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**FIELD PERFORMANCE
OF
GRADE 1 AND 2
LOBLOLLY SEEDLINGS
FROM
A TOP CLIPPING STUDY**

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Abstract

A study was installed to compare light and heavy top clipping with no clipping. Grade 1 and 2 seedlings from each treatment were lifted and planted in the field in both December and March. A supplemental study compared grade 1 and 2 seedlings lifted and planted in March just from the heavy clipping.

Grade 2 seedlings survived better than grade 1 in both studies. In the main study, the differences were 5.8 percentage points for December and 1.2 points in March. In the supplemental study, the difference was 3.2 points.

By age 6 in the supplemental study, there was no difference in growth in either height or DBH between grade 1 and 2 seedlings.

Introduction

In 1988, we installed a study at our Sussex Nursery to compare two degrees of top clipping with unclipped seedlings:

- ① Control -- no clipping
- ② Light Clipping -- clipped at 8 and 10 inches
- ③ Operational Clipping -- clipped at 6, 7, and 8 inches

Clipping was done by hand. Individual plots were 5 feet long. Treatments were replicated 8 times, 4 replications in each of 2 seedbeds. The 2 seedbeds were in the same 9-bed section, and plots in both beds were located 40, 120, 200, and 280 feet from the road.

Lifting, Measuring, and Planting

Seedlings for planting in the field were lifted on December 15 and March 14. On each date, we lifted a single sample from each of the 24 plots (8 replications of the 3 treatments). Samples were 6 inches wide across the seedbed, for a 2-square-foot sample.

Seedlings from the December 15 lifting were measured on December 15 and 16, and seedlings were selected for planting in the field. The seedlings from each of the 8 samples were first separated by root collar diameter into $1/32$ -inch classes. Samples were paired to obtain enough grade 1 and 2 seedlings for four 20-seedling rows of each, from each clipping treatment. Samples from the 2 seedbeds were paired by distance in the beds, i.e. the 2 plots at the 40-foot distance were paired, etc. This procedure provided for 24 rows of 20 seedlings each to be planted in December, 4 field replications of 2 seedling sizes from each of the 3 clipping treatments. Seedlings for planting were selected from each pair of samples proportional to the number in each diameter class in each sample. Grade 2 seedlings ranged from $4/32$ to $6/32$ and Grade 1 seedlings ranged from $6/32$ to $9/32$ inch. After seedlings were selected for each 20-seedling row, top lengths were measured to the nearest inch.

The March lifting was done on March 14, and the seedlings were measured and selected for out-planting on March 17, following the same procedure as for the earlier lifting. The samples were lifted close to where the December samples were lifted, leaving about a 6-inch buffer between the 2 samples.

The seedlings were planted on December 21 and March 22, on the Appomattox-Buckingham State Forest in the central Piedmont of Virginia. The 12 field treatments (3 clipping treatments times 2 lifting dates times 2 seedling sizes) were planted in 4 randomized blocks. The winter of 1988 - 1989 was mild with abundant rainfall.

Seedbed Results

Average seedbed density, root collar diameter, and top length for the 3 clipping treatments and 2 lifting dates are presented in Table 1.

Table 1. Average bed density (number per square foot), root collar diameter (32^{nds} inch), and top length (inches) by clipping treatment and lifting date.

Treatment	Bed Density		Diameter		Top Length	
	12/15	3/14	12/15	3/14	12/15	3/14
Check	27.4	28.6	5.66	6.20	15.1	14.2
Light Clipping	25.1	26.9	5.79	6.11	11.5	11.4
Heavy Clipping	28.2	26.6	5.55	5.84	10.0	10.0
Means	26.9	27.4	5.67	6.05	12.2	11.9

Average root collar diameter was significantly larger for the March 14 lifting (probability of a larger F = 0.000003). Apparently the unusually mild winter allowed diameter growth to occur between December 15 and March 14. The heavy clipping, our operational procedure, reduced average root collar diameter slightly (probability of a larger overall F for clipping = 0.002), as always happens. This kind of clipping

produces more uniform seedlings, reducing numbers in the smallest and largest diameter classes (Table 2).

Table 2. Percent of seedlings by diameter class (32^{nds} inch), for the 3 clipping treatments and both lifting dates.

Lifting Date	Clipping Treatment	Root Collar Diameter Class								Total
		2	3	4	5	6	7	8	9	
December 15	Check	1	3	11	28	36	15	6	0	100
	Light	1	2	8	22	44	17	5	0	99
	Heavy	0	2	10	37	38	10	3	0	100
March 14	Check	0	4	4	18	34	25	11	3	99
	Light	0	1	4	21	41	25	6	2	100
	Heavy	0	0	6	30	44	16	3	1	100

Field Results

Seedlings were measured for 3 years following planting. Overall survival decreased less than a percentage point between age 1 and 3, from 92.7 to 91.8, so average survival at age 3 is presented in Table 3.

