ROOT PRUNING BOOSTS LONGLEAF SURVIVAL

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Root pruning is an effective way of reducing the high proportion of seedling failure common to longleaf pine plantations.

The Alexandria Research Center of the Southern Forest Experiment Station started a series of studies in 1955 to test survival of planted longleaf pine seedlings that had been root-pruned in the nursery beds. The results are decisive. Root pruning does improve seedling survival-most markedly on adverse sites where survival is usually lowest.

The Studies

In one stud , seedlings grown at two bed densities (18 and 27 per square foot were root-pruned in the beds in early November at a depth of 6-7 inches. They were planted on three kinds of sites. First-year survival was compared to that of unpruned stock planted on the same sites.

Another study compared survival of root-pruned (in November) and unpruned stock lifted from the beds with three degrees of care ranging from normal practice to careful hand lifting. The purpose was to determine if pruned stock required special handling.

A third study compared the effects of time and depth of pruning. Stock vas root-pruned in mid-June, mid-August, and mid-November, on each date at two different depths--3-1 inches and 6-7 inches. This study also tested double pruning--shallow (3-4 inches) in June, followed by deep (6-7 inches) in November.

Roots were pruned with a thin, sharp blade mounted behind a tractor and drawn horizontally through the bed at the predetermined depths (fig. 1). As a precaution against mortality from pruning, beds were watered immediately after pruning. All seedlings were lifted in late January or early February, so that the minimum interval

between pruning and lifting was 2 to 3 months. The maximum was 7 months, for the June treatment.

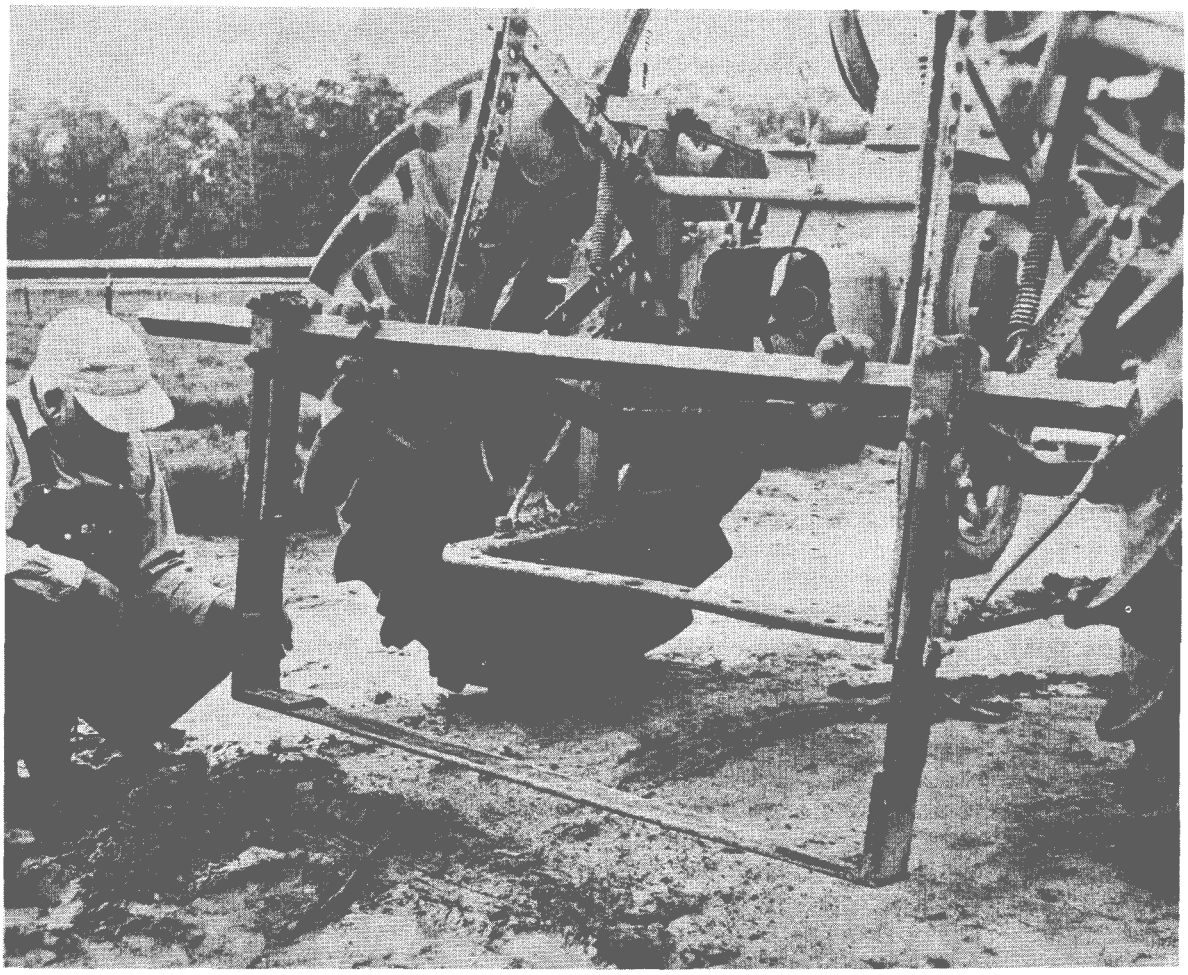

Figure 1.-Root-pruning blade mounted on tractor, ready for use.

