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TREE PLANTING SURVIVAL

A 3 Year Study

Virginia Division of Forestry

Department of Conservation and Economic Development

A THREE YEAR TREE PLANTING SURVIVAL STUDY IN VIRGINIA

by R. L. Marler

Summary

In a planned three year study (1959-60, 1960-61, and 1961-62) the Virginia Division of Forestry obtained planting survival percents for loblolly, shortleaf, and white pine. More than 3,300 different plantings throughout the state of Virginia were field sampled to obtain survival data under different planting site conditions and for different seasons or time of planting.

Results of the study show that planting survival was generally low. Year planted, time of year and planting site all had a considerable effect on planting survival. The planting year 1960-61 clearly showed the adverse effect of season or time of year on planting survival with low survival generally prevailing for loblolly pine planted in the fall.

This study indicates that spring planting is safest.

Recommendation

Based on this study the following recommendation is made:

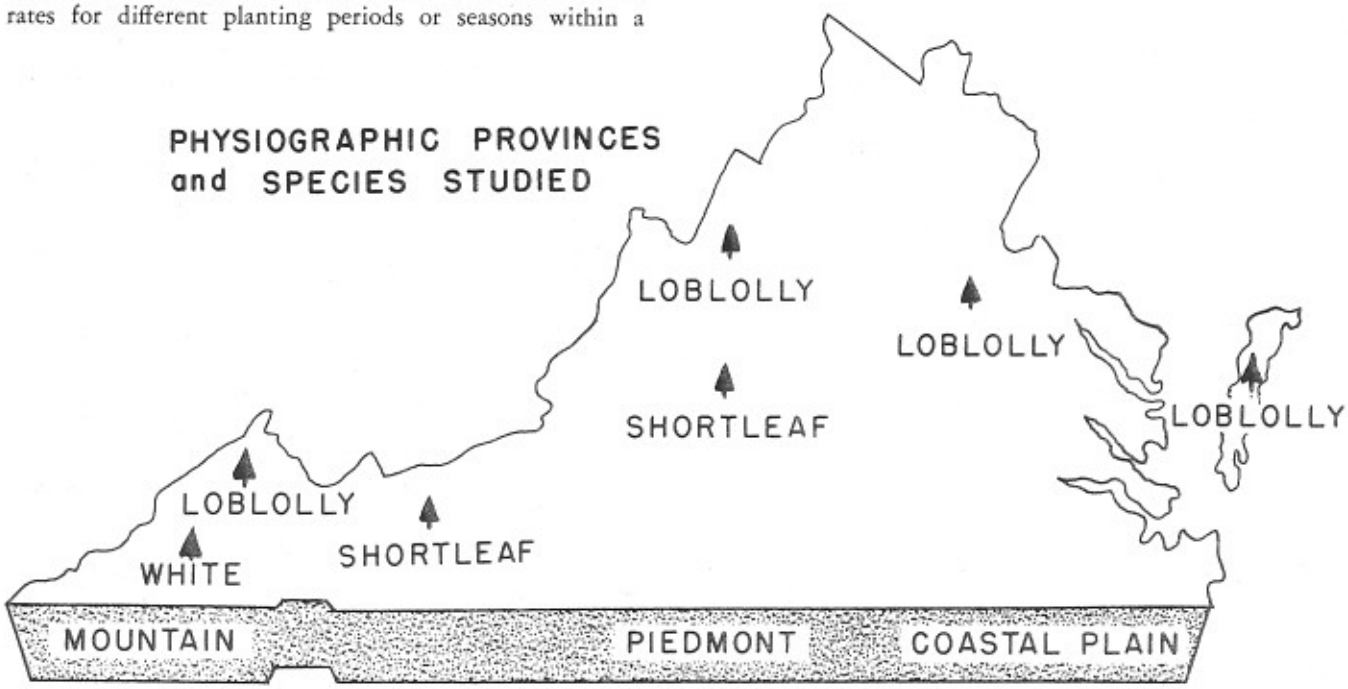
To secure maximum survival, plant pines in the spring (after the middle of February). Avoid fall planting.

Introduction

Landowners interested in planting trees usually ask these two questions: (1) when is the best time of year to plant; and (2) what survival may be expected?

In an attempt to answer the above questions the Virginia Division of Forestry made an extensive study of tree planting survival in Virginia for a three-year period which included the planting seasons 1959-60, 1960-61, and 1961-62. Loblolly, shortleaf, and white pine first year survival rates for different planting periods or seasons within a given planting year and for different planting site conditions were investigated on a statewide basis.

