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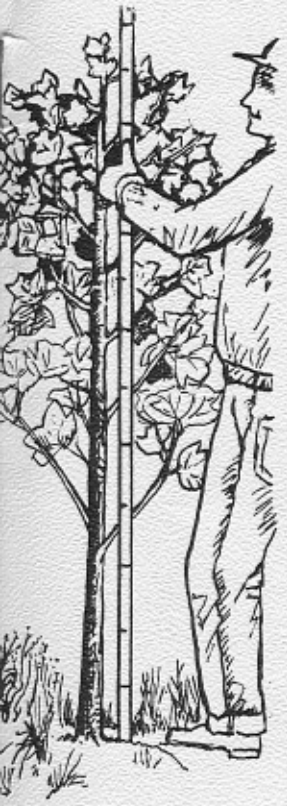
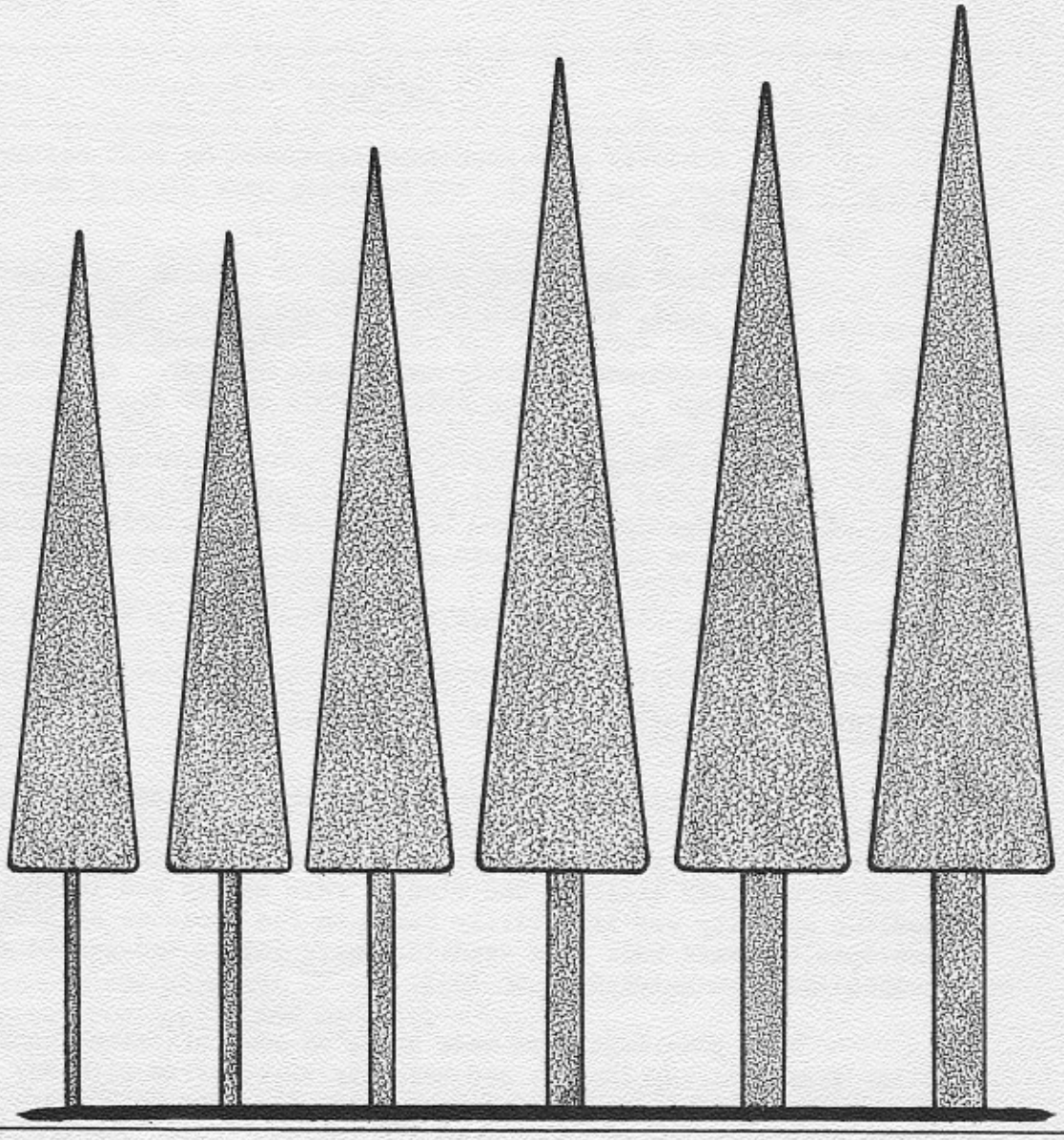
loblolly pine SEEDLING GRADE growth & survival





Virginia Division of Forestry
Department of Conservation and Economic Development

Effect of Seedling Grade on Survival and Growth Of Loblolly Pine Seedlings

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ABSTRACT

Loblolly pine seedlings separated by root collar diameter, top length, and maturity were planted during March of 1966 and 1967.

