluted solution of 2, 4-D amine at a rate of 4lbs/gal Methods of application, spacing of injections, and season of application were based on work done by Peevy (4).

Results

Survival and Stocking

Because different bases-16 seedlings per 100 feet of row versus 100 seed spots per 100 feet-were used to calculate survival for planting and

TABLE 1.—Survival, stocking, and height of planted versus seeded slash and longleaf pine in the Sandhills Region of South Carolina

Species	Regeneration method	Survival percentage and stocking, Growing season: 2nd		4th		6th		Final height
		Pct	*Seedlings/ acre*	*Pct*	*Seedlings/ acre*	*Pct*	*Seedlings/ acre*	*Ft.*
Longleaf	Planted [1]	85 a[3]	743 ab	83 a	723 a	81 a	705 a	1.2 c
	Seeded [2]	8 c	436 c	5 c	281 c	5 c	281 b	0.3 d
Slash	Planted	70 b	607 bc	70 b	577 ab	57 b	395 b	5.2 a
	Seeded	18 c	953 a	9 c	490 b	8 c	453 b	2.8 b

[1] Survival of planted seedlings based on 16 seedlings per 100 linear feet of row.
[2] Survival of seeded seedlings based on number of living seedlings per 100 seed spots.
[3] Averages followed by the same letter are not significantly different at the 5 percent level.

seeding, the comparison of survival percentages (table 1) by regeneration method within a species has little meaning. However, stocking figures do offer a valid comparison of the success or failure of the two methods.

Planted longleaf survived well throughout the trial period, maintaining a survival rate of 81 percent after six growing seasons. In terms of stocking, planting longleaf seedlings resulted in a fully stocked stand after 6 years (705 seedlings/acre), whereas the seeding attempt with longleaf would have to be regarded as a failure (281 seedlings /acre). After 6 years, plots with planted longleaf had significantly higher stocking than any of the other species-regeneration combinations.

The story is somewhat different with slash pine. Survival of planted slash pine was 70 percent after the second and fourth growing seasons, but by the end of the sixth year, survival was down to 57 percent. Seeded slash pine fared better early in the study having a survival rate of 18 percent, or a stocking of 953 seedlings/acre. However, mortality was high over the next 4 years and by the end of the sixth year, there were only 453 seedlings/acre, about the same as for the planted slash. Thus, for both seeded and planted slash pine, these levels of stocking could only be regarded as marginally adequate.

Final Height

After six growing seasons, planted trees of both species were significantly taller than seeded trees (table 1). Further, seeded and planted slash pine were significantly taller than their longleaf pine counterparts. At this time, most of the planted longleaf seedlings were out of the grass stage, with heights averaging 1'.2 feet, while the majority of seeded longleaf were still in the grass stage. Planted slash pine were almost twice as tall as seeded slash. The average difference of 2.4 feet is equivalent to about 2 years' growth on these poor sites at this stage of seedling development.

Discussion

Regeneration of longleaf pine seedlings by planting appears to be the most satisfactory method, of the four species-regeneration combinations tested, for reforestation of droughty sandhill sites in South Carolina. This statement is made because stocking of planted longleaf was significantly greater than that of the other methods after six growing seasons. In fact, it was the only level of stocking regarded as satisfactory. Roth seeded and planted slash pine grew taller than longleaf pine, a fact attributed to different growth habits of the species. However, after 6 years most of the planted longleaf seedlings were out of the grass stage and ready to initiate rapid height growth.

In this study, heights of planted slash and longleaf seedlings were significantly taller than that of seeded seedlings of both species. These results agree with findings of Lohrey (3) on an upland site in Louisiana. Average heights of planted slash pine seedlings were over 2 feet taller than heights of seedlings in other treatments. However, two factors weigh heavily against planting slash pine in the Carolina Sandhills. First, it is highly susceptible to fusiform rust *(Cronartium /usifornte* Hedg.) on these sites (2), a fact that accounted in part for its low stocking values; and second, frequent ice storms cause significantly more damage to slash pine (by windthrow and breakage) than to longleaf pine (5).

Since competition for moisture and nutrients on these impoverished upland sites is intense, a reduction of scrub vegetation either before or shortly after planting may have produced a considerable increase in both survival and height growth. Although chemical control was used in this study, mechanical site preparation using heavy equipment has proved more effective in controlling unwanted woody and herbaceous vegetation on similar sandhills sites (1).

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