This report describes this study and summarizes planting survival for the above named tree species for each of three planting years: 1959-60, 1960-61, and 1961-62. Survival data were taken in the field during the late fall of the same year in which the pine seedlings were planted. Therefore, the planting survival percents reported represent survival at the end of the first growing season.



Study Statewide

The entire state of Virginia was included in the study. Pine plantings in the coastal plain, piedmont, and mountain physiographic provinces were included.

Plantings Included

Only those tree plantings on private landholdings were included in this study. Plantings on U.S. Government lands, state-owned lands, and large ownership holdings (forester managed) were not included.

Another criterion for inclusion of plantings in the study is an obvious one—the planting had to be properly identified with respect to time of planting and planting site. Proper identification of some plantings proved difficult and in case of uncertain identification the planting was not used in the study. The smallest sized individual planting used in the study was 500 seedlings. Some of the larger individual plantings ranged up to 100,000 seedlings or more.

Time of Planting

Each planting year (1959-60, 1960-61, and 1961-62) was arbitrarily divided into three planting periods or seasons so that seasonal effect on planting survival might be studied. These seasons were:

1. Fall (time seedlings lifted in fall to December 31)
2. Winter (January 1 to February 20)
3. Spring (February 21 to early May)

Planting Sites

Planting survival data were gathered for five different planting sites:

1. Field
2. Cut-over woodland
3. Disced woodland
4. Bulldozed woodland
5. Strip mine land

For the 1959-60 year "disced" and "bulldozed" sites were grouped together as "prepared sites." "Prepared sites" is omitted in both the 1960-61 and 1961-62 planting year summaries and "disced" and "bulldozed" appear instead.

Sampling or Survey Method Used

Plantings were listed for each year according to:

1. Physiographic province
2. Species
3. Planting period or season
4. Planting site

There were from 25 to 27 different planting categories each planting year from which individual plantings were randomly "drawn" and planting survival data obtained in the field. The actual number of categories varied from one planting year to another because in some years some categories did not have enough plantings listed to provide a reliable estimate of planting survival.

By way of illustrating the sampling procedure used the following actual case is presented. During the planting year 1959-60 there were 25 different planting categories. One of these categories was loblolly pine plantings made on coastal plain fields during the planting period January 1, 1960, to February 20, 1960. Available for sampling purposes was an entire listing of 101 different plantings involving a total of 813,800 loblolly pine seedlings. From this entire listing random "draws" were made to determine those plantings from which planting survival data would be taken in the field. Of this entire listing of 101 plantings a total of 48 different plantings were chosen for actual field use in determining average planting survival for this particular category. On these 48 different plantings a total of 2,000[1] planted seedlings were field checked for survival. The actual number of planted seedlings field checked on any one of these 48 plantings depended upon chance alone as did the location or locations within each of the 48 plantings where survival data were obtained. It should be pointed out that the number of plantings within a given category from which survival data were obtained depended, first of all, upon the number of plantings listed, and, secondly, on the random "draw."

Large Number of Landowners Involved

All manner and sort of landowners were included in the study. Some landowners had previous tree planting experiences—others had none.

Most landowners planted the seedlings by hand methods. Machine planting was done by some, in fields only.

Some landowners planted the seedlings themselves—others hired the planting done.

As might be expected, handling, caring for the seedlings, and efficiency of the planters varied considerably.

[1]These 2,000 seedlings were divided into units of 10 trees; therefore, there were 200 sampling "units" of 10 seedlings each for each category sampled. One unit of 10 seedlings represented the least number of planted seedlings checked for survival on any single planting.

During the 1959-60 planting year the sample size within each category was 2,000 planted seedlings. For the planting years 1960-61 and 1961-62 the sample size was reduced to 1,500 planted seedlings for each category because it was found this sample size would offer the desired precision. This changed the number of sampling units to 150.

