Effect of Lateral Root Pruning on Development of Nursery-Grown Longleaf Pine Seedlings

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Lateral root pruning, both across and lengthwise to the bed and at 2-, 4-, 6-, and 8-week intervals, failed to stimulate new roots on the first 6 inches of longleaf nursery seedling taproots. The results indicated that, 90 days after germination, longleaf seedlings have developed basically all their potential lateral roots over the first 6 inches of the taproot. The seedlings were not undercut.

Establishment of longleaf pine *(Pinus palustris Mill.)* plantations with nursery-grown seedlings is difficult. Although many factors are important for seedling survival, a well-developed, fibrous root system is believed to enhance seedling survival probability. Seedlings with a fibrous root system are expected to have a greater probability of survival after outplanting, because more roots are available to regenerate new roots, to hold a greater nutrient pool in the seedlings, and to present a greater root surface area to absorb water.

In 1965, Shoulders (*1*) reported that undercutting of longleaf pine seedlings in the nurserybed promoted root development and increased outplanting survival. He concluded that longleaf seedlings should be undercut to a depth of 7 inches in October or November and at least 1 month before lifting. June, August, and December undercuttings were also effective in promoting survival; however, summer root-pruned stock developed new roots, which had to be repruned during grading. Shallow root undercutting (at 4 inches) also increased survival, but the short-rooted seedlings were considered to be more difficult to plant. Finally, a shallow root pruning (4 inches) in June followed by a deep root pruning (7 inches) in November was only slightly more effective than a single root pruning.

Tinus (*2*) reported that lengthwise and cross-bed lateral root pruning, in addition to undercutting the seedlings, was under intensive study in New Zealand forest tree nurseries. These studies indicate that increases in survival and initial growth are sufficient to take 1 year off a 27-year rotation.

The objective of this study was to determine whether systematic lateral pruning would stimulate lateral root development along the taproot of longleaf pine seedlings.

Materials and Methods

Two-week-old longleaf seedlings were transplanted from germination trays into a 90-foot nurserybed at the Alexandria Forestry Center. The seedlings were transplanted 3 inches apart within rows; rows were spaced 4 inches apart. The final seedling bed density was 12 per square foot. All of the seedlings were transplanted on March 11, 1980.

Lateral root pruning was initiated in mid-June and continued through October. The specific pruning treatments were: (1) a control, which was not pruned; (2) across-row pruning and no within-row pruning at the time of lifting; (3) pruning across and within rows at time of lifting; (4) pruning every 2 weeks across rows and no within-row pruning; (5) pruning every 2 weeks across and within rows; (6) pruning every 4 weeks across rows and no within-row pruning; (7) pruning every 4 weeks across rows and within rows; (8) pruning every 6 weeks across rows and no within-row pruning; (9) pruning every 6 weeks across and within rows; (10) pruning every 8 weeks across rows and no within-row pruning; and (11) pruning every 8 weeks across and within rows. Because of the nature of the beds, no undercutting was done.

Each of the 11 pruning treatments occupied a plot area of 4 linear feet along the nurserybed and were one-half of the width of the bed. Each treatment was replicated four times in randomized complete plots. Each replicate had 80 seedlings for a total of 320 seedlings per treatment. The middle row of the seedling bed was sown, but these seedlings were not used in this study in order to eliminate border effects. All pruning was done by sawing through the soil with a sharpened machete at a mid-distance between the seedling rows.

A control check on the effectiveness of lateral root pruning for stimulating root development was done on July 11 (the first pruning date) by randomly lifting 21 seedlings from the entire nurserybed. The number of lateral roots 0.5 inches or longer between the root collar and the first 6 inches of the taproot were counted.

In mid-December 1980, 25 seedlings were randomly lifted from the interior of each replicated treatment plot, and all of the secondary lateral roots exceeding 0.5 inch were counted as above.

Results and Conclusions

The results of lateral root pruning of longleaf seedlings in either a single parallel cut across the seedling rows or a combined across- and within-row pruning regime are given in table 1.

