TOP CLIPPING IN THE NURSERY BED

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Abstract.--Loblolly pine seedlings were top elipped in the seedbed during late summer over a five year period. Clipping improved field survival, and the tallest seedlings generally benefited most from clipping.

INTRODUCTION

Tall, spindly, loblolly pine (Pinus taeda L.) seedlings do not survive as well as stockier, better-balanced seedlings. Top clipping in the seedbeds during late summer was tested to see if it would hold down top growth and produee more balanced seedlings that would survive better. Studies were installed from 1971 through 1975.

1 9 7 1 STUDY

Procedure

The following four treatments were replicated five times in a bed of taller than average seedlings and a bed of shorter than average seedlings:

1. Cheek
2. Clip 8/12
3. Clip 8/12 and 9/9
4. Clip 9/9

Seedlings were clipped to about the average height of the seedlings on August 12 and the clipping height was inereased one ineh for the September 9 elipping:

	Clipping Height	
Taller seedlings	6	7
Shorter seedlings	4.5	5.5

Average bed densities were 58 and 55 seedlings per square foot for the taller and shorter seedlings respectively, and average top length of the eheek trees at the end of the season was 10.0 and 6.8 inehes.

Outplantings were made in mid-Deeember on two sites, a eoastal plain site on the Pocahontas State Forest and a piedmont site on the Cumberland State Forest (three randomized blocks of 20 seedling rows on each site).

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Results

Clipping improved survival of the taller seedlings but not the shorter seedlings, and had little effect on height growth of surviving seedlings (table 1).

Table 1.--Average survival and height after three seasons in the field

		Survival % a/		Height	
		Pocahontas	Cumberland	Pocahontas	Cumberland
Taller	Check	51.7 a	48.3 a	6.2	5.0
	8/12	78.3 ab	95.0 b	5.9	5.2
	8/12 & 9/9	78.3 ab	91.7 b	6.0	5.0
	9/9	93.3 b	93.3 b	5.9	5.2
Shorter	Check	91.7 b	96.7 b	6.0	5.5
	8/12	98.3 b	93.3 b	5.8	5.0
	8/12 & 9/9	88.3 ab	96.7 b	5.8	5.2
	9/9	96.7 b	96.7 b	5.3	5.1

a3 Survival pereents were transformed to arc sin and an analysis of variance was made. Differences between treatments were tested using Duncan's New Multiple Range Test. Means not followed by the same letter are signifieantly different at the .01 level.

1 9 7 2 STUDY

Procedure

Four different treatments were replicated three times at four different seedbed loeations picked to give a range in seedling height. Treatments and elipping heights by seedbed location were as follows:

		Clipping Height by Seedbed			
	Treatment	V		X	Z
1.	Check	-	-	-	-
2.	Clip 8/15		4%		
3.	Clip 9/1		5.5	8	8
4.	Clip 9/15	6%	6%	8	8

The clipping heights were approximately the average heights of the seedlings at time of elipping, except the September 15 clipping in seedbeds X and Z was arbitrarily held to eight inches.

Average seedbed densities were 50, 45, 54, and 49 seedlings per square foot, and average top lengths of the check trees at the end of the season were 6.5, 5.3, 7.7, and 9.3 inches for seedbed locations V, W, X, and Z respectively.

Outplantings were made on December 15 on a piedmont site on the Buckingham State Forest (three randomized blocks of 20 seedling rows).

Results

In general, clipping improved survival (table 2). The tallest seedlings benefited the most from clipping. Clipping had little effect on height growth of surviving seedlings (table 2).

Table 2.--Average survival and height after three seasons in the field

Treatments	Survival% b/					Height				
	Seedbed Location					Seedbed Location				
	V	W	X	Z	Mean	V	W	X	Z	Mean
Check	98.3	95.0	90.0	81.7	91.2	5.4	5.1	4.8	5.2	5.1
Clip 8/15	98.3	100	93.3	90.0	95.4	4.9	5.0	4.7	5.3	5.0
Clip 9/1	96.7	98.3	91.7	93.0	94.9	5.4	4.8	4.9	5.0	5.0
Clip 9/15	100	100	96.7	98.3	98.8	5.2	5.1	5.1	4.9	5.1

b3 Survival percents were transformed to arc sin and an analysis of varianee was made. The main effects of clipping and seedbed loeation were significant at the .005 level. The interaction between clipping and seedbed location was not significant.

1 973 STUDY

Procedure

Seedlings were clipped to a height of 7 inches on September 6 at 12 randomly chosen nursery locations. Seedbed density at the 12 nursery locations ranged from 28 to 46 seedlings per square foot and averaged 37. The percentage of seedlings actually clipped (stem cut) at the 12 nursery locations ranged from 8 to 79 percent and averaged 43 percent. The average top length of the unclipped check seedlings at each nursery location ranged from 6.1 to 9.6 inehes and averaged 7.7 inches.

The clipped and check seedlings from eaeh of the 12 nursery loeations were planted separately on a piedmont site on the Buckingham State Forest (three randomized blocks of 20 seedling rows).

Results

Clipping improved survival and had little effect on height growth of surviving seedlings (table 3).

Table 3.--Average survival and height after two seasons in the field

	Survival % c/	Height
Cheek	89.0	3.18
Clipped	94.2	3.23

c3 Survival pereents were transformed to arc sin and an analysis of variance was made. The main effeet of clipping was significant at the .01 level. The main effeet of nursery location and the interaction between clipping and nursery location were not signifieant.

