Plan ting Grass and Pine for Erosion Control

by
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Establishing a closed pine stand is one of the surest ways to reduce or permanently stop erosion from bare sites, but pines may require up to 10 years after planting to drop sufficient litter to fully protect the site. Interim protection is desirable, but the available methods for getting this protection all have drawbacks. Repeated mulching, for example, is expensive. Perhaps the most practical method is planting fast-growing vegetation, such as grass, along with pine, if the two can be made compatible.

If fertilized, grass can quickly cover and protect a site until pines take over, but it also uses soil moisture which the pine seedlings need. This competition for moisture can he fatal for newly planted pines. Furthermore, unless maintained with fertilizer, the grass cover itself may later decline in vigor or die, leaving the site unprotected.

To control erosion, the grass and pine must be made compatible. Normally, a pine species that survives and grows well on dry sites is required. In the South. loblolly pine: (Pines *taeda* L.) has proven excellent for erosion control (3). In most years, it can be established even in grass. but in particularly dry years grass competition heist be controlled to permit establishment. Keys to control of this competition are selection of grass species and timing of fertilizer application, as shown by the study described in this article.

Pine-Grass Compatibility Test

Weeping lovegrass (Eragrostis curvula) and fingergrass (Digitaria eriantha) were selected for the compatibility test with loblolly pine. Lovegrass grows rapidly from seed and has been commonly used for erosion control because it can grow on dry sites and withstand siltation. Fingergrass grows at a slower rate, extending stolons from planted tillers, and has shown potential for erosion control on sortie sites (21. Combined plantings were tested in this study on two soil types with five different fertilization schedules.

Sites

Tests were made on six sites, all on or near ridgetops, on the Coastal Plain in north Mississippi. All had been severely sheet-eroded, but not gullied, and then naturally revegetated with a variety of species prior to these tests. Three sites had soils with sand as the predominant fraction - a sand, loamy sand, and sandy loath; the other three had a clay loam soil. Vegetation, litter, and the soil layer containing most of the organic matter were bulldozed from each site to simulate dry, bare, eroded conditions. Clearing provided the uniformity within sites that is needed for experimental purposes but is not normally found on naturally eroded sites. Fifteen plots, each 12 x 16.5 feet, were established on each of the six sites; there were 90 plots in all.

Planting

In early April, fifty 1-year-old loblolly pines were liar-planted on each plot at 1.5- x 2.0-foot spacing. (This close spacing provided enough pines to adequately assess survival on the small, uniform plots, but is not suggested as all erosion control treatment or a replacement for the normal 6- x 6- or 6- x 8foot spacings.) In late April, lovegrass seeds were broadcast at 3 pounds per acre on five plots randomly selected from the 15 on each site. Fingergrass tillers were bar-planted on another five plots in early May-one tiller in each tree-planting square. The remaining five plots on each site were kept clear of all vegetation except the planted pine. Each vegetation type-pine. lovegrass-pine, and fingergrass-pine-was represented on five plots at each site.

Fertilizing

All plots received N-P203-K20 al 150-?5-125 pounds per acre, but

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schedules were varied. In one, the entire amount was applied on April 25: in the others, one-third was applied on April 25 and the remainder on either May 22, June 13, July 9, or July 30. On each site the five schedules were randomly assigned to the five plots of each vegetation type. Fertilizers were ammonium nitrate, normal superphosphate, and muriate of potash.

Observation and Analysis

Current foliage production by pine and grass was sampled and height growth and survival of all seedlings were determined for the first two growing seasons after planting. Seedling height growth and grass growth were also sampled during the first growing season. Area covered by vegetation alma and near the soil . surface was measured after the first growing season. Differences in end-of-growing-season observations associated with vegetation type, date of second fertilization, soil (sand or loam), and their interactions were tested for statistical significance at the 0.05 probability level by analysis of variance.

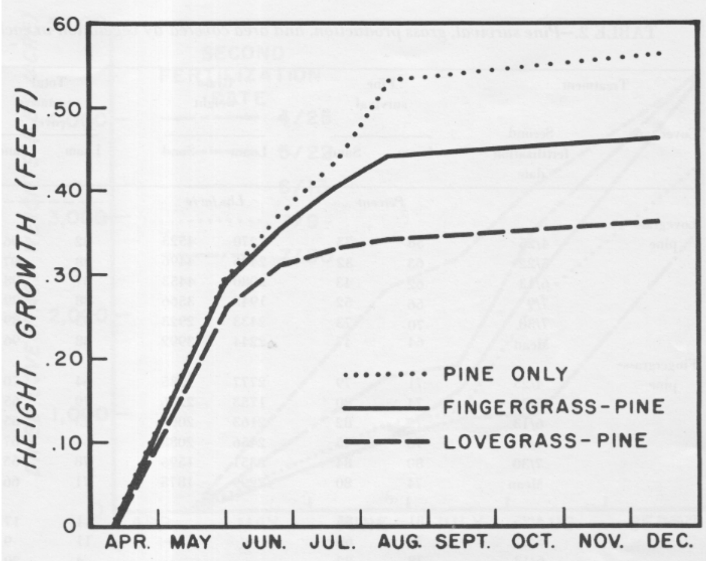

Figure 1.—Competition in the first year, particularly from lovegrass, reduced pine height growth in mid-growing season on sandy sites.

