Economical site preparation for pine in the sandhills

Russell M. Burns
Silviculturist
Southeastern Forest Experiment Station
USDA Forest Service

Most pines cannot be planted amid scrub hardwoods (principally turkey oak and bluejack oak) and wiregrass in the Florida sandhills with any assurance of success. Soils are droughty and infertile, and the dense mat of established woody and herbaceous roots rapidly and efficiently depletes available moisture. Growth of planted pines that survive is slow because of the intense competition.

Conversion of the scrub to pines is possible, but competition from hardwoods and wiregrass has to be reduced. Pine survival and growth is directly related to the intensity of site preparation (5, 6), amount of topsoil present (2), and soil depth (1) . Heavy brush cutters or "choppers" are commonly used for preparing sandhill sites because they cut wiregrass and most hardwoods into the soil, yet leave the topsoil in place. Two treatments with an 11-ton chopper at a prescribed interval between successive treatments are currently recommended for sandhill sites that are to be planted to pine (3, 4). However, repeated use of 11-ton choppers is expensive. Lighter equipment is cheaper to operate.

This study (reporting 10-year results from a sandhill site in Cal-, houn County, Fla.) compares results of preparing sandhill sites with 11-ton choppers and with several pieces of lighter equipment.

Methods

The 60-acre test site is typical of sandhill land in west Florida. The soil is droughty and infertile sand. Rainfall averages almost 60 inches annually: about 28 inches during June, July, August, and September and about 4 inches a month the rest of the year. Air temperature rarely exceeds 100° F. during a 264-day growing season.

Survival and growth of slash pine *(Pinus elliottii* Engelm.) 10 years after planting were the criteria used in comparing the effectiveness of site preparations involving fire and both light and heavy equipment. The ten treatments tested are outlined in table 1. Each treatment was applied in a randomized complete block design to three 2-acre plots during the spring and summer of 1958. Slash pine seedlings (1-0 stock) raised from superior tree seed collected locally were machineplanted at an 8- by 8-foot spacing in January 1959. The seedlings were planted on the ridge, or crest, on plots prepared with a fireplow.

Crawler tractors were used for all operations. Light equipment required less horsepower than heavy equipment and, therefore, was cheaper to operate. For example, the 11-ton chopper required 170 drawbar horsepower, the rootrake and 8-ton chopper required about 80 drawbar h.p., and the 1-ton disk harrow, fireplow, and 41/-ton chopper required only about 55 drawbar h.p.

TABLE 1.—*Sequence of operations as applied during 1958*

Site preparation	Treatment and date of application		
	May 2-9	July 1-11	Aug. 25-29
Control	None	None	None
Burn	Burn	None	None
Plow furrows 8 feet apart	Furrow	None	None
Burn + 11-ton chopper	Burn	Chop	None
Burn + disk + disk	Burn	Disk	Disk
Burn + 11-ton chopper + disk	Burn	Chop	Disk
Burn + rootrake + disk	Burn	Rootrake	Disk
11-ton chopper + 11-ton chopper	Chop	Chop	None
Burn + 11-ton chopper + 4¼-ton chopper	Burn	Chop	Chop
Burn + 11-ton chopper + 8-ton chopper	Burn	Chop	Chop

The soil on each plot was sampled to a maximum depth of 19 1/2 feet. Measurements of height, diameter, and survival 10 years after planting were adjusted for differences in soil depth and analyzed statistically.

Results

Survival of pines 10 years after planting was significantly affected by site preparation but not by soil depth. More pines were alive on plots that received two mechanical treatments than on those that received a single mechanical or burning treatment (fig. 1). Survival was lower on plots prepared only with fire than on unprepared plots.

Intensity of site preparation and soil depth significantly influenced growth of planted pines. After 10 years in the field, trees were taller and larger in diameter on chopped, disked, and rootraked plots than on those prepared only with fire or by furrowing with a fireplow. They were largest on plots prepared with two machines, i.e., first with an 11ton chopper and then with a 1-ton disk, a 41/4-ton chopper, an 8-ton chopper, or an 11-ton chopper, or on plots prepared first with a rootrake and then disked. Burning followed by two disking treatments or by a single treatment with an 11ton chopper was only slightly better than furrowing. Trees on plots prepared by burning alone averaged only a foot taller and 0.3 inch larger in d.b.h. at age 10 than those on untreated control plots.

Effects of soil depth on tree size were most pronounced on intensively prepared plots. Here, treatment effects tended to accentuate the influence of differences in soil depth. At age 10, pines were taller and larger in diameter on plots with the shallowest soils (80 inches) and became progressively smaller as soil depth increased.