1 9 7 4 MAIN STUDY

Procedure

A rotary mower (bush hog) was used to clip 28 full seedbeds on September 11. Beds 2, 4, 6, and 8 in each of seven sections were clipped, leaving beds 1, 3, 5, 7, and 9 as unelipped eheeks. The mower was equipped with skids (to maintain a uniform elipping height) that ran in the paths between beds, and the clipping height was thus regulated by the depth of these paths. The average clipping height was about 8.5 inches (which *we* feel was too high; we were aiming for a height of about 7.5 inches).

A clipped sample (three inches wide across the bed) was randomly taken from each of the 28 elipped beds, and a check sample was taken along side each clipped sample. Seedbed density ranged from 9 to 60 seedlings per square foot and averaged 39. Only 23 percent of the seedlings were actually clipped (stem cut), and average top length was reduced only slightly: from 7.8 inches for unclipped to 7.2 inches for clipped seedlings.

The seedlings were planted at eight widely scattered locations, three coastal plain and five piedmont. At each planting location 100 clipped and 100 check seedlings were planted (five 20 seedling rows of each).

Results

Clipping improved survival only slightly. After one season in the field average survival is:

Clipped - 81.5%

Check - 79.6%

This difference is not statistieally signifieant.

1 9 7 4 SUPPLEMENTAL STUDY

Procedure

Five of the 28 seedbeds that were mowed had enough slope at one end so that

considerable soil erosion had occurred in the paths between beds. This caused the seedlings to be clipped shorter and shorter toward the ends of the beds. In each of the five beds, samples **(six** inches wide across the bed) were lifted where the clipping height was 7.5, 6.5, and 5.5 inches. A pair of eheek samples were lifted on either side of each clipped sample.

The seedlings were planted on a piedmont site on the Cumberland State Forest on December 18 (three randomized blocks of 20 seedling rows).

Results

Clipping to a height of 7.5 inches redueed survival slightly (table 4).

Table 4.--Average survival after one season in the field

Treatment	Survival %
Check	90.2
Clip to 7.5	90.7
Clip to 6.5	91.7
Clip to 7.5	86.8

d3 An analysis of variance was made using the survival differences between clipped and check seedlings for each sample (three clipping heights x five seedbeds). The main effect of clipping height was not significant.

1 9 7 5 STUDY

Procedure

The following eight treatments were replieated three times at two seedbed locations, one with tall, spindly seedlings and the other with shorter seedlings (still taller than the average for the nursery):

1. Check
2. Clip 8/14
3. Clip 8/14 & 9/2
4. Clip 8/14, 9/2,
7. Clip 8/14 &9/15
6. Clip 9/2
7. Clip 9/2 & 9/17
8. Clip 9/15

Clipping height was 7 inches on all dates. Average seedbed density was 71 and 44 seedlings per square foot for the taller and shorter seedlings respectively. The

percent of seedlings elipped was as follows:

	Taller Seedlings	Shorter Seedlings
Clip 8314	88	73
Clip 932	94	66
Clip 9317	98	62

The seedlings were planted on a piedmont site on the Buckingham State Forest on December 29 (four randomized blocks of 20 seedling rows).

Results

Survival was tallied in mid-July (this is early to be determining survival, and we expeet survival to drop further before it stabilizes). Clipping was very beneficial, especially for the taller seedlings, and September clipping was better than August clipping (table 7).

Table S.--Average survival midway through the first season in the field

	Survival %[ej]	
Treatment	Taller Seedlings	Shorter Seedlings
Check	20 a	67 a
Clip 8314	30 ab	73 ab
Clip 8314, 932	34 ab	84 ab
Clip 8314, 932, 9317	48 be	86 b
Clip 8314, 9317	77 c	91 b
Clip 9/2	79 e	90 b
Clip 932, 9/17	67 c	90 b
Clip 9317	77 c	92 b

e3 Survival percents were transformed to arc sin and an analysis of variance was made. Differences between treatments were tested using Dunean's New Multiple Range Test. Means not followed by the same letter are significantly different at the .01 level.

DISCUSSION

Clipping stops height growth for about three weeks. Several fascicle buds develop just below the cut during this three week period, and when these begin to elongate, height growth resumes. Seedlings that are not clipped (shorter than the elipping height used) continue height growth, and top clipping tends to "release" these seedlings.

Clipping therefore produces seedlings of more uniform size. Top length, of

course, is much more uniform, but stem diameter is also more uniform. Beeause of the release effect, clipping results in somewhat fewer small diameter seedlings. At the same time, the diameter growth of the large seedlings (that are elipped) is reduced. The overall result is a seedling crop with fewer small seedlings and large seedlings, with more of the seedlings in the average stem diameter classes.

Clipping does not seem to have any effect on the size of the root system. In all of our studies, clipped and unclipped seedlings (of the same root collar diameter) have appeared to have root systems of the same size. Clipped seedlings, therefore, have better top to root ratios, beeause top length is redueed while size of root system does not seem to be affeeted.

We believe, however, that there may be a physiologieal benefit from top clipping in addition to a possible benefit from improvement in physical balance between tops and roots. September elipping has been better than August elipping in most cases (especially in the 1975 study), and yet seedlings elipped in August are not very different from seedlings clipped in September with respect to top to root ratio. There may be a physiological response to elipping that is more favorable with September clipping than August clipping.

Forking has not been a problem. When height growth resumes in the seedbed there are often several leaders, which are present when the seedlings are planted in the field. But one leader soon dominates, and we have not found any forked seedlings (with forks originating from the point of elipping) after two or three seasons in the field.