Lovegrass Depresses Pine Growth

Summer rainfall was generally below normal during the study (table 1). Lovegrass covered the soil rapidly amid almost completely under these conditions (table 2). however, when completely fertilized shortly after planting, lovegrass did not permit a 70-percent pine survival, which is necessary for permanent erosion control. On sands completely fertilized early-in April or May-only one-third of the pines survived the first year (table 2). Surviving seedlings on these plots grew slower than those on nongrass plots during midseason (fig. 1), so height growth differed significantly (0.05 level), though slightly, by reason's end. Lovegrass competition also significantly reduced the pines' needle production per unit of height growth, even on plots fertilized late in the year. Pines competing with lovegrass often produced tufts of fascicles only at growth terminals and not along the main stem and branches as did pines in nongrass plots. Consequently, on sands the 3 g. of needles produced by a seedling were just 27 percent of that produced in the first year on nongrass plots. and the pine crowns covered less than 2 percent of the area (table 2). After 2 years, the 11 g. of needles produced by the average pine in lovegrass amounted to just 18 percent of the weight produced by a seedling free of grass competition.

On the loam soils where lovegrass growth was less, its competition did not reduce pine sun iv al or growth so drastically.

Delayed Fertilization Aids Pine Survival in Lovegrass

Compatibility of lovegrass with pine was improved by delaying two-thirds of the fertilization until late July. On sandy sites, where lovegrass covered over 90 percent of the area, delaying the second fertilization increased pine survival from 33 to 73 percent-near that of pines grown without grass competition (table 2). Apparently, pines became established before grass began its rapid growth in response to the second fertilization (fig. 2). On sand,

TABLE 1.—*Summer monthly rainfall was generally below normal during test*

Month	Long term normal rainfall	Departure from normal: First year	Departure from normal: Second year
	Inches		
April	4.88	+0.11	+2.93
May	4.38	+1.57	−2.69
June	4.34	−1.56	−1.67
July	4.26	−1.72	−3.50
August	3.61	− .99	+1.07
September	3.32	+4.81	− .51
October	2.98	+1.60	−1.00

TABLE 2.—*Pine survival, grass production, and area covered by vegetation in each treatment after first growing season*

Treatment		Pine survival		Grass weight		Total vegetative cover		Pine cover only		Cover[1] near soil surface	
Cover type	Second fertilization date	Loam	Sand	Loam	Sand	Loam	Sand	Loam	Sand	Loam	Sand
		Percent		*Lbs./acre*		*Percent*					
Lovegrass-pine	4/25	58	33	2270	4523	82	96	1	1	23	31
	5/22	63	32	2496	4496	88	97	1	1	22	30
	6/13	62	43	2080	4453	87	98	5	1	21	37
	7/9	66	52	1943	3566	88	99	1	1	27	31
	7/30	70	73	2433	2923	95	89	3	3	33	22
	Mean	64	47	2244	3992	88	96	2	1	25	30
Fingergrass-pine	4/25	71	79	2777	1685	64	70	5	7	15	17
	5/22	74	80	1753	2286	79	65	7	13	15	19
	6/13	72	82	2163	2060	73	65	7	12	17	17
	7/9	76	75	2456	2085	61	67	7	5	17	13
	7/30	80	84	2351	1595	78	65	7	13	10	10
	Mean	74	80	2299	1875	71	66	7	10	15	15
Pine	4/25	81	85	—	—	11	17	11	17	<1	<1
	5/22	78	68	—	—	11	9	11	9	<1	<1
	6/13	78	82	—	—	4	20	4	20	<1	<1
	7/9	82	76	—	—	13	21	13	21	<1	<1
	7/30	84	86	—	—	11	19	11	19	<1	<1
	Mean	81	79	—	—	10	17	10	17	<1	<1

[1]Vegetation on or within 1 inch of soil surface.

delaying fertilization until late July seemed to reduce total lovegrass growth and the area it covered, but these effects were not statistically significant.

On loam, where lovegrass covered less area and pine survival was generally greater than on sand, delayed fertilization benefited survival less.

Second-year pine mortality averaged about 6 percent in lovegrass. It did not appear to be influenced by fertilizer treatment on either site.

Fingergrass Allows Better Pine Growth

Generally, pine survival was higher in slow-growing fingergrass than in faster-growing lovegrass. Pines became established while the small fingergrass tillers slowly occupied the site by extending stolons and roots. On loam, where fingergrass grew best, delaying fertilization improved pine survival slightly.