So that the reader may be aware of the number of different plantings from which planting survival data were obtained the following summary shows by planting year the total number of plantings available for study and the actual number used from which planting survival data were taken in the field:

Planting Year	(Available) *No. Plantings*	(Used) *No. Plantings*	*Percent of Total Used*
1959-60	2,223	1,138	51
1960-61	2,789	1,220	44
1961-62	2,361	959	41
Totals	7,373	3,317	Avg. 45

Results

The following summaries by planting year show the average first year planting survival percents obtained with error term at 95 percent confidence:

Planting Year 1959-1960

Physiographic Province	*Pine Species*	*Season*	*Field*	*Cut-over*	*Prepared*	*Strip Mine*
Coastal Plain	Loblolly	Fall	76.8±2.6	67.2±3.3	65.2±3.6	
		Winter	71.2±4.0	59.4±4.3	69.4±4.1	
		Spring	70.7±4.3	63.9±3.7	66.7±3.9	
Piedmont	Loblolly	Fall	63.0±3.5	51.7±3.6	64.6±3.7	
		Winter	67.7±3.8	60.9±3.6	64.8±3.8	
		Spring	68.0±3.8	63.8±3.5	62.3±4.3	
Mountain	Loblolly	Spring	69.2±4.6	75.6±4.9		
Piedmont	Shortleaf	Spring	47.7±4.5			
Mountain	Shortleaf	Spring	70.3±4.9			
Mountain	White	Spring	65.4±3.6	73.7±4.4		
Mountain	Shortleaf	Spring				62.5±6.4

Comments on 1959-60 Planting Year:

1. Planting survival percent was generally low in all categories ranging from 48 percent for piedmont shortleaf pine field plantings (spring) to 77 percent for coastal plain loblolly pine field plantings (fall).

2. No effect of season on loblolly pine planting survival in either the coastal plain or piedmont appeared, with the possible exception of a comparison between cut-over piedmont loblolly pine plantings made in fall (52 percent survival) versus spring (64 percent survival).

3. Slightly higher loblolly pine planting survival rates were obtained on coastal plain and piedmont field planting sites than either cut-over or prepared sites.

4. Shortleaf pine planting survival in the piedmont was alarmingly low—approximately 48 percent.

Planting Year 1960-1961

Physiographic Province	*Pine Species*	*Season*	*Field*	*Cut-over*	*Disced*	*Bulldozed*	*Strip Mines*
Coastal Plain	Loblolly	Fall	57.3±3.9	50.6±5.1	68.1±3.9	36.5±5.6	
		Winter	81.1±3.8	56.3±5.3		63.6±4.7	
		Spring	77.0±4.3	66.0±3.8	72.2±4.2	75.1±4.3	
Piedmont	Loblolly	Fall	39.3±5.6	54.4±4.1		35.3±5.3	
		Winter	61.5±5.2	67.5±4.0		56.3±4.6	
		Spring	77.8±3.1	70.7±3.3	67.7±4.0	67.9±3.8	
Mountain	Loblolly	Spring	72.9±4.5	63.8±4.7			55.6±5.0
Mountain	White	Spring	86.6±2.6	86.3±2.8			
Mountain	Shortleaf	Spring	67.6±4.2				

Comments on 1960-61 Planting Year:

1. Low planting survival rates generally prevailed.

2. Time of planting or season affected loblolly pine survival in both the coastal plain and piedmont with the seasonal effect appearing stronger in the piedmont. Almost without exception, the later in the planting season loblolly pines were planted the higher the survival. This is perhaps best illustrated by piedmont loblolly pine field plantings: fall-39.3 percent; winter-61.5 percent; and spring-77.8 percent.

3. Irrespective of planting site, survival was low for loblolly pine planted in the fall (coastal plain disced sites appeared to be the only exception).

4. The "across the board" impression gained is that spring loblolly pine plantings were generally successful—a marked contrast to fall plantings. In most instances, spring loblolly plantings in both coastal plain and piedmont were more successful than winter plantings.

5. Fall loblolly pine planting survivals on bulldozed sites, both piedmont and coastal plain, were alarmingly low —35.3 and 36.5 percent respectively. Low planting survival on bulldozed sites is a real economic loss in view of the high cost of site preparation.

6. Coastal plain field and disced loblolly pine plantings proved better planting site risks (seasons combined) than did cut-over or bulldozed planting sites. For the piedmont, the effect of planting site on seedling survival was not as evident.

7. On the plus side, mountain white pine plantings (all made in the spring) on both field and cut-over planting sites resulted in high first year survival rates: fields 86.6 percent and cut-over 86.3 percent.

