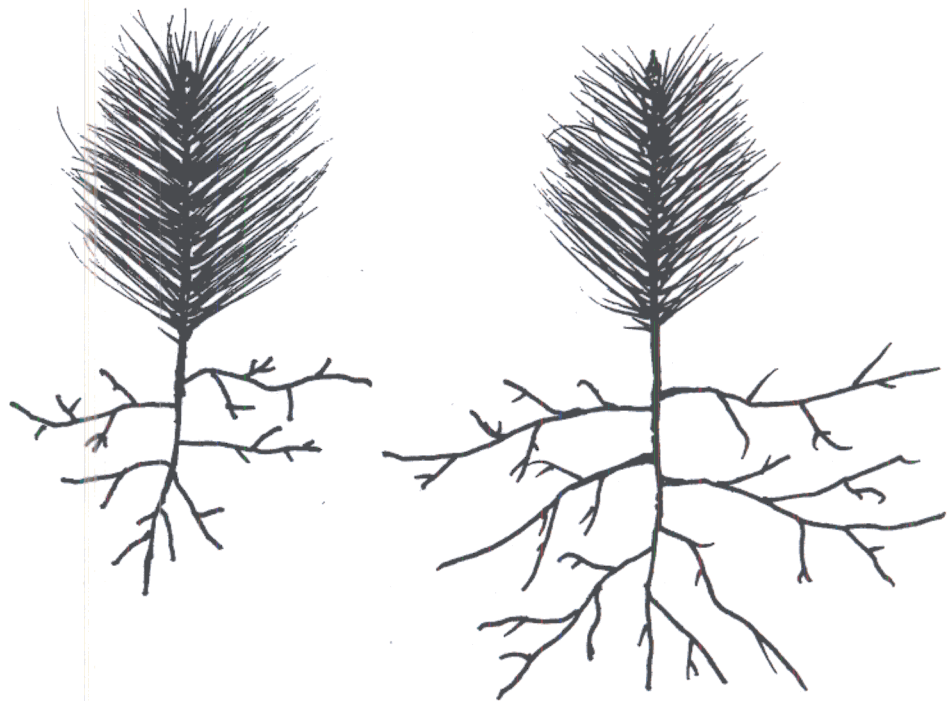
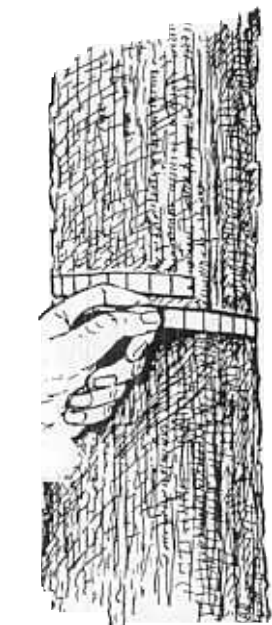
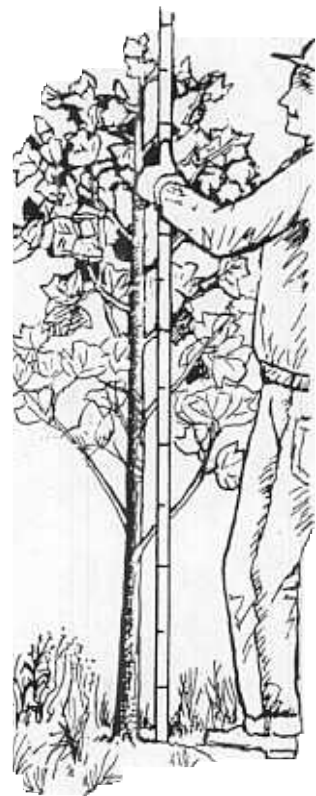


