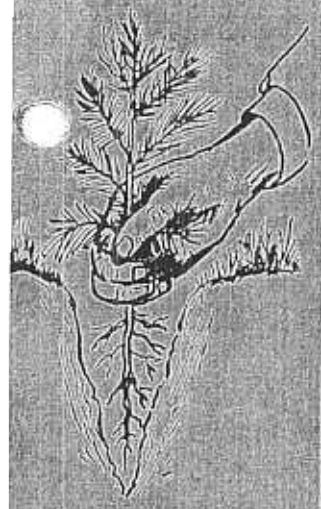
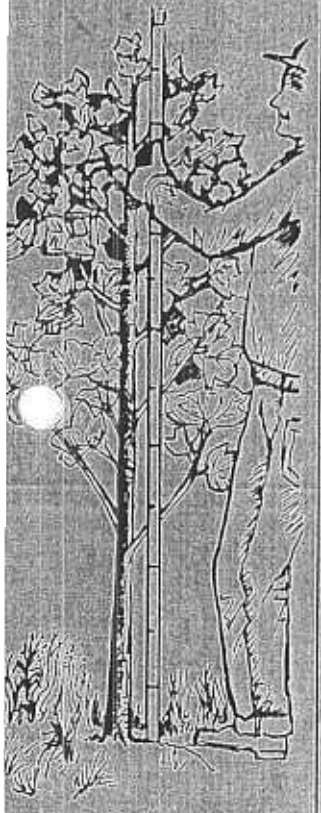
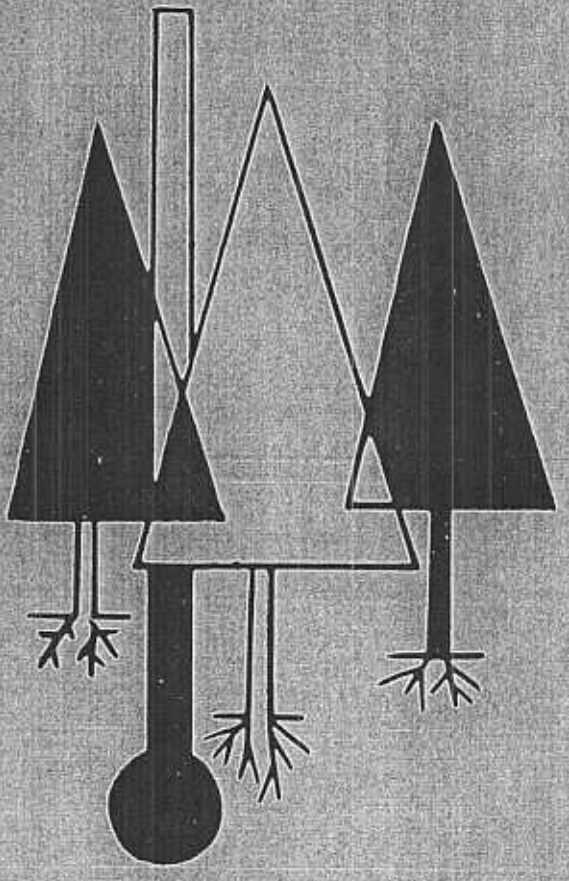
OCCASIONAL REPORT 51 JAN. 1977





COLD DAMAGE



TO LOBLOLLY SEEDLINGS AT NEW KENT NURSERY

Virginia Division of Forestry
Department of Conservation and Economic Development

January 1977 Cold Damage to Loblolly Seedlings at New Kent Nursery

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INTRODUCTION

November and December of 1976 and January of 1977 were unusually cold in Virginia. Average temperature for January was the coldest on record. The "big freeze" finally broke in February and lifting of tree seedlings at the New Kent Nursery began on February 14th, after seven weeks during which seedlings could not be lifted due to frozen ground. Browning of loblolly pine seedling tops began in January and became progressively worse through February and into March, when it finally seemed to stabilize. During the first week of March, sampling was done to assess the extent of the damage.