Table 3. Average survival at age 3 by clipping treatment, lifting and planting date, and seedling grade.

Clipping Treatment	Lift 12/15, Plant 12/21		Lift 3/14, Plant 3/22		Means
	Grade 1	Grade 2	Grade 1	Grade 2	
Check	82.5	90.0	91.2	94.9	89.6
Light	90.0	90.0	91.2	92.5	90.9
Heavy	88.8	98.8	96.2	95.0	94.7
Means	87.1	92.9	92.9	94.1	91.8

The unusually mild winter with abundant rainfall resulted in unusually high survival rates for the seedlings planted in December. Differences due to top clipping are usually greater than occurred in this study. An analysis of variance was performed after transforming average survival percents to arc sine percent. The overall effect of clipping was not statistically significant (probability of a larger F = 0.092), but heavy clipping was significantly better than no clipping (probability of a larger F = 0.041). Seedlings lifted and planted in March survived better than seedlings lifted and planted in December, but the difference was not quite significant (probability of a larger F = 0.052). Grade 2 seedlings survived better than grade 1 (probability of a larger F = 0.028). None of the interactions among clipping treatments, lifting and planting date, and seedling grade were significant. Although the interactions were not significant,

clipping was more beneficial for December planting and the difference between grade 1 and 2 seedlings was greater in December, which is what we would expect.

Average height at age 3 is presented in Table 4.

Table 4. Average height (in feet) at age 3 by clipping treatment, lifting and planting date, and seedling grade.

Clipping Treatment	Lift 12/15, Plant 12/21		Lift 3/14, Plant 3/22		Means
	Grade 1	Grade 2	Grade 1	Grade 2	
Check	6.1	6.2	6.3	5.9	6.1
Light	6.4	5.9	6.1	6.2	6.1
Heavy	5.9	6.1	5.7	5.7	5.9
Means	6.1	6.1	6.0	5.9	6.0

Heavy clipping reduced age 3 heights by about 0.2 foot, which is less than the difference in top length that existed when the seedlings were lifted (Table 1). The overall difference in height between grade 1 and 2 seedlings was 0.08 foot, which is about equal to the average difference in top length when the seedlings were lifted, which was 0.07 foot. Age 3 average heights were subjected to an analysis of variance, and none of the main effects or their interactions were significant.

Supplemental Study

We installed another study on the same tract to compare grade 1 and 2 seedlings in block plots of 49 seedlings each, 7 rows of 7 seedlings each at a spacing of 8 by 8 feet. The seedlings were lifted on March 13 from the heavy clipping plots (clipped 3 times) of the main study. When lifting these seedlings we stayed well away from where the samples for the main study were lifted the next day. We lifted 8 batches of seedlings, from each of the 8 seedbed replications of the heavy clipping treatment. The grade 1 and 2 seedlings were separated for each sample, and from each sample we randomly selected 49 seedlings of each grade for a pair of plots in the field. Consequently, there were 8 pairs of plots in the field and these were planted on March 17. Two buffer rows were planted around the 16 plots at the same 8 by 8 foot spacing, using grade 1 trees to buffer grade 1 plots and grade 2 seedlings for grade 2 plots.

Heights were measured at age 1, 2, 3, 4, and 6, and DBH to the nearest 0.1 inch was measured at age 6. Average survival and height at each measurement and average DBH at age 6 is presented in Table 5.

Table 5. Average survival and height (in feet) at age 1, 2, 3, 4, and 6, and average DBH (in inches) at age 6.

Age	Survival		Height		DBH	
	Grade 1	Grade 2	Grade 1	Grade 2	Grade 1	Grade 2
1	86.5	89.9	1.09	1.05	--	--
2	86.0	89.6	2.65	2.60	--	--
3	85.7	89.0	5.52	5.40	--	--
4	85.5	88.7	9.12	8.98	--	--
6	85.0	88.2	16.12	15.90	3.06	2.97

At age 6, grade 2 seedlings had survived 3.2 percentage points better than grade 1, were 0.22 foot shorter (2.6 inches), and 0.09 inches smaller in diameter (about $\frac{2.9}{32}$ inch). The differences in height and DBH are about the same as existed between the two groups of seedlings when they were lifted. Analyses of variance for age 6 survival (after first transforming to arc sine percent), height, and DBH were performed, and differences between grade 1 and 2 seedlings were not statistically significant (probability of a larger F = 0.530, 0.637, and 0.533 for survival, height, and DBH, respectively).