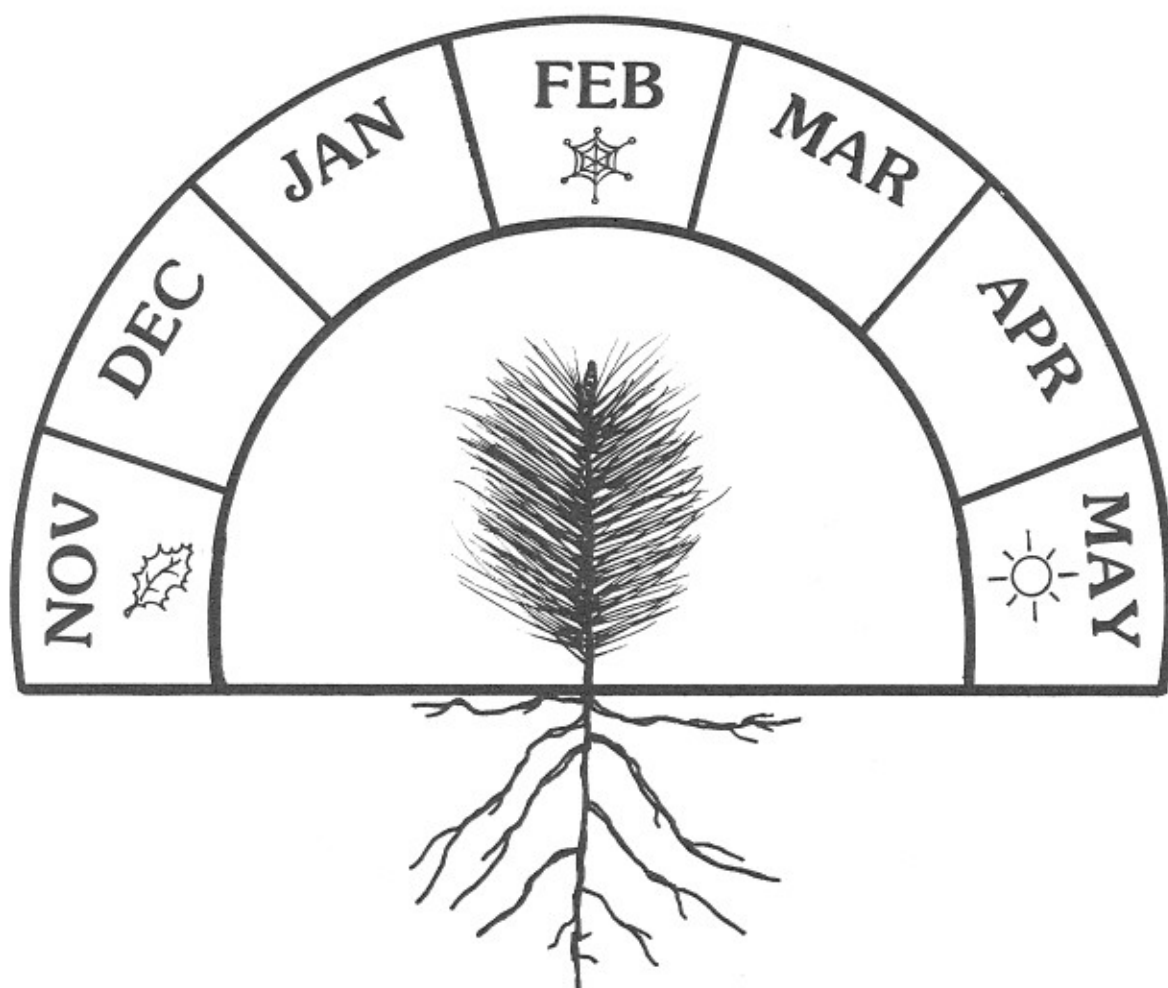


EARLY PLANTING, OVER-WINTER STORAGE, AND LATE PLANTING OF WHITE PINE SEEDLINGS



Virginia
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ABSTRACT

A three year study was installed to evaluate early planting, over-winter storage, and late planting of white pine seedlings. The dates for early lifting and planting were November 15, December 1, and December 15. Seedlings stored over winter were planted on March 1. Additional seedlings were lifted on March 1 and planted on March 1, April 1 and May 1.