Planting Year 1961-1962

Physiographic Province	*Pine Species*	*Season*	*Field*	*Cut-over*	*Disced*	*Bulldozed*	*Strip Mines*
Coastal Plain	Loblolly	Fall		63.4±3.5	66.0±3.4	64.7±3.6	
		Winter	91.4±2.1	77.0±2.6		79.2±2.8	
		Spring	83.9±3.5	74.7±2.9	67.3±3.3	79.1±2.8	
Piedmont	Loblolly	Fall	60.5±4.3	72.2±4.3			
		Winter	80.2±3.3	65.9±4.8		73.0±2.7	
		Spring	81.4±3.4	75.1±3.4	75.7±3.3	74.0±3.7	
Mountain	Loblolly	Spring	81.1±2.9	66.5±5.3			66.1±4.2
Mountain	Shortleaf	Spring	70.4±4.2				62.1±3.9
Mountain	White	Spring	88.6±2.5	86.0±3.5			

Comments on 1961-62 Planting Year:

1. General planting survival, although not high, was somewhat improved over the 1959-60 and 1960-61 planting years.

2. Loblolly pine field plantings survived well on both piedmont and coastal plain sites (the only exception to this being piedmont fall plantings which averaged nearly 20 percent lower in survival than either piedmont winter or spring plantings—unfortunately, there were not enough coastal plain fall plantings to provide a reliable estimate for this category so fall and later season comparisons could not be made).

3. For coastal plain and piedmont loblolly pine plantings there are five possible fall versus spring comparisons which can be made. Three of the comparisons (coastal plain cut-over, coastal plain bulldozed, and piedmont field) show considerably higher survival rates for spring plantings than fall. For the other two categories where comparisons can be made (coastal plain disced and piedmont cut-over) there are not any noticeable fall and spring survival differences.

4. There were four categories available for fall versus winter comparisons in coastal plain and piedmont loblolly pine plantings. Three of these comparisons, winter coastal plain cut-over, winter coastal plain bulldozed, and winter piedmont field plantings show considerable higher survival rates than did their fall counterparts. The fourth comparison, piedmont cut-over, does not show much difference in survival (72.2 percent fall versus 65.9 percent winter).

5. White pine plantings survived well—88.6 percent fields and 86.0 percent cut-over.

Statistical Note

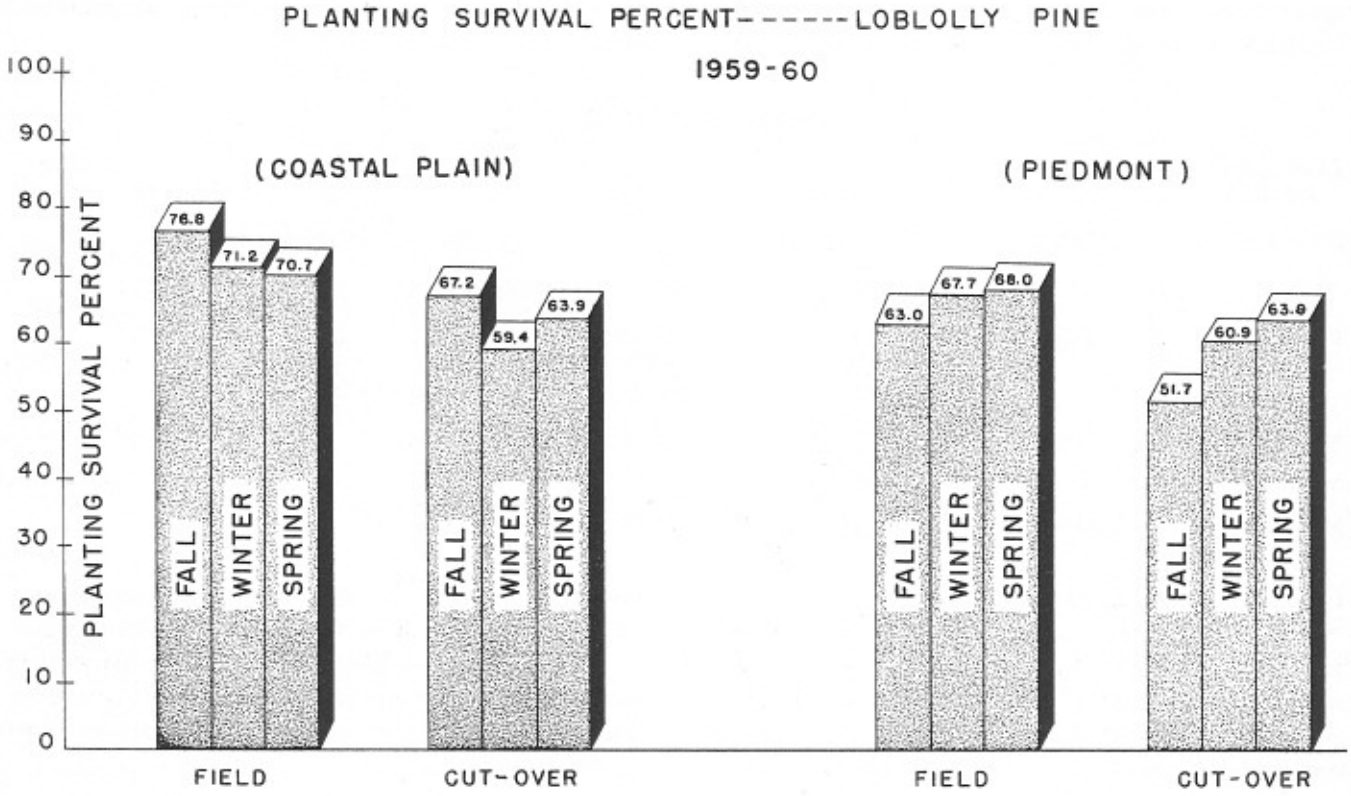
The statistics used in this report include mean or average planting survival percents with error terms expressed at the 95 percent confidence level.

