Furrows Improve Longleaf Survival In Scrub Oak

By ROBERT D. SHIPMAN
Southeastern Forest Experiment Station
U. S. D. A. Forest Service

A narrow strip of rolling land 10 to 40 miles wide and 420 miles long which stretches southwestward from Sanford, N. C. to Columbus, Ga., represents some of the "toughest" planting sites in the South. The Sandhills, so-called because of the rounded, sand-dune hills, follow the edge of the Piedmont and form the upper part of the Coastal Plain. Total acreage of the Sandhill Region is about eight million acres and some three million of these are coarse sands suitable only for the production of forest crops, according to K. W. Dorman. In South Carolina alone, the artificial regeneration of approximately a half million acres of scrub oak land presents a real challenge to landowners of the state. To date, only a small part of the job of successfully regenerating these areas has been accomplished. Most of the successful plantings have been with slash pine, in spite of the fact that this species reaches the northernmost limit of its natural range in southern South Carolina.

There are various reasons why the reforesting of these sites has met with difficulty. In the middle of a scrub oak "barren" during the months of May, June, or July, it is not improbable that air tempertures may reach or surpass 110° F. Surface soils, which radiate heat from glaring, white sands may go as high as 142-145° F. Although rainfall averages 45-50 inches a year, it frequently does not occur for a three- to four-week interval during the critical growing season. When rain does fall at this period, deep sands and scrub oak quickly remove it. These areas, aptly called "deserts in the rain" are occasionally subject to quick freezes, ice storms and high winds.

Past history of the Sandhill Region reveals that longleaf pine once grew well in association with scattered scrub oak in the understory. It was only natural that early plantings by the South Carolina Commission of Forestry should be longleaf pine. From 1936 to 1948, over half of the seedlings planted at the Sand Hills State Forest near Patrick, S. C. were longleaf. Since 1948, the number planted each year was drastically reduced in favor of slash and loblolly pines. The reasons for this are obvious—longleaf survival was low, averaging only 20 to 30 per cent. Assuming that a satisfactory method can be found to increase first-year survival, there are reasons why longleaf may be the better species over the "long haul." Its relative freedom from infection by southern fusiform rust, its remarkable resistance to fire and ice damage, and its acceptable growth rate are definitely in its favor on the drier sites. Much of the future planting in the Sandhills will be on scrub oak areas, inasmuch as the old fields, which are usually better sites, have been planted first in most localities.

The Research Program

Anticipating the future demands for successful plantings of longleaf on scrub oak areas, the Santee Research Center of the Southeastern Forest Experiment Station, has recently attacked the problem in an effort to improve the rehabilitation of these lands. Initial tests, begun in 1952 in cooperation with the South Carolina Commission of Forestry, the Savannah River Project of the Atomic Energy Commission, and the School of Forestry of North Carolina State College have yielded some promising early results. The major objectives of the research program have been to find better methods of preplanting site preparation and to improve the early survival and growth of longleaf pine. As a part of the over-all program, some of the work has been on the nursery problem of growing seedlings that will survive better when planted in the Sandhills. Nursery studies now in progress concern the effect of seed source, seedbed density, seedling grade, and top and root-pruning.

Site Preparation Studies

A logical approach to the scrub oak site problem is to determine what longleaf survival might be expected under various degrees of removal of scrub oak and wiregrass before planting. For example, can we expect better survival by complete eradication of scrub oak, or will some partial release or removal do the job? This type of approach also leads to more detailed studies of the basic or fundamental reasons affecting longleaf survival in the Sandhills.

Early Study Described

In an initial study at the Manchester State Forest (South Carolina) four methods of preplanting site treatment were tested. The study involved one randomized block of four 1/5-acre plots at each of three locations within a two-mile radius. At each location the scrub oak ranged from 0.5 to 3.5 inches d.b.h. and numbered about 3500 stems per acre.

One treatment consisted of completely removing all vegetation. This was done by a heavy crawler tractor pulling an eight-disk plow. The areas were disked several times at a depth of 10 inches until practically all scrub oak roots and stems were eradicated. Occasional larger stems, thrown up by the plow, were carried off by hand. These plots were not dragged or leveled off after clearing.

In a second treatment, 45 per cent of the scrub oak stems one-inch and over in diameter were killed. This was done by cutting all stems within a two-foot radius of each planting spot. Stumps were then poisoned with crystalline Ammate so as to prevent sprouting. Cut stems were left on the plot.

A third treatment involved deep furrows approximately six feet apart using an ordinary crawler-type tractor pulling a "Sieco" double-disk plow. This method of furrowing opened a trench approximately eight inches deep having a flat base 18 inches wide, which more or less eliminates any silting in of loose soil. Surviving scrub oaks between furrows were left standing (Figure 1).

One plot in each block was left as a control with no scrub oak removal or other site preparation (Figure 2).