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ROOT PRUNING

WHITE PINE SEEDLINGS PRIOR TO PLANTING



Virginia
Department of Forestry



ROOT PRUNING WHITE PINE PRIOR TO PLANTING
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ABSTRACT

In six separate studies over a four year period, we tested pruning seedling roots to lengths of 1, 3, and 5 inches, and compared them to unpruned seedlings. Roots were pruned to 1 inch in two studies, 3 inches in six studies, and 5 inches in four studies. Pruning roots to a 1-inch length reduced survival drastically, by 60 and 75 percentage points for the two studies. Pruning roots to a 3-inch length reduced survival an average of 12 percentage points and pruning to a 5-inch length reduced survival an average of 3 percentage points. Height growth of surviving seedlings was not greatly affected by root pruning, even the most severe pruning.

INTRODUCTION

Over a three year period from 1971 to 1974, we installed five separate studies of the effect of root pruning on loblolly pine seedling survival. The results were reported in our Occasional Report 52. Root pruning to lengths of three and five inches was compared to no root pruning on small seedlings (2½ to 4/32-inch root collar diameter) and large seedlings (5 to 6½/32-inch root collar diameter). Seedlings were root pruned one at a time, smoothing all roots down along the tap root and cutting all roots either three or five inches below the point where the first root emerged. The five-inch pruning had little effect on survival; compared to unpruned seedlings, five-inch pruning increased survival of small seedlings by one percentage point and reduced survival of large seedlings by four percentage points. The three-inch pruning reduced survival significantly; compared to unpruned seedlings, three-inch pruning reduced survival of small seedlings by 6 percentage points and large seedlings by 8 percentage points (Occasional Report 52).

Similar studies were installed with white pine seedlings in 1980, 1981, 1983 and 1984.

PROCEDURES

Spring of 1980 -- Two Studies

Identical studies were installed on two separate tracts in southwest Virginia. A single, standard package of 500 white pine seedlings was used for each study. Our intention was to test pruning treatments of three and five inches, as we had done with loblolly. The seedlings in these two packages,

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however, had sustained considerable root damage during lifting, so that five-inch pruning would have been similar to no pruning on most seedlings. Consequently, we decided to prune roots to lengths of one and three inches, measured from the point where the first lateral root emerged.

The two root pruning treatments plus an unpruned control were replicated five times in each study, planting a 20-seedling row of each treatment in each replication. This required a total of 15 bundles of 20 seedlings each. A standard package of 500 seedlings contains 10 bundles of 50 seedlings each. These 10 bundles were opened, and two seedlings were randomly taken from each to obtain the 20 seedlings for each row to be planted in the field. In this manner, the seedlings for each planting row were systematically taken from throughout the package. Root pruning was done after the seedlings were selected for planting.

One person did all of the planting, and seedlings were planted about one inch deeper than they grew in the nursery on the Cox tract and from one to three inches deeper than they grew in the nursery on the Bowman tract. The Cox tract was planted on March 21, and the Bowman tract on April 15.

Spring of 1981 -- One Study

This study compared seedlings pruned to three and five inches with unpruned seedlings. For the three and five-inch pruning treatments, seedlings were planted at two depths. Half were planted two inches deeper than the seedlings grew in the nursery, and half were planted to the bottom of an eight inch hole, at a depth three to five inches deeper than the seedlings grew in the nursery, being careful not to bury the terminal bud of very short seedlings. The unpruned seedlings were all planted to the bottom of an eight-inch hole. This made a total of five different treatments. These five treatments were replicated five times, using 20-seedling rows. Standard, 500 seedling packages were opened, and each bundle of 50 was evenly counted into the 25 groups of 20 seedlings each needed for planting. Pruning was done as in the previous study. Seedlings were planted on April 8, on the Knox Tract in southwest Virginia.