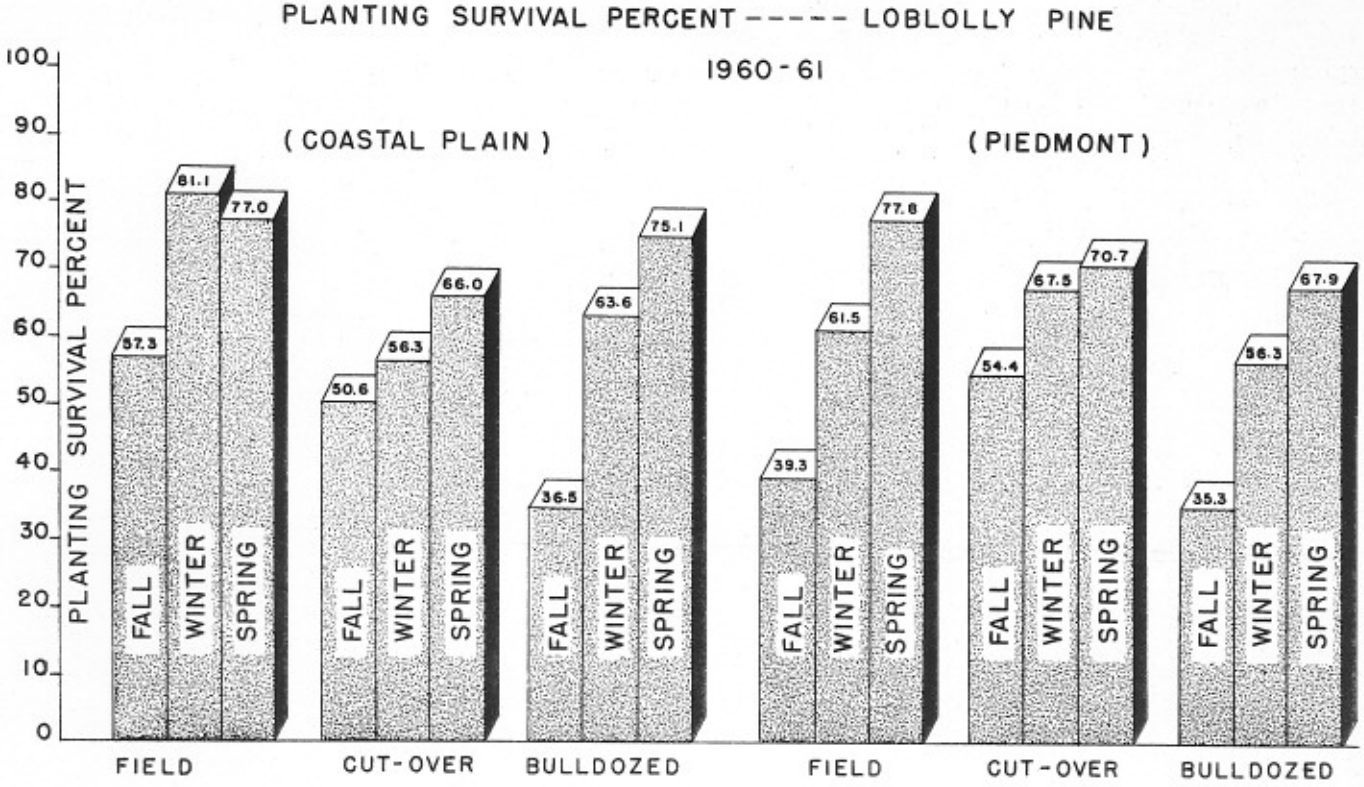
"Student's T" tests were made comparing various mean planting percents and are available, upon request.

