

ECONOMIC CONSIDERATIONS OF GROWING AND GRADING SOUTHERN PINE NURSERY STOCK

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This report has been prepared to: (1) draw attention to management trends in some southern pine nurseries in the last decade, (2) point up apparent nursery and reforestation problems, and (3) report results of 10-year objective studies undertaken by the Texas Forest Service that may contribute to the direction, success, and economic returns of future reforestation efforts.

In the late 1940's, it was apparent that managers of some southern pine nurseries considered production quantity as the prime management goal. Wakeley's book¹ served to temper this outlook and directed attention to production by morphological grade.

About 1952, there was general acknowledgment that soil conditioning should be stepped up on many of the older nurseries. With the increased use of sawdust as a soil conditioner came moderate to heavy applications of commercial fertilizers. Production goals of 1 to 1-L million shippable seedlings per acre soon became common and existing nurseries struggled vainly to meet seedling orders. With the advent of the Soil Bank program, the race was, on to set up new nurseries and get them into production in 1957 in anticipation of a large seedling demand.

Seedling production at some locations again suggested "production fever." Morphological grades were still used to grade and ship seedlings; however, soil conditioning and fertilizer applications were about the same as those carried out on pre-Soil Bank nurseries, even though the new locations were on soils that had been in pasture or weed fallow for years. Critical examination of recent research work suggests that such practices may make it difficult to hold seedlings within morphological standards and may further complicate effort to produce seedlings of desired physiological grade.

The following is a summary presentation of data and supplementary comment covering grade-recovery and out-planting tests of slash and loblolly pine during the years 1948-52.

Procedure

Six seedling-grade classes of 1-0 slash and loblolly pine were established to test survival and growth response. Grade separations were made by stem-diameter² groups within the following top-height classes:

<u>Class</u>	<u>Height</u>	<u>Stem diameter</u>
	<i>Inches</i>	<i>Inch</i>
Small	3.0 - 5.9	1/20 and 2/20
Medium	6.0 - 8.9	2/20 and 3/20
Large	9.0 - 11.9	3/20 and 4/20

The "small" 1/20-inch diameter seedlings were principally "blue-tops," with primary needles predominating.

1 Wakeley, Philip C. Planting the southern pines. U.S. Dept. Agr., Agr. Monog. 18, 233 pp. 1954.

2 Measured at 1 inch above root collar.

Four, 1-square foot random samples were taken from randomly selected nursery beds to determine grade-recovery ratios for each species and each bed-management practice; e.g.; broadcast, 4-row, 6-row, or 8-row seeded beds. These recovery studies were made annually over a period of 3 years at the Indian Mound Nursery at Alto, Texas.

Two lots of 50 seedlings, for each grade, were outplanted in 1949 in Caddo soil. Similar lots were planted on two Caddo soil locations and one Bowie soil each year, for the following 3 years. All plantings were located on upper flatwood soils within an area 20 miles in diameter.

Table 1 shows third year survival pattern of the 1-0 stock, by various seedling grades, for the 1950, 1951, and 1952 planting seasons.

Table 2 and figure 1 illustrate height and diameter development of grades. The important responses noted are as follows:

a. There is approximately a direct line response between survival and height development and increases in stem diameter and top length.

b. Loblolly consistently showed better survival than comparable grades of slash pine exposed to protracted periods of summer drought. Apparently, loblolly has an inherent physiological advantage for given size classes over slash pine, or it may reflect earlier maturity at a given age under common conditions. This is evidenced by terminal bud formation, woody stem, and fascicled needle development in a high percentage of even the "small" seedling group.

c. Premium seedlings are suggested as those with 50 percent fascicled needles, exceeding minimum 3/ 20-inch stem diameter, and 6- to 12-inch top length for loblolly, and 6- to 9-inch top length for slash pine. Larger slash pine seedlings attained greater growth in good planting years but did not have as consistent good survival in dry years.