Seedlings lifted and planted early, in November and December, survived as well as seedlings lifted and planted on March 1. Seedlings lifted early, stored over winter, and planted on March 1 did not survive as well as seedlings freshly lifted and planted on March 1. However, the differences can be partly attributed to the fact that 3 and 3½ months in storage was too long for satisfactory storage in standard, open-end packages. For seedlings lifted about March 1, survival tended to fall off when stored and planted on April 1 and May 1.

On the average, seedling heights after three seasons in the field were little affected by lifting and planting dates.

INTRODUCTION

At our Augusta Nursery in the Shenandoah Valley of Virginia, the soil often freezes in early December, and sometimes doesn't thaw until late February. When it does thaw for brief periods during the winter, the soils are often too wet to lift seedlings. There is an opportunity for some early lifting, but most of the lifting has traditionally been done in late February and March. Consequently, planting often doesn't start until later than we would like, and considerable planting is done in late April and May, when dry ground sometimes makes planting difficult and reduces survival.

Two things could help relieve this problem. One would be to lift seedlings early and plant them early, perhaps from mid-November until mid-December. The other would be to lift seedlings early, before the ground freezes, and store them over winter so they would be available for planting as soon as landowners might request them in late winter or early spring.

A study was installed over a three year period between 1981 and 1984, to compare early planting, planting on March 1 with seedlings lifted early and stored over winter, and planting on March 1, April 1, and May 1 with seedlings lifted on March 1.

PROCEDURE

Similar studies were installed over a three year period, 1981-82, 1982-83, and 1983-84, in each of our three western regions. The 1981-82 study included lifting on November 15, December 1, and December 15. Some of the seedlings lifted on these three dates were planted within two days at each of the three study locations, and some were packaged and placed in cold storage until the next planting date. The 1982-83 and 1983-84 studies eliminated the December 15 lifting and planting, but otherwise were the same as the 1981-82 study. For all three years, seedlings were also lifted on March 1. Some of these seedlings were planted within two days and others were placed in packages and stored until April 1 and May 1, when they were removed from cold storage and planted.

One of the 1984-85 locations suffered severe mortality from pales weevil, so this study had to be dropped. The remaining eight studies were evaluated annually for three years, measuring heights of surviving seedlings to the nearest .1 foot.

Field installations included 3 replications of each treatment in randomized blocks, with a 20-seedling row of each treatment randomly assigned to each block. Six of the nine field installations were on abandoned fields and three were on site-prepared, cutover woodland.

RESULTS AND DISCUSSION

The 15-week storage period from November 15 until March 1 was too long for the standard, 500-seedling, open-ended packages we use operationally. The seedlings were somewhat dry when some of the packages were opened. This was also true of some of the seedlings lifted and stored on December 1. If we were to use over-winter storage operationally, we would probably want to provide more protection from drying than is provided by standard, open-ended packages.

Table 1 presents survival information for all eight studies after two seasons in the field (three seasons for one study), excluding the one study that had to be abandoned because of pales weevil damage.^{1/} Table 2 presents average survival for all studies combined, for the eight treatments that were common to all studies. The very low survival for the Region 7 study in 1982-83 can probably be attributed to below normal rainfall in July, August, and September of 1983. Excluding this study from the summary in Table 2 increases the overall averages for the remaining 7 studies by from 5 to 7 percentage points and does not change the ranking of the treatments.

^{1/}Survival percents were transformed to arc sine percent and analyses of variance were performed. Duncan's New Multiple Range Test was used to test for differences among treatments, and means in the table followed by the same letter are not significantly different at the .05 level.

Early planting, using seedlings lifted between November 15 and December 15, was as good as planting with freshly lifted seedlings on March 1. This study suggests that we can safely do more planting in late November and early December. The only precaution might be to postpone early planting if the soil is dry.