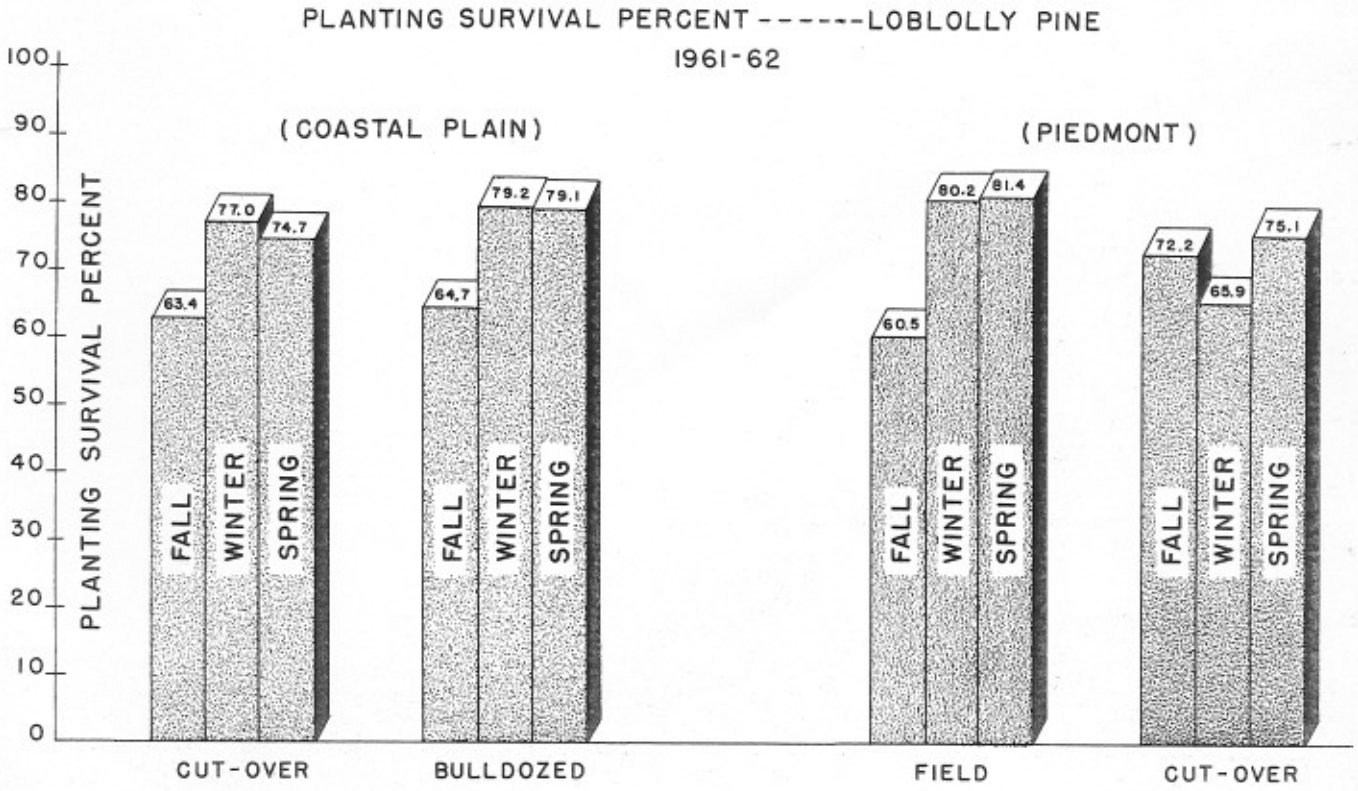
The data did not lend itself to an analysis of variance.