The effect of root pruning on the stimulation of lateral root production was not dramatic, although 9 of the 10 pruning treatments had mean lateral root counts greater than the control nonpruned seedlings. The mean lateral root count ranged from 14.96 to 18.02 for the 10 treatments, while the mean lateral root count of the control seedlings was 15.58. These differences were not statistically significant at the $p<0.05$ level. The lowest mean root count (14.96) was recorded for the seedlings root pruned only lengthwise every 4 weeks (table 1). The highest mean lateral,root count (18.02) occurred for the seedlings that were root pruned both across and within rows every 6 weeks.

The mean number of lateral roots for the 21 seedlings lifted on July 11 was 15.33 (table 2). These seedlings were considered to be a control since they were randomly removed from the entire nurserybed on the day that lateral root pruning began. They had been in the nurserybeds exactly 90 days. These data indicate that lateral root growth of longleaf pine seedlings is not stimulated by lateral root pruning. Equally important, they indicate that, after 3 months of growth in nurserybeds, secondary or lateral root development along the first 6 inches of the taproot is essentially fixed. Thus, stimulus of longleaf root growth may not be possible by lateral root pruning alone.

Although root pruning was done on a 2-, 4-, 6-, or 8-week cycle in either one or two directions, no detectable difference in lateral root development showed. This is surprising since half of the plots were root pruned in both directions and thus underwent radical root volume loss. The large loss of lateral root volume suffered by the seedlings was not sufficient to stimulate new lateral root growth. However, no root undercutting was done in this study, and possible relationships with undercutting and lateral pruning are not known.

Under the conditions of this study, the results indicate that lateral root pruning, by itself, will not significantly increase the number of lateral roots within the first 6 inches of the taproot. The current method of broadcasting longleaf seed over the nurserybed has been questioned and some nursery personnel feel that longleaf should be sown in rows to permit lateral root pruning. Row-sown longleaf beds may be preferred over broadcast beds since lateral root pruning could be easily done between the rows with coulter blades. This would reduce the labor cost of root trimming done in the packing shed following lifting, but it

Table 1.—*Mean number of lateral roots longer than 0.5 inch on 9-month-old longleaf seedlings subjected to different lateral root pruning regimes (Each plot mean is based on 25 seedlings randomly selected from each nursery treatment plot.)*

Treatment code	Frequency of pruning	Method seedling beds pruned		Mean number of lateral roots/ plot				
		Lengthwise	Across	1	2	3	4	(X)
1	Not pruned	–[1]	-	18.96	15.08	12.73	15.57	15.58
2	At lifting	+[2]	-	18.52	15.44	13.00	18.00	16.24
3	At lifting	+	+	19.96	19.76	13.04	15.52	17.07
4	Every 2 weeks	+	-	20.48	17.88	17.52	14.56	17.61
5	Every 2 weeks	+	+	22.20	18.00	13.36	17.52	17.71
6	Every 4 weeks	+	-	18.52	11.81	14.44	15.08	14.96
7	Every 4 weeks	+	+	19.44	20.24	14.40	15.04	17.28
8	Every 6 weeks	+	-	18.76	16.68	13.20	21.72	17.59
9	Every 6 weeks	+	+	24.48	15.44	13.84	18.32	18.02
10	Every 8 weeks	+	-	21.00	15.92	14.92	15.52	16.84
11	Every 8 weeks	+	+	19.24	18.12	11.88	16.84	16.52

[1] – = no pruning treatment.

[2] + = pruning treatment.

is doubtful that additional lateral roots will be produced by lateral root pruning alone.

Table 2.—*Mean number of lateral roots for 21 longleaf seedlings lifted 90 days after growth in a nursery bed*[1]

Seedling	Number of roots
1	17
2	13
3	25
4	13
5	19
6	17
7	13
8	15
9	22
10	12
11	18
12	19
13	17
14	10
15	21
16	10
17	13
18	19
19	9
20	11
21	9
Average	15.33

[1] The seedlings had not been undercut or lateral root pruned. Spacing between seedlings was 3 inches and between rows fl inches. All lateral roots longer than 0.5 inch were counted.

Literature Cited

1. Shoulders, E. Root pruning in southern pine nurseries. Tree Plant. Notes. 70: 12-15; 1965.
2. Tinus, Richard W. Concepts for seedling production and handling being developed in New Zealand. In: Forest regeneration: Proceedings of the symposium on engineering systems for forest regeneration; 1981 March 2-6; Raleigh, NC, ASAE publication 10-81. St. Joseph, MI: American Society of Agricultural Engineers; 1981: 56-60.