There was little difference in survival between 2/32, 3/32, 4/32, 5/32, and 6/32 inch seedlings, but survival of 7/32 inch seedlings was significantly lower in both years. Top length and maturity had little effect on survival for seedlings of the same initial root collar diameter.

Height growth during the 3 years following planting was related to initial root collar diameter. Larger diameter seedlings grew faster. Top length and maturity had little effect on height growth for seedlings of the same initial root collar diameter.

DESCRIPTION OF STUDY

Small lots of seedlings were lifted at random locations from 18 different seedbeds in 1966 and 30 different seedbeds in 1967. Seedlings were first separated by root collar diameter into 1/32 inch classes, then by length of top into 2 inch classes, and finally into mature and immature classes. Seedling maturity was arbitrarily based on the presence or absence of a well-developed terminal bud. The seedlings were lifted and graded from March 7-10 in 1966 and from March 8-13 in 1967.

Test plantings were made using as many different combinations of root collar diameter, top length, and maturity as occurred with any frequency among the seedlings lifted and graded (see Table 1). For both years, about 92 percent of the seedlings lifted and graded are represented in the combinations checked in Table 1.

Table 1. Combinations of Stem Diameter, Top Length, and Maturity Used in the Test Plantings.

Top Length	Maturity	1966 STUDY Root Collar Diameter 2/32	3/32	4/32	5/32	6/32	7/32	1967 STUDY Root Collar Diameter 2/32	3/32	4/32	5/32	6/32	7/32 1/
4"	*Immature*	x	x	x				x	x				
	Mature		x	x									
6"	*Immature*	x	x	x	x	x		x	x	x	x		
	Mature		x	x	x	x			x	x	x		
8"	*Immature*			x	x	x	x		x	x	x	x	
	Mature			x	x	x	x		x	x	x	x	
10"	*Immature*					x	x			x	x	x	
	Mature					x	x			x	x	x	

The 1966 seedlings were divided into 4 separate tests as follows:

1. 2/32 and 3/32 inch stem diameters with 4 and 6 inch tops, immature only.
2. 3/32 and 4/32 inch stem diameters with 4 and 6 inch tops, both immature and mature.
3. 4/32, 5/32, and 6/32 inch stem diameters with 6 and 8 inch tops, both immature and mature.
4. 6/32 and 7/32 inch seedlings with 8 and 10 inch tops, both immature and mature.

The 1967 seedlings were divided into 4 separate tests as follows:

1. 2/32 and 3/32 inch stem diameters with 4 and 6 inch tops, immature only.
2. 3/32 and 4/32 inch stem diameters with 6 and 8 inch tops, both immature and mature.
3. 4/32 and 5/32 inch stem diameters with 6, 8, and 10 inch tops, both immature and mature.
4. 5/32 and 6/32 inch stem diameters with 8 and 10 inch tops, both immature and mature.

In addition, three 25-seedling rows of 7/32 inch stem diameter seedlings were planted (there were not enough 7/32 inch seedlings to permit separation into different top length and maturity classes).

1/ *A total of seventy-five 7/32 inch seedlings were graded, which had top lengths of 8, 10, and 12 inches. These were pooled to provide enough seedlings for three 25-seedling rows.*

Each of the 4 separate tests were replicated 3 times in randomized blocks, using row plots of 20 seedlings each. In addition, the 3 replications of the 4 separate tests were randomly assigned to 3 larger blocks, so that each larger block contained one replication of each of the 4 separate tests. This permitted overall comparisons of seedlings in all tests.

The seedlings were planted on March 16 and 17 in 1966 and on March 15 and 16 in 1967. Spacing was 3 by 3 feet.

The 1966 and 1967 plantings are adjacent on a nearly-level ridge top. The soils are in the Tatum and Nason soil series, and are well-drained soils with a very fine sandy loam surface. The site was prepared for planting by bulldozing off tree tops and brush remaining after logging. Hardwood sprouts were cut down each year after planting to minimize the effects of hardwood competition.

