

Carolina Studies Offer Possibilities of Increasing Pine Growth On Savannah Sites

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Savannahs, or "upland grass-sedge bogs," occur extensively in the lower Atlantic Coastal Plain (7). They are found on poorly drained upland depressions and are usually dominated by grasses and sedges, but pines-longleaf (*Pinus palustris* Mill.), pond (*P. serotina* Michx.), slash (*P. elliotii* Engelm. var. *elliotii*), and loblolly (*P. taeda* L.)-are often represented as scattered trees or in open stands. Savannahs are problem areas as prospective planting sites because of their naturally low productivity, the high risk of flooding during wet seasons, and the high fire hazard during dry seasons.

A cooperative study on the Francis Marion National Forest in South Carolina was initiated to determine which of four southern pine species was best adapted to savannah sites. Species tested were slash, loblolly, pond, and longleaf pines. The only cultural

practices imposed on the study area were burning the rough prior to planting, using good planting stock and proper planting technique, controlling hardwood competition chemically during the third growing season after planting, and protecting from fire.

Methods

The study was done on a freshly burned savannah in January 1960. Plots 60 feet square were handplanted with 81 trees at 6- by 6-foot spacing. Plantings of the four species were replicated eight times in two 4 x 4 Latin squares. The study area is flat, and the soil poorly drained with seasonally high water tables. The soil type has recently been classified Bladen clay loam; the topsoil is shallow and the clay subsoil 50 inches or more in depth.²

Survival and height data were

Savannahs, typically problem areas as prospective planting sites, were the subject of recent South Carolina studies. These studies suggest that pine growth can be substantially increased by cultural measures on such sites.

collected after the first through the fifth growing seasons and after the seventh and tenth growing seasons. During each inventory, the incidence of diseases and insects was recorded. Samples of slash and loblolly needles were collected in June of the eleventh growing season from the previous season's first growth flush at the top of the tree. Foliar phosphorus (P) was determined following the method described by Wells (8).

Results

Survival

Survival rate of slash pine exceeded that of the other pines from the first through tenth growing seasons. First-year survival of slash was 91 percent and its tenth-year survival was 80 percent (fig. 1). Loblolly had a survival rate of 89 percent and pond pine had 86 percent survival during the first year, and both had a tenth-year survival rate of 68 percent. Survival of longleaf pine was 74 percent the first year and 41 percent the tenth year.

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² Bobby Long, soils specialist with the Soil Conservation Service at Moncks Corner, S. C., identified the soil.

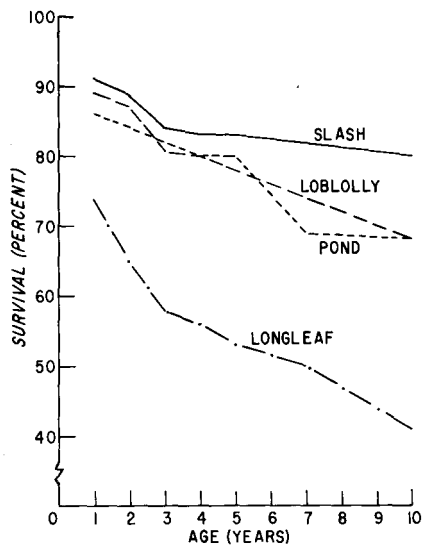


Figure 1.—Survival of slash, loblolly, pond, and longleaf pines through tenth year on a wet savannah site.

The tenth-year survival of slash pine showed highly significant differences in comparisons with loblolly and pond pines. The low first-year survival of longleaf pine, coupled with high mortality through the tenth year, resulted in a sparsely stocked stand after the tenth year. Serious brown-spot needle blight on longleaf obviously affected survival. After the tenth year, 77 percent of the longleaf were infected with brown-spot, and 29 percent of the loblolly and 9 percent of the slash showed some form of needle blight. No other diseases or insects affected study results.

Height

Slash pine has shown the fastest growth rate among the four species since the second year, and loblolly and pond have shown a similar growth pattern through

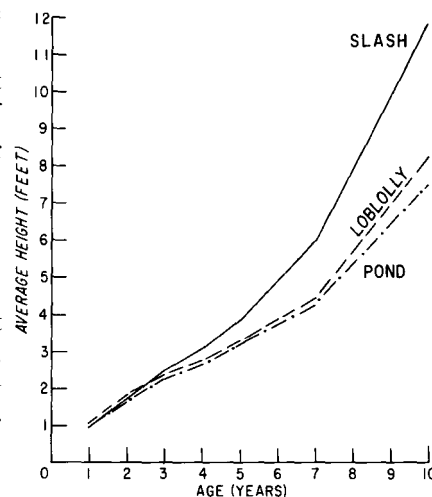
the tenth growing season (fig. 2). pine foliage averaged 0.043 percent. Longleaf pine has been slow in initiating height growth: 86 percent of the surviving longleaf seedlings were in the "grass stage" after 7 years, and 61 percent of the stand was still in the same stage at the end of the tenth year.