TABLE 1.--Survival percent of slash and loblolly 1-0 stock, by seedling grade, after three growing seasons on Bowie and Caddo Soils of lower Coastal Plain

Growing season planted and species	<u>Small</u> top 3.0-5.9 inches and stem diameter of--		<u>Medium</u> top 6.0-8.9 inches and stem diameter of--		<u>Large</u> top 9.0-11.9 inches and stem diameter of--		Total rainfall ¹
	1/20 in.	2/20 in.	2/20 in.	3/20 in.	3/20 in.	4/20 in.	
1950:	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Inches</i> 45
Slash.....	25	58	72	89	59	79	
Loblolly.....	32	54	59	75	78	84	
1951:							44
Slash.....	4	14	21	26	18	17	
Loblolly.....	17	32	54	58	70	67	
1952:							54
Slash.....	11	22	21	25	25	28	
Loblolly.....	23	55	50	52	55	54	
3-year average:							
Slash.....	13	31	38	47	34	41	
Loblolly.....	24	47	54	62	68	68	

¹ Deficient during growing season each year.

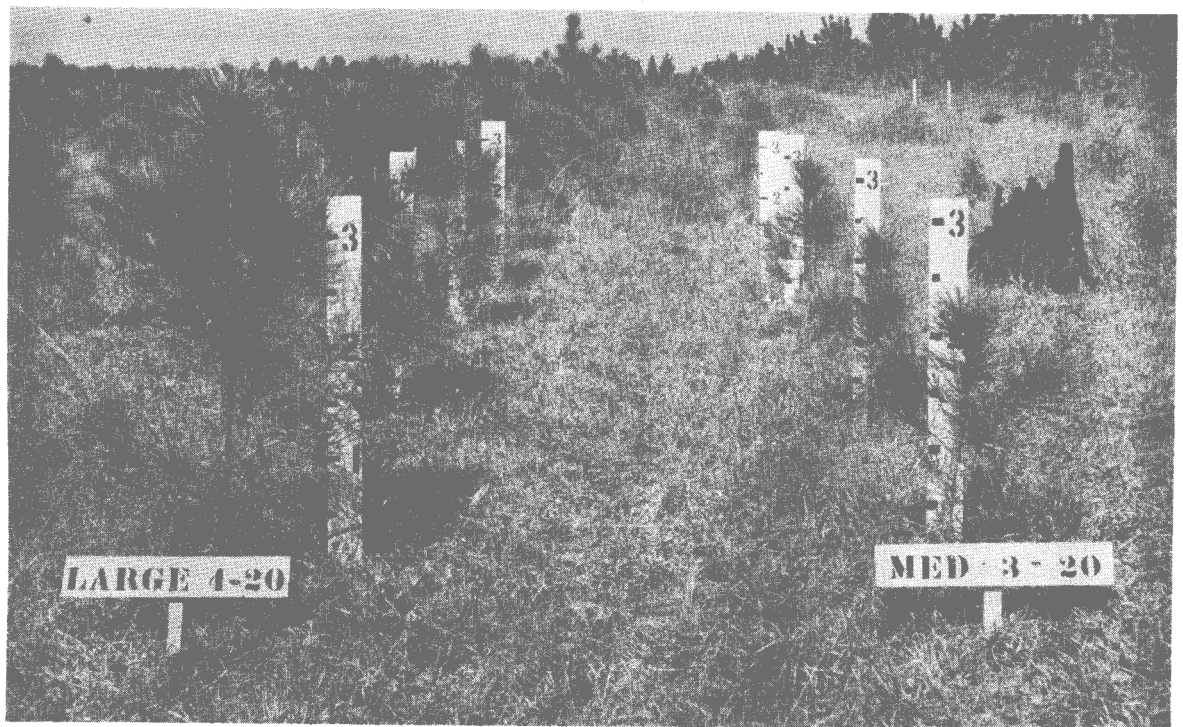
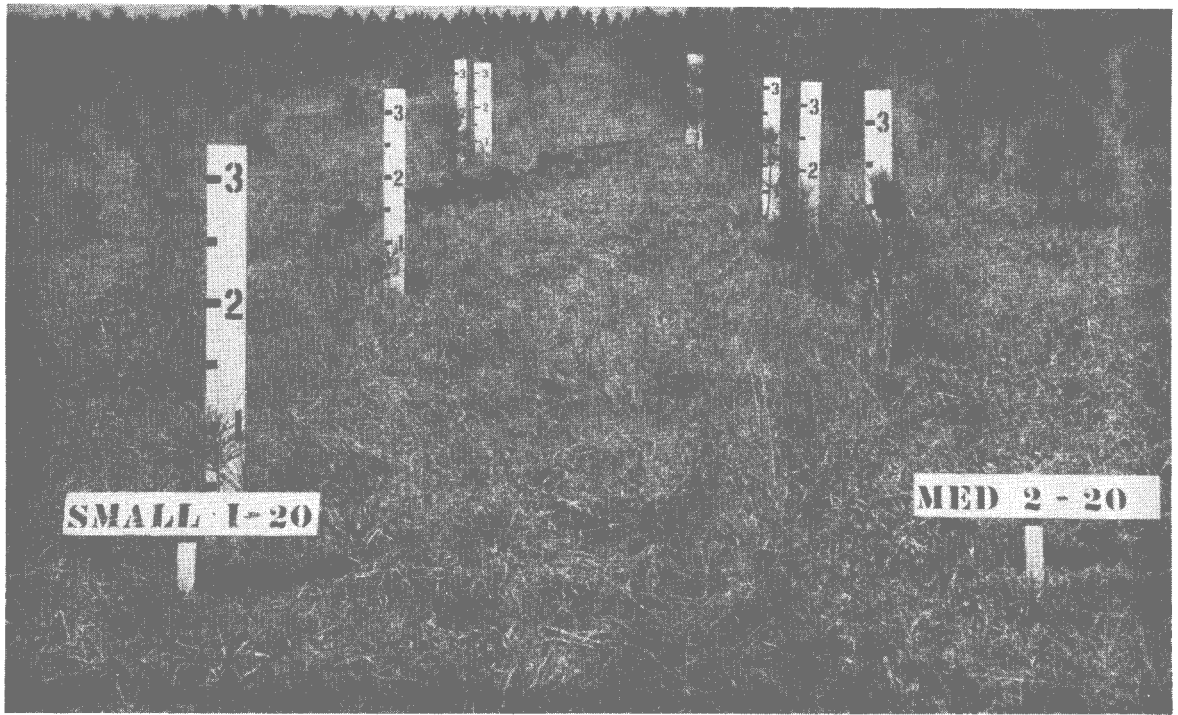