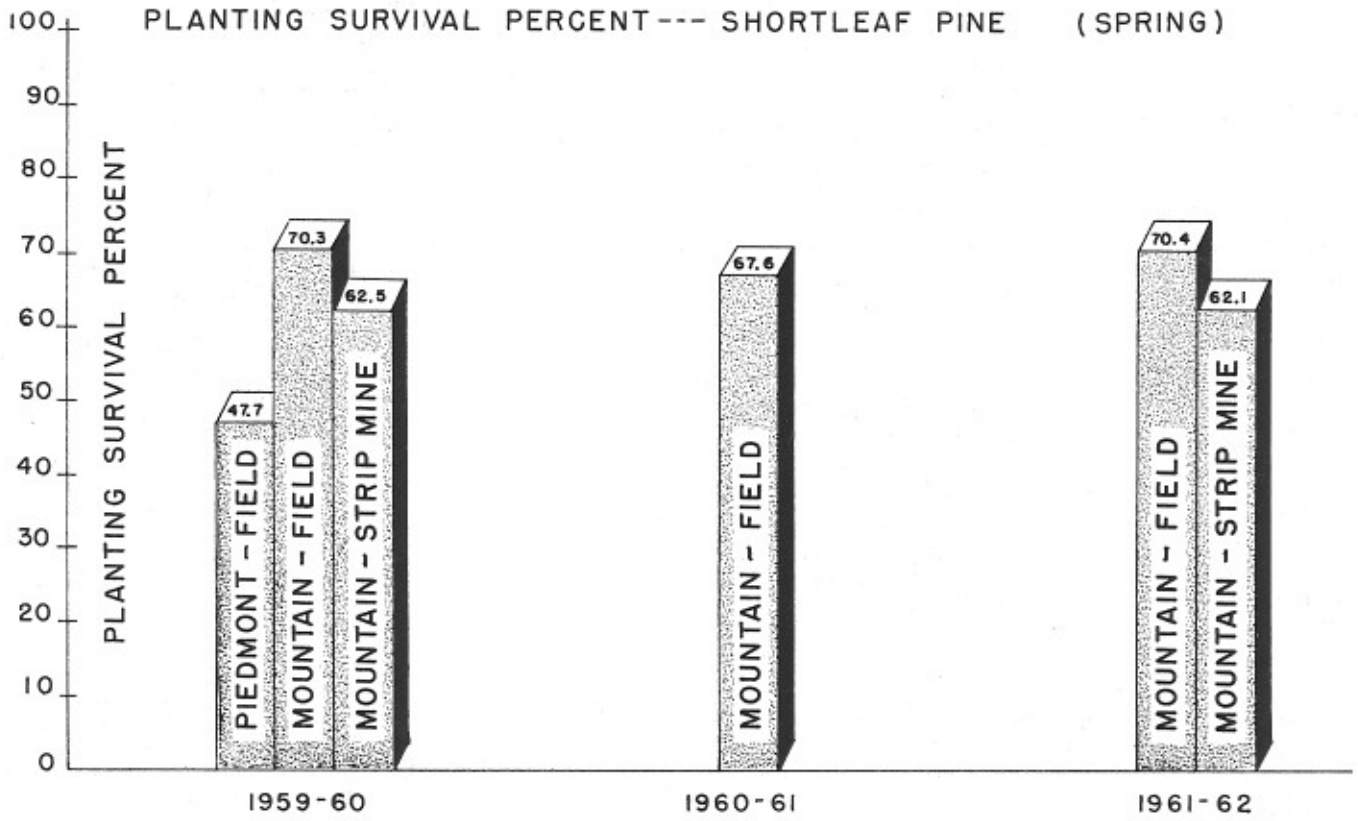
It is felt that even though a more rigorous statistical examination of the data could not be made that this in no way lessens the validity of the data presented in this report.

