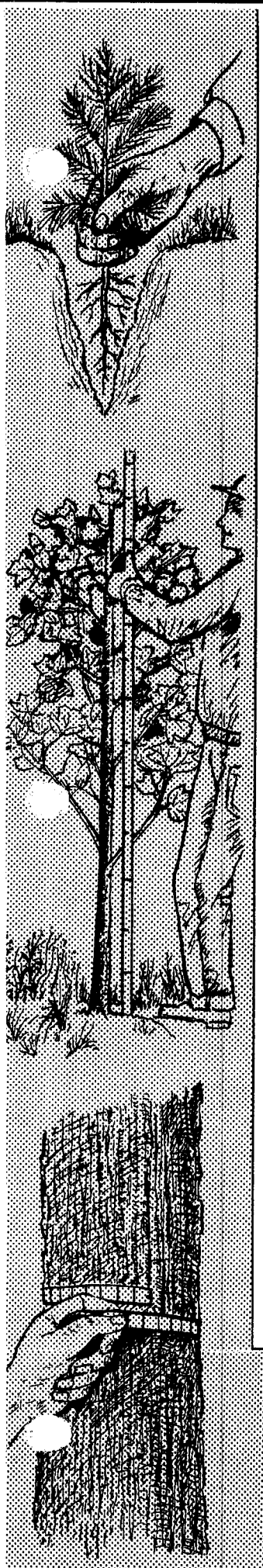

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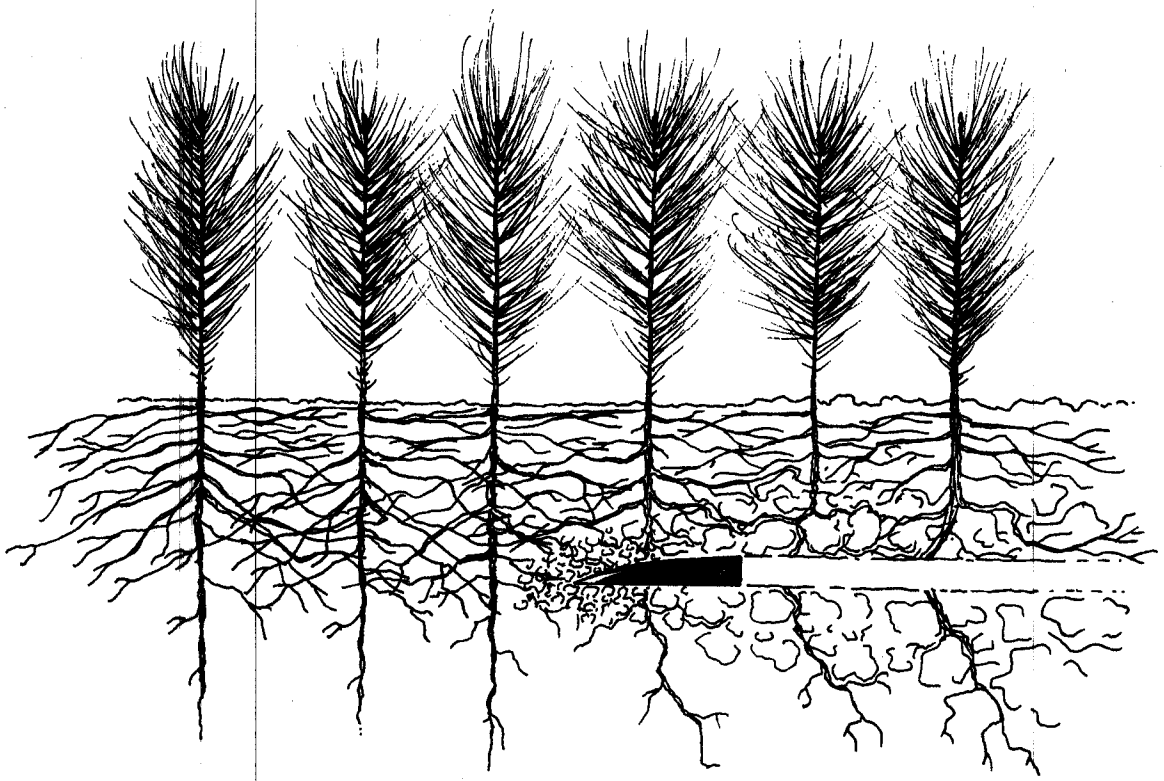
LOBLOLLY PINE UNDERCUTTING, LATERAL ROOT PRUNING, TOP CLIPPING STUDY



Virginia Division of Forestry
Department of Conservation and Economic Development

A STUDY OF UNDERCUTTING, LATERAL ROOT PRUNING AND TOP CLIPPING IN LOBLOLLY PINE NURSERY BEDS

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ABSTRACT

Loblolly pine seedlings were undercut and lateral root-pruned in the nursery seedbeds on three different dates: August 8, September 1, and October 4. Half of each plot was top-clipped on September 1.