In the first year, pines in fingergrass produced two times as much weight in needles as those in lovegrass, and after 2 years, two and a half times as much. As in loyegrass. needle production was not affected by delayed fertilization. Fingergrass with pine covered seven and four timer more area than pine alone on loam and sand, respectively, after the first growing season. Fingergrass with pine covered only 69 and HI percent of the area covered by loyegrass with pine on sand and loam.

Though grass and pine foliage were in position to intercept raindrops, most was not near enough to the soil to check runoff. Lovegrass covered 30 percent or less of the soil near the surface and fingergrass, about 15 percent (table 2). In effect, though, this difference in cover may have been partially offset by the soil-trapping stolons of fingergrass. Pines covered little area either above or at the surface and would have covered less if planted at normally wider spacing.

Discussion

Lovegrass planted and fertilized to quickly protect a site may overwhelm pine seedlings, preventing permanent control of erosion. The study described in this article demonstrates, however, that competition from grass can he reduced through proper timing of fertilizer application. Since nearly as many pines can then sun is e in grass as on grass-free sites, formation of the pine cover is not greatly retarded. This control of competition can he achieved with a small sacrifice or trade-off in quality or quantity of the temporary grass coyer for the increase in pine survival. Since must pines that survive the first year or two after planting grow to maturity. grasses might be fertilized again iii later years to maintain a complete grass cover until the pines blanket the site with protective litter. Adequate pine survival for erosion control can also be assured by using a relatively slowgrowing grass to reduce competition, but there the quantity of temporan cover is sacrificed during the first year or two.

Optimum methods to provide both rapid and permanent erosion control are still to be discovered. Perhaps time of fertilization should be tied to soil moisture level or rainfall, rather than to a fixed date. Other grass species may be superior for rapid cover on many sites. However, the results demonstrate that combined plantings are feasible for both rapid and long-terra site protection if competition between species is controlled.

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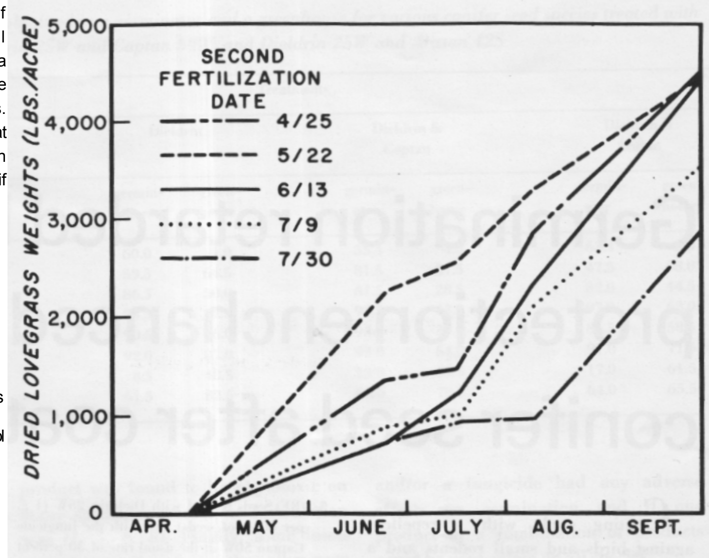

Figure 2.—Lovegrass on sand grew fastest and produced most of its weight after, rather than before, the second fertilization.

News & Reviews

"FDR's Trees" Still Standing

President Franklin D. Roosevelt saw with his own eve.. the black blizzard of dust that whirled across the Great Plains in the '30s.

his response was an audacious experiment to slow the wind and hold the blowing topsoil and swirling sand of the dust bowl on the vast, mostly treeless, prairies. He ordered the planting of "shelter belts" of trees and shrubs-222 million were put in-in a 200-mile-wide swath stretching from the Dakotas south a thousand miles into the Texas Panhandle.

Now, more than 30 years later, many of "FDR's trees" still stand-a living memorial to one of man's greatest efforts to control nature.

Although tanners and foresters would plant windbreaks somewhat differently today than was done in the "dirty thirties;" most say, the shelter belts have helped protect crops, cattle and human, from high winds, the arctic cold and the burning heat which the volatile seasons bring to the unsheltered plains.

In July of 1934, the nation's chief forester, F.A. Silcox said: "This will be the largest project ever undertaken in this country to modify climate and other agricultural conditions..."

The operation was known as the Prairie States Forestry Project and it ran from 1934 into 1942.

The 100-foot-wide belts, usually consisting of 10 to 15 rows, contained many species of trees. There were evergreens such as junipers and pines, as well as deciduous varieties such as honey locust, sycamore, green ash, Russian olive, cottonwood, Siberian elm, and white willow.

In May of 1935, the program's first trees were planted in the sandy soil of a 160-acre cotton faun S miles sea of Willow in southwestern Oklahoma. Those trees are standing today.

The government provided the seedlings and paid for the planting; the farmers provided the land. In some cases, farmers planted their own belts.

After the program began, the drought on the plains eased and the dust subsided somewhat. The nation became much more concerned about the prospects of a second world war than about blowing dust.

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