After a soil stabilization period of one month, all plots were hand-planted with longleaf pine. This fall-sown planting stock was raised at South Carolina's Horace L. Tilghman Nursery from seed of local origin. Only one-year-old Grade 1 longleaf seedlings, foliage clipped to five inches in length,

FIGURE 1.—*Preplanting scrub oak site preparation by means of deep furrows. Scrub oak between furrows was left standing.*

FIGURE 2.—*Check plot, in which longleaf seedlings were planted without any site preparation or disturbance. Sites of this kind support approximately 3500 scrub oak stems per acre.*

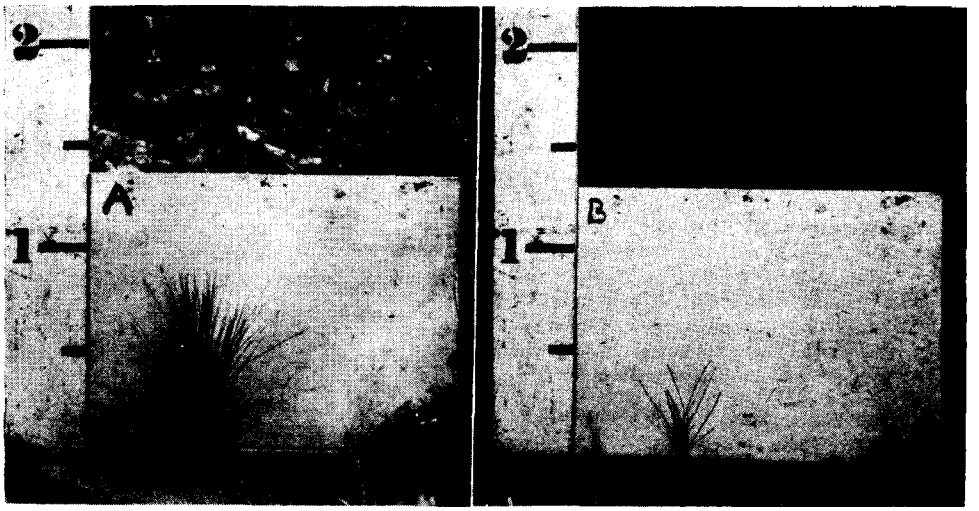

FIGURE 3.—*A comparison of vigor and size of longleaf seedlings after one year,* (A), *Deep furrows.* (B), *Check or control plot.*

were planted in each plot with a six-foot square spacing.

Throughout the course of the growing season, soil samples were taken at random in all plots. At 10-day intervals these samples were weighed and the amount of soil moisture was obtained by oven-drying. The samples were taken at two soil depths, 2-3 inches and 5-7 inches. The wilting coefficient was subtracted from the per cent total moisture to determine the amount of moisture available to seedlings in each site preparation treatment. Surface soil temperatures were also recorded by means of soil thermometers and these served to record the periodic changes in temperature resulting from alteration of the site.

Early Results Show Promise

In this study, survival was considerably higher on the furrowed plots than elsewhere (Table 1). In addition, the vigor and color of individual seedlings in the furrows were outstanding—an indication that earlier height growth may also result from this treatment (Figure 3). On the other hand, seedlings in the check and partially released plots were generally quite spindly and poor in vigor. Much of the mortality on most plots appeared to stem from heat and drought. Some of the seedlings in the plowed and disked areas were destroyed by subterranean rodents which chewed off roots and often pulled the stems into the rodent burrows.

Table 1.—Relation of soil moisture, temperature, and longleaf pine survival to site preparation treatment

Treatment	*First-year survival Per cent*	*Average soil moisture index Per cent*[1]	*Surface soil temperature in F° Average*
Furrowed (8-inch depth)	71	79	112.1
No release (check)	57	61	102.3
Complete eradication (plowed and disked)	48	100[2]	112.2
Release (45% stems cut and stumps poisoned)	45	82	109.2

[1]Moisture index expressed as a per cent is the ratio of the amount of available soil moisture present in each site treatment to the amount present above the wilting point for the complete eradication treatment.

[2]Soil moisture significantly higher than any other treatment.

It is not altogether clear why survival was highest in the furrowed plots. The soil moisture and temperature observations made during the first growing season indicate no outstanding benefits from furrowing. On the average, soil moisture was significantly higher on the completely cleared plots than on the remaining plots. However, during much of the growing season, there was little difference between the eradicated and furrowed plots. Surface soil temperatures recorded during the same period of the growing season indicate very little difference in average temperature, although the least extremes in temperature were observed on furrowed plots. Nevertheless, high survival in the furrows demonstrates that this treatment produces an environment best suited to the establishments of longleaf pine on scrub oak sites.

There are several possible reasons why survival was poorer in the cleared and poisoned plots than in the check plots. After disking on the cleared plots, there appears to be a less stable soil condition which may contribute to the high mortality. A longer waiting period to permit thorough settling of the soil should be tested. Also, by complete removal, the area is exposed to wind and consequently greater evaporation and sharp temperature drops. The high mortality on partially released areas is difficult to explain in view of the improved soil moisture conditions, partial shading, and reduction of severe exposure. Possibly some of the pine seedlings on these plots were killed by Ammate inasmuch as the scrub oak was poisoned immediately after planting. Ammate placed in notched stumps may have washed into the soil and affected the pines.

The furrowing treatment as applied in this test removes over 80 per cent of the scrub oak competition in the process of constructing furrows.

Summary

First-year survival of longleaf pine on Sandhill sites where scrub oak is predominant can be improved by pre-planting site preparation. Tests indicate that some partial degree of scrub oak removal involving furrowing techniques may provide an answer to better longleaf survival on these sites than other methods. Longleaf pine planted in deeply furrowed plots in scrub oak densities of 3500 stems per acre resulted in markedly higher first-year survival than in completely cleared, partially released, or check plots.

There are indications that deep furrows may help protect the seedlings from drying winds and extremes in temperature. Furrows can be established at less cost than complete plowing and disking, and can help to reduce the cost of later release work by eliminating most of the scrub oak during the construction of furrows. Additional experiments are now in progress, involving both deep and shallow furrows and other site preparation treatments.

Reprinted from

SOUTHERN LUMBERMAN

issue of June 15, 1955