PROCEDURE

Damage was tallied across the seedbeds on one foot wide sample plots. Three damage classes were recognized:

Undamaged - no detectable damage to seedling top

Moderately Damaged - up to 1/3 of the top killed

Severely Damaged - more than 1/3 of the top killed

The tally by damage class was kept separate by seedbed row, so we could later relate extent of damage to position in the seedbed.

In each nursery section,[1/] three of the nine seedbeds were randomly chosen to be sampled, and a single sample plot was randomly located in each of the three chosen seedbeds. A total of 55 plots were tallied, 31 in the West Nursery and 24 in the Far West Nursery.

RESULTS

Top kill occurred throughout the Nursery. On the 55 sample plots, 19 percent of the seedlings were damaged (with a standard error of one percent). Most of the damage was moderate (17 percent) with little severe damage (two percent).

Position in Seedbed

Seedbeds are four feet wide and contain eight rows of seedlings six inches apart. Between the seedbeds are paths two feet wide. The beds at New Kent run approximately northwest-southeast. Damage varied considerably according to position in the seedbed as shown in the following table. Damage was much less severe in the seedling rows on the southwest edge of the bed.

1/ *Nursery sections contain nine seedbeds each four feet wide separated by paths two feet wide. Irrigation lines run between sections.*

Seedling Row	Percent of Seedlings Damaged West Nursery	Far West Nursery
1 Southwest	2.0	3.8
2	10.6	8.5
3	14.0	13.6
4	19.6	19.4
5	24.8	22.9
6	29.8	36.1
7	22.1	31.1
8 Northeast	16.4	33.5
	17.6	21.4

On sunny days, when the ground is frozen, thawing occurs along the southwest edge of the seedbed as illustrated in Figure 1. Where the ground is shaded by the seedlings, within the seedbed and along the northeast edge of the seedbed, the ground remains frozen (unless the air temperature rises well above freezing). Even though the ground was frozen to a great depth through the month of January, on sunny days enough thawing apparently occurred along the southwest edge of the bed for seedlings with roots in this thawed soil to absorb some water. Damage was highest for the sixth row, which is about mid-way between zones of thawing (see Figure 1).