Tenth-year heights were 11.8 feet for slash, 8.2 for loblolly, and 7.5 for pond pine. Statistically, the height of slash exceeded loblolly or pond pine with 99 percent confidence, but the difference in the tenth-year height of loblolly and pond was not statistically significant. The height of longleaf pines which were 20- to 25-foot loblolly trees at beyond the "grass stage" and in age 10 (8). active height growth averaged only 2.5 feet the tenth year.

Phosphorus Content of Foliage

Foliar analyses indicated very low uptake of P by loblolly and slash pines. The P content of slash

Figure 2.—Average height of slash, loblolly, and pond pines through tenth year on a wet savannah site.



Through the tenth year, survival and height growth rates of slash pine exceeded those of the other pines studied. Loblolly and pond pine ranked next and were about equal in performance. Longleaf pine had poorest survival and growth rates in this comparison. Actually, the height growth of slash pine (the best of the four species) was only about 1 foot per year with an indicated site index of less than 50. Such poor growth rates would make planting this or similar savannah sites a most unattractive venture.

So the questions arise: What factor or factors are limiting growth on this site? What measures offer possibilities for increasing growth?

Poor Soil Fertility

The analyses of slash and loblolly foliage after the tenth growing season provide strong

evidence of a P deficiency. The P Walker also demonstrated that content of 0.043 percent for slash fertilizing with 1,000 lb. 8-8-8 at a pine and 0.049 percent for loblolly given water regime increased slash are both well below the critical level growth from 26 to 74 percent and of 0.090 percent of foliar P for loblolly growth from 62 to 97 slash pine set by Pritchett (5) and percent. Walker's studies suggest the 0.085 percent level for loblolly that nutritional aspects may be suggested by Wells and Crutchfield more important than water relation (9). Phosphorus fertilization should aspects on the Bladen soil. help overcome this nutrient deficiency. Wells and Crutchfield (9) observed an 82 percent height increase of loblolly pine 3 years Several studies (1, 2, 3, 4) have after planting on a Bayboro loam shown the beneficial effects of savannah by adding 25 lb. P per acre. bedding in the early years after Their area was ditched for planting. These effects may be drainage and then bedded and due to a combination of nutrition planted before broadcast application and aeration. In bedding, topsoil of triple superphosphate. Pritchett from an 8- to 9-foot strip is (5) also obtained a large growth brought together on a 3- to 4-foot increase from P fertilization of bed, thus concentrating available slash pine on a wet site in nutrients and at the same time Florida. His volume increases increasing elevation of the bed to were 15 and 20 times (compared to improve aeration. no fertilization) for respective This study suggests the possibility applications of 17.4 and 34.8 lb. P that pine growth, especially slash and loblolly, can be substantially increased by cultural measures on these wet savannah sites. But whether these cultural measures are all economically feasible and broadly applicable remains to be seen.

Poor Soil Aeration

Poor soil aeration may also be a limiting factor to growth on this wet savannah, although evidence for this is not as strong as it is for poor fertility. In studies of controlled water table levels, Walker (6) showed that a water table held 4 inches below the surface of a Bladen soil compared to one held at soil surface increased height growth of slash by 152 percent and loblolly by 262 percent. When the 4-inch controlled water table level was compared with a naturally occurring water regime, however, differences were insignificant (indicating that draining such an area might not be too beneficial).

Recommendations

Several studies (1, 2, 3, 4) have shown the beneficial effects of bedding in the early years after planting. These effects may be due to a combination of nutrition and aeration. In bedding, topsoil from an 8- to 9-foot strip is brought together on a 3- to 4-foot bed, thus concentrating available nutrients and at the same time increasing elevation of the bed to improve aeration. This study suggests the possibility that pine growth, especially slash and loblolly, can be substantially increased by cultural measures on these wet savannah sites. But whether these cultural measures are all economically feasible and broadly applicable remains to be seen.

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Warning: Recommendations for use of pesticides are reviewed regularly. The registrations on all suggested uses of pesticides in this publication were in effect at press time. Check with your County Agricultural Agent, State Agricultural Experiment Station, or local forester to determine if these recommendations are still current.

Caution: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife-if they are not handled or applied properly. Use all pesticides selectively and carefully as prescribed. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.