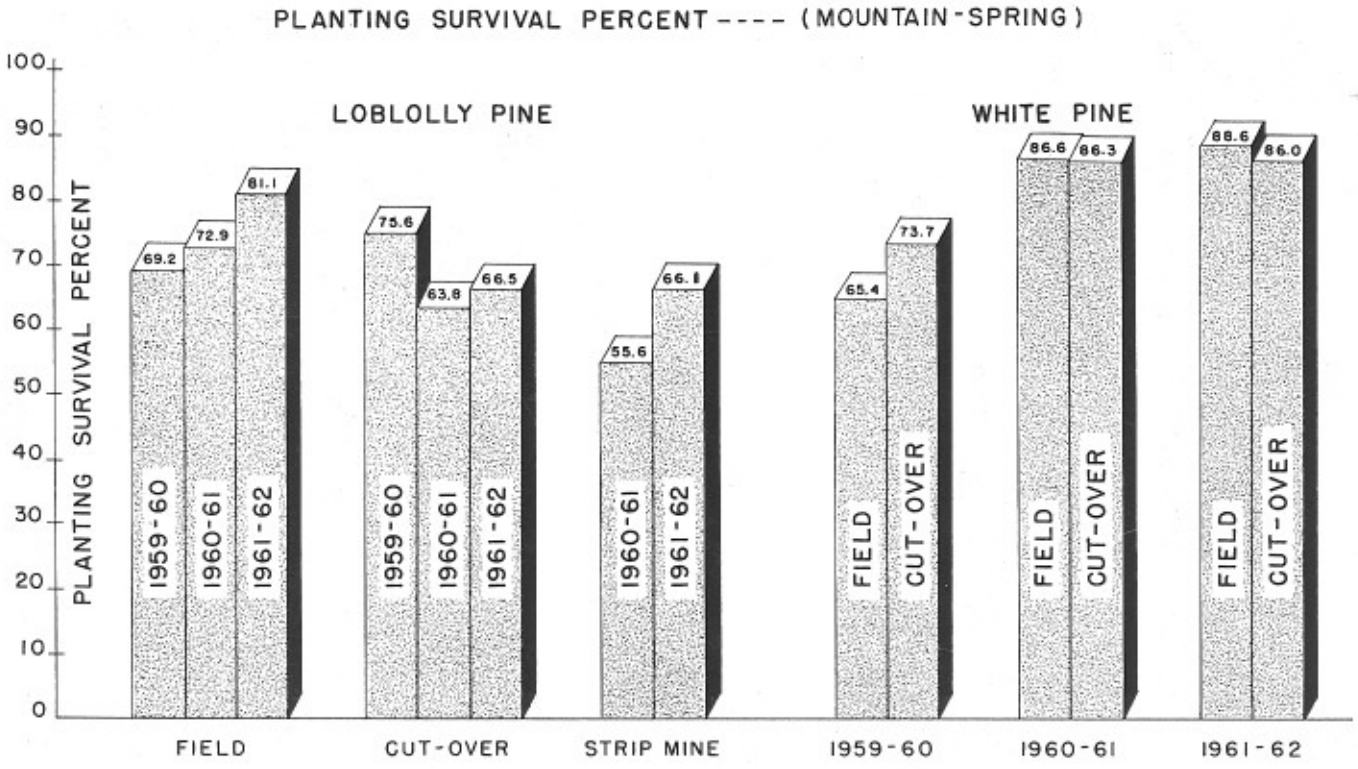
We wish to acknowledge and thank Thomas C. Evans, formerly with the United States Forest Service and presently Professor of Mensuration at Virginia Polytechnic Institute, Blacksburg, Virginia, for his guidance and help in statistical matters pertaining to this study.




PLANTING SURVIVAL PERCENT ----- LOBLOLLY PINE
1960-61
(COASTAL PLAIN)
(PIEDMONT)
PLANTING SURVIVAL PERCENT
100
90
80
70
60
50
40
30
20
10
0
57.3
81.1
77.0
50.6
56.3
66.0
36.5
63.6
75.1
39.3
61.5
77.6
54.4
67.5
70.7
35.3
56.3
67.9
FALL
WINTER
SPRING
FIELD
CUT-OVER
BULLDOZED
FIELD
CUT-OVER
BULLDOZED


PLANTING SURVIVAL PERCENT ------LOBLOLLY PINE
1961-62
(COASTAL PLAIN)
(PIEDMONT)
PLANTING SURVIVAL PERCENT
100
90
80
70
60
50
40
30
20
10
0
63.4
77.0
74.7
64.7
79.2
79.1
60.5
80.2
81.4
72.2
65.9
75.1
FALL
WINTER
SPRING
CUT-OVER
BULLDOZED
FIELD
CUT-OVER


PLANTING SURVIVAL PERCENT --- SHORTLEAF PINE (SPRING)
PLANTING SURVIVAL PERCENT
100
90
80
70
60
50
40
30
20
10
0
47.7
70.3
62.5
67.6
70.4
62.1
PIEDMONT - FIELD
MOUNTAIN - FIELD
MOUNTAIN - STRIP MINE
MOUNTAIN - FIELD
MOUNTAIN - FIELD
MOUNTAIN - STRIP MINE
1959-60
1960-61
1961-62


PLANTING SURVIVAL PERCENT ---- (MOUNTAIN-SPRING)
PLANTING SURVIVAL PERCENT
100
90
80
70
60
50
40
30
20
10
0
LOBLOLLY PINE
WHITE PINE
69.2
72.9
81.1
75.6
63.8
66.5
55.6
66.1
65.4
73.7
86.6
86.3
88.6
86.0
1959-60
1960-61
1961-62
1960-61
1961-62
FIELD
CUT-OVER
FIELD
CUT-OVER
FIELD
CUT-OVER
FIELD
CUT-OVER
STRIP MINE
1959-60
1960-61
1961-62