In the seedbeds, diameter was reduced by undercutting, but not by lateral-root pruning or top-clipping. Top length was reduced by undercutting and top clipping, but not by lateral pruning. Only the August undercutting had a noticeable effect on root system morphology.

After planting in the field, none of the treatments affected survival, but undercut seedlings grew slightly better.

DESCRIPTION OF STUDY

A study to test the effects of undercutting, lateral root pruning and top clipping was installed in loblolly pine seedbeds at the New Kent Nursery in the summer of 1977. The following 7 undercutting treatments were replicated in 3 different seedbeds (the 3 seedbeds were in different nursery blocks). Each plot was a 20 foot length of seedbed.

1. Not undercut
2. undercut 8/8
3. " 8/8 and 9/1
4. " 8/8, 9/1 and 10/4
5. " 9/1
6. " 9/1 and 10/4
7. " 10/4

Each plot was divided in half to produce two 10 foot long subplots, and each subplot was again divided in half to produce two 5 foot long sub-subplots. Lateral root pruning was done on half of each plot (subplot) that was undercut. Lateral pruning was done each time undercutting was done. The lateral pruning was done first, with undercutting following immediately. Top clipping was done on half of each subplot (sub-subplot). All top clipping was done on September 1. The experimental design was, therefore, a split-split-plot with undercutting treatments assigned to main plots, lateral pruning to sub-plots, and top clipping to sub-sub plots.

The undercutting was done at a depth of about 5 inches, and was followed immediately by irrigation. This worked satisfactorily in a preliminary test of the undercutter when the soil was moist. However, when the first undercutting treatment was applied on August 8 the soil was drier and looser than it was during the preliminary test (the soils at the New Kent Nursery are loamy sands and sands with typically close to 90 percent sand in the topsoil). There were many fissures running across the beds after undercutting and in one of the three seedbeds the roots were dragged and the seedlings leaned at about a 45 degree angle after undercutting. The seedlings in all three seedbeds quickly wilted and the terminals drooped. They did not fully recover during irrigation, however, they had fully recovered by the next morning. We learned from this experience and made sure the soil was moist, irrigating if necessary, before undercutting on September 1 and October 4. No wilting (or leaning) occurred following these undercuttings.

Lateral root pruning was done to a depth of 3 to 4 inches, using coulters running midway between each row of seedlings (seedbeds contain 8 rows of seedlings and are separated by paths 2 feet wide).

Top clipping was done at a height of 7 inches with hand shears. When the clipping was done on September 1, the proportion of seedlings clipped on a plot was strongly affected by whether or not the plot had been undercut on August 8. The August 8 undercutting reduced height growth, so that considerably fewer seedings were tall enough to be clipped on these plots.

Height growth at the New Kent Nursery usually stops about the first of October. Considerable diameter growth occurs during October, but usually stops about the first of November. Considerable root growth occurs during both October and November, sometimes continuing even into December.

SEEDBED RESULTS

The August 8 undercutting caused scattered seedling mortality in the seedbed in which the seedlings were dragged. Obviously, the soil was too dry when the undercutting was done.

Seedlings were dug up at the ends of some of the undercutting plots on September 1, prior to the second undercutting, and on October 4, prior to the third undercutting. The purpose of this was to look for effects of the earlier undercuttings on new root growth and root system morphology. By September 1, the seedlings undercut on August 8 had produced new sinker roots close to the point of cutting. These sinker roots formed at the severed tap root and on cut or broken lateral roots.

On December 6 a 3-inch wide (one square foot) sample across the bed was lifted from the central portion of each sub-subplot. It was noticed while lifting the samples that seedlings undercut on August 8 were harder to pull; they had more lateral roots resulting in a denser root system. The September 1 and October 4 undercuttings did not noticeably alter root system morphology.

Root collar diameter and top length were measured on all of the seedlings in each sample. Analyses of variance were carried out on sample means for seedbed density, root collar diameter, and top length.

Seedbed Density

Seedbed density averaged 38 seedlings per square foot. None of the treatments had a significant effect on seedling numbers (despite the fact that some seedlings were killed by the August 8 undercutting).

Root Collar Diameter

Undercutting significantly reduced diameter growth (probability = .0008), but lateral pruning and top clipping did not (Table 1). None of the interactions among treatments were significant. Growth reduction was related to date of undercutting. August undercutting reduced diameter about 13%, September undercutting about 8%, and October undercutting about 3% (Table 1).