Figure 1. Development of graded slash pine seedlings on Caddo soil at end of third growing season, Survival pattern is suggested by absence of stakes at 6 foot intervals.

TABLE 2.--Average height and diameter development per annum of slash and loblolly 1-0 seedlings, by grade, on Caddo soil¹

Height² Growth per Annum

Species and age of planting	<u>Small</u> top 3.0-5.9 inches and stem diameter of--		<u>Medium</u> top 6.0-8.9 inches and stem diameter of--		<u>Large</u> top 9.0-11.9 inches and stem diameter of--	
	1/20 in.	2/20 in.	2/20 in.	3/20 in.	3/20 in.	4/20 in.
Slash:	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
8.....	1.79	2.13	1.98	2.03	2.03	2.13
8.....	1.93	2.09	1.89	2.14	2.12	2.29
9.....	³ 1.68	⁴ 2.26	1.86	2.00	2.09	2.17
9.....	⁵ 1.68	2.20	2.26	2.26	2.49	2.40
11.....	1.76	1.73	2.09	2.23	2.30	2.43
Mean.....	1.77	2.08	2.02	2.13	2.21	2.28
Loblolly:						
8 ⁶75	.78	.81	.98	.96	.98
8.....	1.20	1.28	1.45	1.51	1.56	1.63
9.....	--	1.13	--	1.43	--	1.40
11 ⁶	<u>.64</u>	<u>.85</u>	<u>.67</u>	<u>.89</u>	<u>.98</u>	<u>.80</u>
Mean.....	.86	1.01	.98	1.20	1.17	1.20

Diameter Growth per Annum

Slash:	<i>Inch</i>	<i>Inch</i>	<i>Inch</i>	<i>Inch</i>	<i>Inch</i>	<i>Inch</i>
8.....	0.35	0.50	0.48	0.51	0.49	0.53
9.....	.40	.49	.47	.50	.51	.52
10.....	<u>.31</u>	<u>.31</u>	<u>.38</u>	<u>.37</u>	<u>.40</u>	<u>.45</u>
Mean.....	.35	.43	.44	.46	.47	.50

¹ Bowie soil locations damaged by wildfire.

² Average of two replications, each location.

³ 2 trees.

⁴ 6 trees.

⁵ 1 tree.