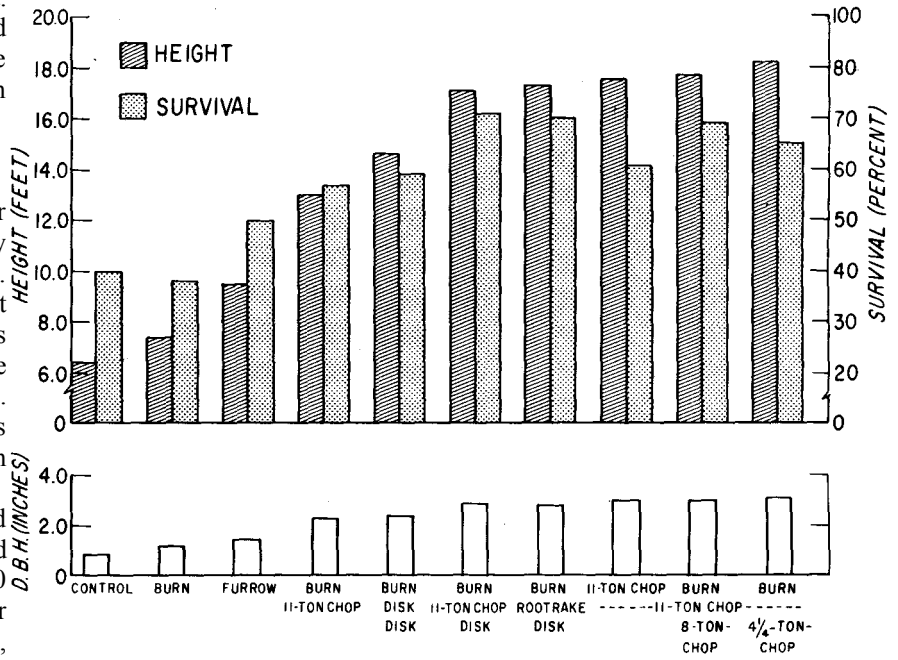

Figure 1.—Height, survival, and diameter of pines 10 years after planting. Values are adjusted for differences in soil depth.

This relationship is illustrated by average measurements of trees from three plots that had been prepared by burning followed by rootraking and then disking:

Soil depth	Height	D.b.h.
Feet	Feet	Inches
7.0	25.3	3.8
15.5	13.7	2.5
19.5		10.8
		1.9

Discussion

Lack of any meaningful differences in survival and growth among the five best treatments listed in figure 1 suggests that economy of operation should dictate the choice of equipment used. Because light equipment is cheaper to own, operate, and maintain than heavy equipment, it should be used whenever comparable results can be obtained. The light equipment tested here seemed particularly well suited for the second of two mechanical treatments, after all the heavy work was done.

Both an 11-ton chopper and a rootrake were effective in the first operation. The chopper (fig. 2) processed wiregrass and trees up to 4 inches in diameter by cutting them into the soil, left the topsoil in place, and required an operator skilled only in driving. In contrast, the rootrake (fig. 3) required only about half the horsepower of the chopper yet had the capacity to uproot and move trees of all sizes normally encountered in the sandhills. But the rootrake was inefficient and costly to operate: about half of its operating time was lost in backing, a comparatively high-salaried operator skilled at both driving and manipulating the blade was required, and topsoil was removed from the treated area along with the debris. For these reasons, the I1-ton chopper was considered the best equipment for the first treatment.

The 1-ton disk harrow (fig. 4) had none of the drawbacks of the rootrake, but it did not appear rugged enough for sustained use in the first treatment. Time was lost clearing trees and other debris lodged

Figure 2.—Duplex chopper used in site preparation on the sandhills. During operation, both drums are filled with water.

between the disks. However, when only small hardwood sprouts needed to be processed, as in a followup treatment, the disk harrow appeared to be ideally suited for the job.

Conclusions

An 11-ton chopper is best for the first of two site preparations for pine on the sandhills. A saving
in time and in the operating cost can be realized in the second treatment by substituting a 1-ton disk harrow, a 41/4-ton chopper, or an
8-ton chopper for the 11-ton chop
per. All are capable of eliminating sprouts and utilize considerably less horsepower.

Fire alone does little to prepare hardwood-dominated sandhill sites for pine. Burning may facilitate mechanical site preparation by removing accumulated debris and by killing hardwood stems, but, on sandhill land where organic matter is already in short supply in the soil, removal of organic debris that can be mechanically incorporated into the soil may actually reduce site productivity.

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Figure 3.—Rootrake typical of those used in site preparation. (The above model was not used in the present study.)

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Figure 4.—Heavy-duty disk harrow used in preparing sandhill sites.