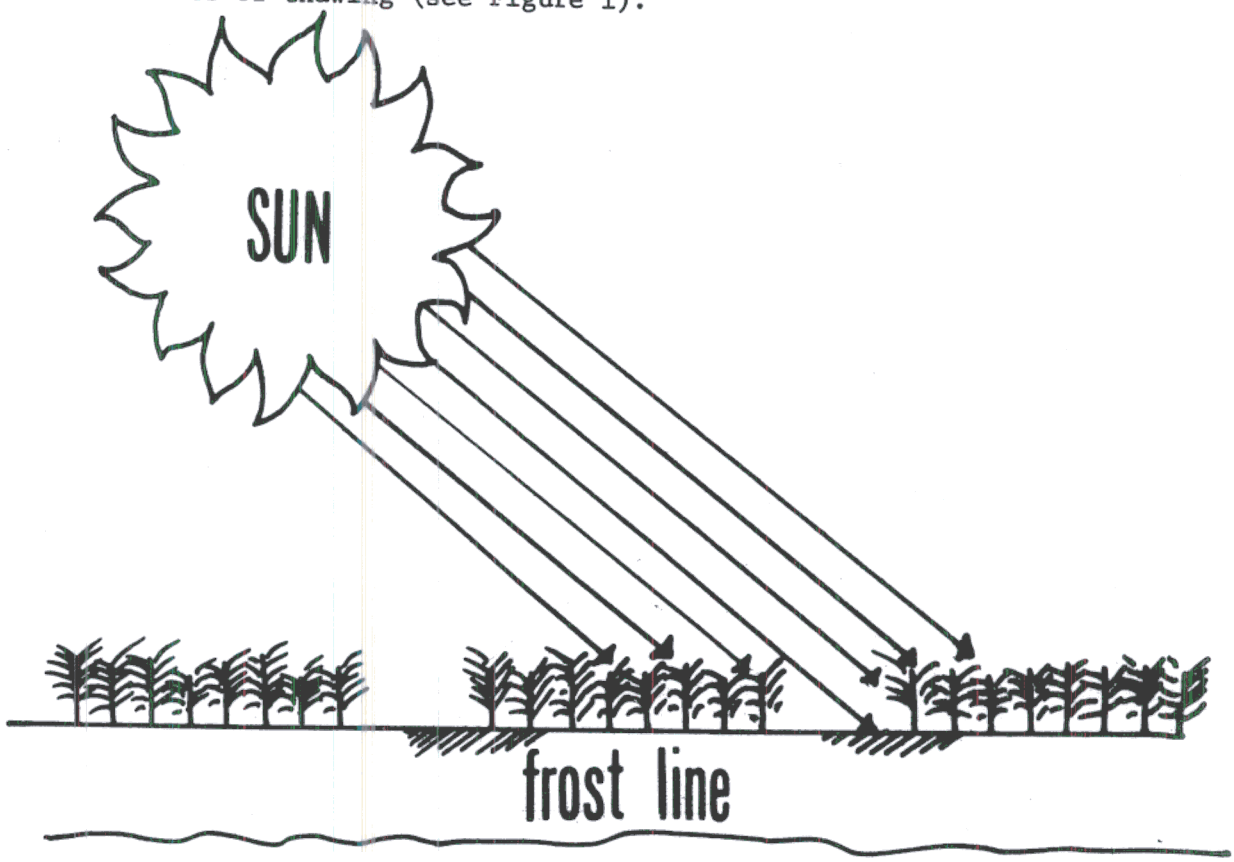

Figure 1. Shallow zones of thawed soil along the southwest edges of the seedbeds

Comparing the West and Far West Nurseries, damage was similar in rows one through five, but damage in the Far West was greater in rows six through eight. This difference may be explained by the fact that the seedbeds in the West Nursery are oriented closer to north and south than the seedbeds in the Far West (133° compared to 117°), which would result in wider zones of thawed soil in the West Nursery.

Desiccation during the long period of time when the ground was frozen seems to have been the major cause of damage. A second factor that may have contributed to the greater damage along the northeast side of the seedbed is exposure to cold northerly winds, which were unusually severe during January. There are two reasons why this was probably a less important factor:

1. If this were the most important factor, the damage would have been greatest in row eight, the outside row on the northeast side. This was not the case, however, especially in the West Nursery.

2. Considerable damage occurred to small seedlings in the middle of the seedbed that were below the general canopy level of the seedbed, and were therefore well protected from the wind.

Seedbed Density

Densities for the 55 sample plots ranged from 18 to 52 seedlings per square foot and damage tended to increase as seedbed density increased. A linear regression explained 14 percent of the variation in seedling damage and was significant at the .01 level. Estimates from this regression ranged from 11 percent of the seedlings damaged at 18 seedlings per square foot to 25 percent damaged at 52 seedlings per square foot.

Top Clipping

Of the 55 seedbeds sampled, 40 had been top clipped (to an average height of seven inches in mid-September) and 15 had not. Damage was slightly less in the clipped beds, 17.9 percent in the clipped and 20.5 percent in the unclipped, but the difference was not statistically significant.

Top Length

Top lengths were measured on 13 of the sample plots in unclipped seedbeds. Average top length ranged from six to ten inches on these 13 plots. As average top length increased, damage tended to increase. A linear regression explained 38 percent of the variation in seedling damage and was significant at the .05 level. Estimates from this regression ranged from 10 percent of the seedlings damaged at a six inch top length to 34 percent damaged at a ten inch top length.

DISCUSSION

It is interesting to speculate whether irrigation during the time when the ground was frozen might have reduced damage. Repeated thawing and freezing tended to dry the soil along the southwest edges of the seedbeds. Irrigation might have permitted roots in these shallow zones of thawed soil to take up more water, and perhaps reduce damage. However, to do the irrigating and completely drain the lines during days when the temperature was above freezing may not have been possible.

It is also interesting to speculate whether damage would have been less had the

seedbeds been oriented north and south. Such a change in orientation would increase the width of the zone of thawing between seedbeds, and perhaps even result in some thawing between rows in the middle of the seedbed.