Spring of 1983 -- Two Studies

These two studies were similar to the study installed in 1981. Unpruned seedlings and seedlings root pruned to three and five inches were planted to the bottom of an eight-inch hole, with seedlings pruned to three and five inches also planted at shallower depths, for a total of five treatments. Seedlings were selected and pruned in the same manner as described for the previous two years. The five treatments were replicated five times in each study, using 20-seedling rows. On the Stafford tract, in the northern Shenandoah Valley, the two planting depths were at the root collar and to the bottom of an eight-inch hole. On the Dixon tract, in southwest Virginia, the two planting depths were one to two inches deeper than the seedlings grew in the nursery and to the bottom of an eight-inch hole.

Spring of 1984 -- One Study

This study included the same three pruning treatments as the previous two years. Seedlings between 5/32 and 9/32 inch in root collar diameter were selected for the study. The three treatments were replicated three times, using 20-seedling rows. Seedlings were planted on March 21, and we planted them about three inches deeper than they grew in the seedbed. This study was planted on the Appomattox-Buckingham State Forest in the central Piedmont of Virginia.

RESULTS

The studies were measured each year for several years after planting. Unlike loblolly pine, white pine seedlings sometimes suffer considerable mortality during the second year following planting. Therefore, survival is presented after three or four years, as well as after the first year, for each of the studies (Table 1).

A summer drought caused extremely low first-year survival on the Stafford tract in 1983. The landowner mowed the study area and replanted it, destroying the study. Consequently, only first year data is presented for this study.

Seedlings root pruned to five inches survived almost as well as unpruned seedlings. For the four studies including 5-inch pruning, overall first-year survival was only three percentage points lower. Three inch pruning, on the other hand, is obviously too severe. All six studies included three-inch pruning, and overall first year survival averaged 12 percentage points lower than for unpruned seedlings. One inch pruning reduced survival 60 and 75 percentage points below unpruned seedlings in the two studies that included this extremely drastic treatment.

Deeper planting did not significantly improve survival of root-pruned seedlings in the three studies in which planting depth was included as a treatment. To insure that no roots end up exposed after planting, however, we believe that planting seedlings one to two inches deeper than they grew in the nursery is a good practice.

Average height at age 3 or 4 (age 1 for one study) is also presented in Table 1. Pruning roots to lengths of 3 and 5 inches had little effect on height growth.

Table 1. Survival and height for all 6 studies.1/

1980 Studies						
Treatment	Bowman Tract			Cox Tract		
	Survival		Height	Survival		Height
	1st	4th	Age 4	1st	3rd	Age 3
	90 a	90	4.0 a			2.2 a
	77 a	74	3.7 b			2.0 a
	30 b	27	3.0 c			2.0 a

1981 Study - Knox Tract			
Treatment	Survival		Height
	1st	4th	Age 4
Unpruned-deep	97 a	96	3.7 ab
5" pruning-deep	94 a	94	3.6 ab
5" pruning-"normal"	93 ab	93	4.1 a
3" pruning-deep	86 b	84	3.3 b
3" pruning-"normal"	86 b	86	3.9 a

1983 Studies					
Treatment	Dixon Tract			Stafford Tract 2/	
	Survival		Height	Survival	Height
	1st	4th	Age 4	1st	Age 1 3/
	92 a	92	3.8 a	15 a	.8
	89 a	89	3.7 a	11 a	.6
	89 a	86	3.7 a	7 a	.8
	85 a	85	3.5 a	16 a	.6
	84 a	83	3.8 a	6 a	.8

1984 Study - Appomattox State Forest			
Treatment	Survival		Height
	1st	4th	Age 4
Unpruned	88 a	68	4.3 a
5" pruning	90 a	73	4.3 a
3" pruning	82 a	80	4.3 a

- 1/ Survival percents were transformed to arc sine percent, and analyses of variance were performed. Analyses of variance were also performed on mean heights. Duncan's New Multiple Range Test was used to test for differences among treatments. Means followed by the same letter are not significantly different at the .05 level.
- 2/ Because of extremely low first year survival, the landowner mowed the area and replanted, destroying the study.
- 3/ Five of the 25 rows had no seedlings surviving, so an ANOV of mean height was not performed.