Table 1. Mean Root Collar Diameter (32nds inch) As Affected By Undercutting, Lateral Root Pruning, and Top Clipping

	Lateral Pruning		Top Clipping			
Undercutting	Yes	No	Yes	No	Combined	
Not Undercut	-	-	4.71	4.83	4.77	
8/8	4.29	4.17	4.18	4.28	4.23	
8/8, 9/1	4.14	3.97	4.08	4.03	4.05	4.16
8/8, 9/1, 10/4	4.17	4.20	4.18	4.19	4.19	
9/1	4.33	4.43	4.32	4.44	4.38	
9/1, 10/4	4.49	4.34	4.32	4.51	4.42	4.39
10/4	4.49	4.76	4.70	4.55	4.62	
Means	4.32	4.31	4.36	4.40	4.38	

Top Length

Undercutting and top clipping both significantly reduced top length (probability = .00002 and .0000006 respectively). The interaction between undercutting and top clipping was also significant (probability = .03). This interaction is explained by the reduced height growth on plots undercut on August 8, so when the top cliping was done on September 1 a smaller percentage of seedlings were clipped on these plots. Lateral root pruning had no effect on top length (Table 2).

Table 2. Mean Top Length As Affected by Undercutting, Lateral Root Pruning, and Top Clipping

	Lateral Pruning		Top Clipping			
Undercutting	Yes	No	Yes	No	Combined	
Not Undercut	-	-	7.12	8.68	7.90	
8/8	6.20	6.18	6.02	6.36	6.19	
8/8, 9/1	6.46	6.35	6.23	6.58	6.41	6.22
8/8, 9/1, 10/4	6.21	5.95	5.83	6.32	6.08	
9/1	7.62	7.65	6.91	8.36	7.63	
9/1, 10/4	7.56	7.28	6.90	7.94	7.42	7.53
10/4	7.58	7.99	7.18	8.39	7.78	
Means	6.94	6.90	6.60	7.52	7.06	

FIELD PLANTING

Procedure

Seedlings were selected for planting in the field from the same samples that were lifted and measured to evaluate seedbed treatments. Lateral root pruning had no measurable effect in the seedbeds, so lateral pruned and unpruned seedlings were combined for field planting. Therefore, fourteen treat ments were planted in the field (7 undercutting x 2 top clipping = 14 treatments). There were 6 samples (from 6 different sub-subplots) from which to select seedlings for each treatment planted in the field. Representative samples were obtained by taking proportional numbers of seedlings from each diameter class from each of the 6 samples per treatment.

The seedlings were planted on December 14 on a well-drained upland site on the Buckingham State Forest in the central piedmont. The winter of 1977-78 was unusually cold and the seedlings turned brown, but most of them recovered and overall survival was good.

The height of each surviving seedling was measured after one, two and three seasons in the field. Considerable girdling by mice occurred during the winter of 1979-80, after the second season in the field, causing scattered seedling mortality during the third season.

Survival

Overall survival for all treatments was 89, 88 and 81 percent after 1, 2, and 3 seasons in the field. The big drop between the second and third season was due to girdling by mice, which was not evenly distributed over the plots. Survival after the second season in the field, therefore, is summarized in Table 3. Undercutting and top clipping had no consistent effect on survival[1/].

Table 3. Average Survival by Treatment After the Second Season in the Field

Undercutting	Clipped	Not Clipped	Means
Not Undercut	88	87	88
8/8	83	90	87
8/8, 9/1	92	93	92
8/8,9/1, 10/4	95	92	93
9/1	92	75	83
9/1, 10/4	82	88	85
10/4	97	77	87
Means	90	86	88

[1/] Survival percents were transformed to arc sin and an ANOV was made. Neither undercutting or top clipping significantly affected survival.

Height Growth

The effect of undercutting and top clipping on height growth is shown in Table 4. After three seasons in the field, undercut seedlings averaged about 0.4 feet taller than check seedlings (probability = .036)[2/]. Top clipped seedlings averaged about .1 feet taller than unclipped seedlings, but this difference was not statistically significant[2/].

Table 4. Average Height by Treatment After Three Seasons in the Field

	Average Height in Feet		
Undercutting	Clipped	Not Clipped	Means
Not Undercut	4.9	4.5	4.7
8/8	5.3	5.0	5.2
8/8, 9/1	5.0	5.1	5.0
8/8, 9/1, 10/4	5.4	5.0	5.2
9/1	4.8	4.8	4.8
9/1, 10/4	5.2	5.2	5.2
10/4	5.4	5.1	5.3
Means	5.1	5.0	5.1

DISCUSSION

Undercutting reduced the size of the seedlings in the seedbed; both diameter and height were reduced. The August undercutting affected root system morphology, resulting in a denser root system. In the field, undercutting did not affect survival, but did improve height growth slightly. Considering that the August undercutting was done when the soil was too dry, dragging the seedlings, we feel that undercutting deserves further testing at the New Kent Nursery. Lateral pruning, on the other hand, had no effect on the seedlings.

Top clipping has been a standard practice at the New Kent Nursery for several years. It controls height growth and promotes more uniform seedlings that usually survive somewhat better.

2/ An ANOV was made of mean heights after 3 seasons in the field. The effect of undercutting was significant (probability =.036), but top clipping and the interaction of undercutting and top clipping were not.