The seedlings were measured at the end of each growing season through the third season following planting.

SURVIVAL

Survival 3 years after planting is summarized in Table 2. Survival was excellent for all diameter classes except the 7/32 inch seedlings.

For seedlings of the same stem diameter, top length had little effect on survival, as shown in Table 3. For seedlings of the same stem diameter and top length, maturity (presence of a terminal bud) had very little effect on survival, as shown in Table 4.

Table 2. Survival Percent After 3 Seasons.[2/]

1966 STUDY

Top Length	Maturity	Root Collar Diameter								
		Test 1		Test 2		Test 3			Test 4	
		2/32	3/32	3/32	4/32	4/32	5/32	6/32	6/32	7/32
4"	*Immature*	93	98	93	88					
	Mature			87	92					
6"	*Immature*	93	90	95	100	95	95	95		
	Mature			97	100	98	97	98		
8"	*Immature*					100	100	98	100	93
	Mature					92	93	93	98	80
10"	*Immature*								95	85
	Mature								93	85
Mean		93.3		93.3		95.6	96.2	96.5	85.8	

Table 2 (continued).

1967 STUDY

Top Length	Maturity	Root Collar Diameter								
		Test 1		Test 2		Test 3		Test 4		
		2/32	3/32	3/32	4/32	4/32	5/32	5/32	6/32	7/32
4"	*Immature*	88	95							
	Mature									
6"	*Immature*	88	93	90	88	90	95			
	Mature			92	95	87	92			
8"	*Immature*			88	97	85	95	95	93	
	Mature			82	90	95	93	93	92	
10"	*Immature*					90	93	90	88	
	Mature					85	93	93	90	
Mean		88.3	90.0	90.2		93.2		90.8		77.0

2/ Each figure in the body of the table is the average of three 20-seedling rows. The diameter class mean for 7/32 inch seedlings in 1967 is the average of three 25-seedling rows.

Analyses of variance were made of survival after 3 seasons. Survival percents were transformed to arc sin. Factorial analyses were made for the separate tests. For the combined data of all tests, Duncan's New Multiple Range Test for unequal replication (Steele & Torie, 1960, Principles and Procedures of Statistics, p. 114) was used to test differences between stem diameter classes. Significant differences are listed below:

Separate Analyses

1966 -- Test 1: None
Test 2: Seedlings with 6 inch tops survived better than seedlings with 4 inch tops (.005 level).
Test 3: For seedlings with 6 inch tops, mature seedlings survived better; but for seedlings with 8 inch tops, immature seedlings survived better (.025 level).
Test 4: 6/32 inch seedlings survived better than 7/32 inch seedlings (.025 level).

1967 -- Test 1: None
Test 2: None
Test 3: 5/32 inch seedlings survived better than 4/32 inch seedlings (.025 level).
Test 4: None

Combined Analyses

In both 1966 and 1967, the 3/32, 4/32, 5/32, and 6/32 inch seedlings survived better than the 7/32 inch seedlings (.05 level).

Table 3. Survival Percent After 3 Seasons by Top Length (Stem Diameter and Maturity Classes Combined).

1966 STUDY			1967 STUDY		
Test	Top Length	Survival	Test	Top Length	Survival
1	4	95.8	1	4	91.7
	6	91.7		6	90.8
2	4	90.0	2	6	91.2
	6	97.9		8	89.2
3	6	96.4	3	6	90.8
	8	96.1		8	92.1
4	8	92.9		10	90.4
	10	89.6	4	8	93.2
				10	90.3

Table 4. Survival Percent After 3 Seasons by Maturity (Stem Diameter and Top Length Classes Combined, Test 1 Omitted).

	1966 STUDY	1967 STUDY
Mature	93.1	90.8
Immature	95.2	91.2

HEIGHT GROWTH

Height growth during the 3 years following planting was related to initial root collar diameter, as shown in Figures 1 and 2. Large diameter seedlings grew faster, and the difference in height between large and small diameter seedlings increased each year. Top length and maturity, however, had no consistent effect on height growth, as shown in Tables 5.and 6.

Table 5. Mean Height After 3 Seasons by Top Length (Stem Diameter and Maturity Classes Combined).