All stock was graded, and seedlings with root collar diameters of less than 3/16 inch or needles shorter than 8 inches were culled. Unpruned seedlings with roots less than 5 inches long were also discarded. Regardless of prior pruning, seedling roots too long to plant conveniently were clipped. Seedlings were stored from 1 to 3 weeks in Forest Service bales before planting. Each treatment was replicated in field outplantings as well as in the nursery.

Effect on Survival

Root pruning in November benefited stock grown at both bed densities. The improvement was most pronounced in seedlings outplanted on a poorly drained site, where the difference in survival between pruned and unpruned stock was 17 percent (46 vs 29 percent). The survival difference between the two bed densities was not significant, but pruned and unpruned stock from low-density beds survived equally well when planted on good sites. That is, root pruning was most effective in high-density beds or when stock was planted on adverse sites.

The second study demonstrated that root-pruned longleaf seedlings require no special care in lifting to preserve their higher survival potential. Lifting methods that give good survival of normal nursery stock are adequate for root-pruned seedlings. Survival of pruned stock was 42 percent when carefully lifted, as compared to 43 percent when undercut with a lifting blade and pulled in the normal manner. Only 28 percent of the unpruned stock lived through the first year. The low survivals of all stock were probably due to the draughty site selected to obtain a rigorous test.

In the third study, all combinations of pruning depth and time boosted first-year survival of longleaf pine seedlings substantially and significantly, by comparison with unpruned stock, as follows:

Date and kind of pruning:	Survival (percent)
June	
Shallow	56
Deep	62
August	
Shallow	74
Deep	69
November	
Shallow	66
Deep	68
Double pruning (shallow in June, deep in November)	77
No pruning	27

Double pruning gave significantly higher survival than single, shallow pruning in June, but otherwise differences between the treatments were unimportant and non significant. First year survival of unpruned longleaf seedlings averaged 27 percent, while survival of root-pruned stock ranged from 56 to 77 percent. Shallow-pruned stock averaged 65 percent survival for the three planting times; deep pruned stock, 66 percent. For both depths of pruning combined, average first-year survivals of seedlings pruned in June, August, and November were 59, 71, and 67 percent, respectively.

Effect on Stock

Pruning in the nursery bed affected the root systems in different ways, depending on when the pruning was done. Seedlings pruned in June or August developed new taproots--often two or more-near the point where the original taproot was severed. These new roots extended well below lifting depth by the end of the season. November-pruned stock did not produce new taproots, but the wound area callused and, on many of the seedlings, white budlike primordia formed near the cut.

Lateral root development was not measured, but plantable seedlings from pruned and unpruned beds appeared to have about equal numbers of secondary roots above the pruning zone.

None of the pruning treatments caused mortality of seedlings in the nursery bed, Moreover, pruning had little influence on the diameter of the root collar or the length of needles of plantable seedlings, regardless of when it was done or how severely the root systems were reduced.

Discussion

These studies have demonstrated that root pruning in the nursery bed improves survival of longleaf pine seedlings. They have also shown that, within reasonable limits, time and depth of pruning are not critical to the success of the treatment. Some lapse of time between pruning and lifting is probably necessary; the minimum period was not determined, but 2 to 3 months are probably sufficient.

Root-pruned stock need not be grown at any particular bed density, nor lifted with other than the standard techniques, to retain the over-all advantage to survival.

Survival is only one of the factors in deciding when and how to root-prune. Thought must also be given to the difficulty and expense of the treatment 'in each particular nursery, as well as the ease or difficulty of planting pruned stock. When all factors are considered, late-season pruning at a depth of about 7 inches has several advantages. Little or no regrowth of roots occurs, and hence seedlings require no clipping of roots on the grading table or at the planting site. Root systems of seedlings pruned in early or middle summer are somewhat similar to those of unpruned stock,

and require clipping before planting. Shallow pruning late in the season provides the same advantage, but is not recommended because short-rooted longleaf seedlings are difficult to plant by machine.

With proper equipment, root pruning is relatively simple and easy. Tractors used for lifting are usually powerful enough to draw the blade smoothly and at a uniform speed. The tractor should be equipped with a double-acting hydraulic cylinder or other device for maintaining accurate depth settings. Positive control of both upward and downward movement of the blade is essential. The blade should be rigid, yet thin enough to pass through the soil with a minimum of disturbance. It should be mounted so that it is truly horizontal at pruning depth, and must be sharp enough to cut the roots cleanly. Blades may be mounted at right angles or obliquely to the long aids of the bed.