⁶ Heavily retarded by tip-moth damage.

d. "Spindly" seedlings, such as those having 3/20-inch diameter and 9-inch top length with few fascicled needles, were the most susceptible to cold desiccating winds occurring immediately after planting or to protracted summer drought.

e. Height and diameter development indicate concerted effort should be made to grow and grade seedlings for maximum numbers of premium grade. Such trees, when planted in the field, showed promise of the greatest economic return.

f. Slash pine outgrew loblolly in the juvenile period. Loblolly was seriously retarded by tip-moth damage at one location but was only lightly retarded at other locations. Growth of both species was consistently greater on well-drained Bowie soils than on moderately to poorly drained Caddo soils.

g. There was little difference in production of acceptable seedlings by method of seeding, whether seeded broadcast or by 4-, 6-, or 8-row beds.

MANAGEMENT CONSIDERATIONS

Data from this study indicate stress should be placed on growing medium-sized seedlings that show a strong reddish-purple color after a few hard frosts, and low incidence of terminal "surge" or flush growth. Such seedlings usually show good physiological maturity by having 50 percent or more live crown in fascicled needles and a high frequency of terminal bud.

Table 3 lists the grading standards used for shipment of 1-0 stock in Texas Forest Service nurseries during the current planting season. Although morphological standards are used to define grades, only those standards are used that will tend to eliminate most of the physiologically immature seedlings. These standards are more specific than the standards Wakeley offers, and thus concentrate attention toward judging physiological maturity minimums. Note that the minimums for fascicled needles are in strong contrast to "part" at least in 3's and 2's" used in past grading. Spindly, succulent-stemmed seedlings are thus discarded as culls even though they meet previous standards as No. 2 stock.

In essence, the normal population curve is visualized when grading. The selection process lops off individuals at both ends and retains individuals from the more stable, medium-sized population at center. Even though survival and development are favorable for "large" loblolly, it is desirable to exercise reserve in the production and shipment of such seedlings until tendency toward extreme limbiness, potential form, and susceptibility to Cronartium are defined.

TABLE 3.--Grading standards for shipment of 1-0 slash and loblolly pine from Texas Forest Service nurseries

Grades and species	Stem diameter ¹	Top length	Top ² and root condition ³
<u>Minimum acceptable:</u>	<i>Inches</i>	<i>Inches</i>	
Slash.....	3/32	5-8	25 percent or more of live crown in fascicled needles; buds may be absent.
Loblolly.....	3/32	3-8	25 percent or more of live crown in fascicled needles, buds usually present.
<u>Premium:</u>			
Slash.....	4/32-10/32	6-9	50 percent or more of live crown in fascicled needles; buds usually present.
Loblolly.....	4/32-10/32	6-12	Do.
<u>Maximum acceptable:</u>			
Slash.....	4/32-10/32	9-12	50 percent or more of live crown in fascicled needles; buds present.
Loblolly and Slash.....	5/32-12/32	13-15	Do.

¹ At ground line--minimum to usual maximum.

² Fascicled needles reddish purple in most seedlings. Stem mostly woody.

³ All roots a minimum of 5 inches in length, with well-developed laterals.

Visual-aid guide panels have been developed by the Texas Forest Service to depict minimum seedling character for each grade. These are used for personnel training and reference at the grading table. When consumer demand approximates nursery production, grading may be extended to include minimum and maximum acceptable grades. If demand is less than production, confinement to premium grade is suggested.

The impact of the preceding is more evident if we relate it to economics. Eleven year growth records of "small" splash pine reveal an average height of 19.2 feet on Caddo soil. Juvenile height for 3/20-inch diameter stock, "medium" and larger, averages 25.5 feet. Average d.b.h. at 10 years for these groups is 3.1 and 4.1 inches, respectively. If the 1-inch differential is carried forward to rotation end at 50+ years on an average site index 80, there may be a stocking differential of about 4.1 m. board feet per acre. This, at an average stumpage evaluation of \$40 per m., would provide a \$164 per acre advantage from using premium stock.

Although Wakeley and Hatcher³ touch only briefly on economics, it is believed that nursery managers can make the most bold break and cross a "new threshold" of emphasis in working with potential planters. In addition to the tangible values that accrue from research and technical application, there are highly important intangible values that we consider, such as public relations. It is hoped the above may help attain balance when considering the ebb and flow of consumer demand for future reforestation stock.

³ Hatcher, John. Prescription planting guide for technical foresters (10 pp. mimeo), 1958.