1966 STUDY			1967 STUDY		
Test	Top Length	Height	Test	Top Length	Height
1	4	5.20	1	4	5.12
	6	5.08		6	5.08
2	4	4.73	2	6	5.42
	6	5.20		8	5.59
3	6	5.87	3	6	5.71
	8	6.07		8	5.74
4	8	6.23		10	5.88
	10	6.25	4	8	6.00
				10	5.80

Table 6. Mean Height After 3 Seasons by Maturity (Stem Diameter and Top Length Classes Combined, Test 1 Omitted).

	1966 STUDY	1967 STUDY
Mature	5.66	5.82
Immature	5.86	5.65

FIGURE 1. MEAN HEIGHT BY STEM DIAMETER

1966

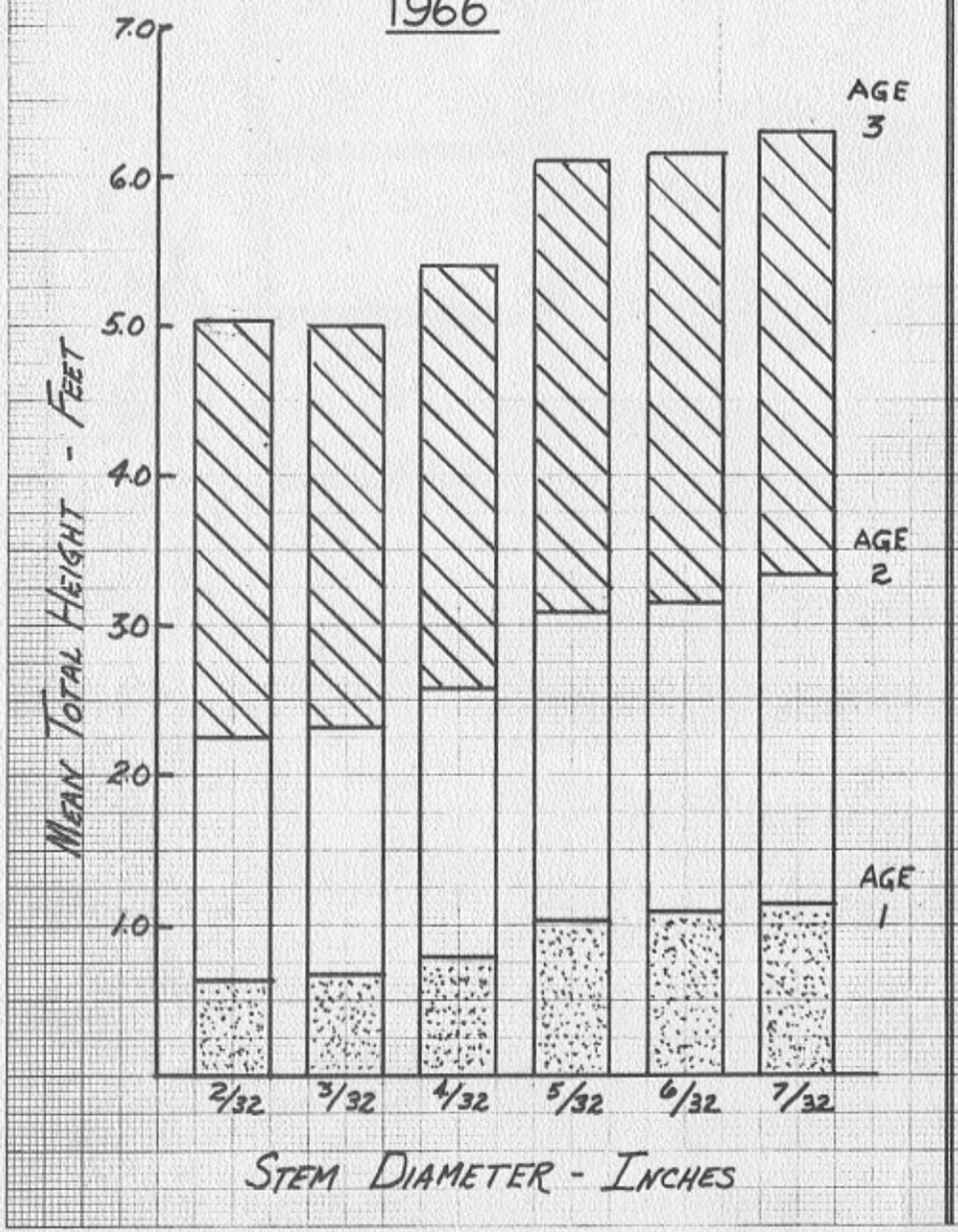

FIGURE 2. MEAN HEIGHT BY STEM DIAMETER

1967