Early lifting, with over-winter storage until March 1, also looks promising. Apparently, the seedlings are dormant enough by November 15 to store satisfactorily for the 3 1/2 month period until March 1. If we were going to do this operationally, however, we would want to cover seedling packages with plastic or pack seedlings in waterproof boxes to reduce moisture loss during storage.

Table 3 presents average seedling height after 3 seasons in the field (4 seasons for one study) for all 8 studies. Table 4 presents average height for all studies combined, for the eight treatments that were common to all studies. Heights were little affected by treatments.

Table 1. Average survival for each study after 2 seasons^{1/}.

Year	Lift	Plant	Region			Means
			5	6	7	
1982-83	11/15	11/15	90 a	95 a	38 a	74
		12/1	80 ab	72 ab	37 a	63
		12/15	67 bcd	82 ab	20 a	56
		3/1	68 bcd	88 ab	17 a	58
	12/1	12/1	77 abc	83 ab	37 a	66
		12/15	67 bcd	87 ab	40 a	64
		3/1	58 cd	88 ab	28 a	58
	12/15	12/15	68 bcd	65 ab	35 a	56
		3/1	58 cd	83 ab	25 a	55
	3/1	3/1	70 bcd	85 ab	23 a	59
		4/1	68 bcd	87 ab	23 a	59
		5/1	53 d	54 b	27 a	45
	Means		69	81	29	60

Year	Lift	Plant	Region			Means
			5	6	7	
1983-84	11/15	11/15	93 a	90 a	75 a	86
		12/1	88 ab	81 a	88 a	86
		3/1	45 d	70 a	72 a	62
	12/1	12/1	88 ab	73 a	88 a	83
		3/1	90 ab	93 a	87 a	90
	3/1	3/1	90 ab	92 a	83 a	88
		4/1	82 b	85 a	72 a	79
		5/1	65 c	80 a	78 a	74
	Means		80	83	80	81

^{1/} After 3 seasons for Region 6 in 1983-84.

Table 1 (Continued).

<u>Year</u>	<u>Lift</u>	<u>Plant</u>	<u>Region</u>		<u>7^{2/}</u>	<u>Means</u>
			<u>5</u>	<u>6</u>		
1984-85	11/15	11/15	68 a	85 abc	-	76
		12/1	78 a	92 ab	-	85
		3/1	80 a	83 bc	-	82
	12/1	12/1	77 a	82 bc	-	80
		3/1	68 a	68 c	-	68
	3/1	3/1	82 a	97 a	-	90
		4/1	67 a	82 bc	-	74
		5/1	75 a	80 bc	-	78
		Means	74	84	-	79

Table 2. Overall average survival.

<u>Lift</u>	<u>Plant</u>	<u>All 8 Studies</u>	<u>7 Studies^{3/}</u>
11/15	11/15	79	85
	12/1	77	83
	3/1	65	72
12/1	12/1	76	81
	3/1	73	79
3/1	3/1	78	85
	4/1	71	77
	5/1	64	69

^{2/}Destroyed by pales weevils.

^{3/}Excluding the Region 7 study in 1982-83.

Table 3. Average height for each study after 3 seasons^{1/}

Year	Lift	Plant	Region		7	Means
			5	6		
1982-83	11/15	11/15	3.4 a	4.5 a	1.7 a	3.2
		12/1	3.2 ab	4.2 a	1.2 ab	2.8
		12/15	3.2 ab	4.2 a	1.2 ab	2.8
		3/1	2.9 b	4.3 a	1.0 b	2.7
	12/1	12/1	3.2 ab	4.2 a	1.6 ab	3.0
		12/15	2.9 b	3.6 b	1.5 ab	2.7
		3/1	3.2 ab	4.2 a	1.2 ab	2.8
	12/15	12/15	2.8 b	4.0 ab	1.4 ab	2.7
		3/1	2.9 b	4.0 ab	1.3 ab	2.7
	3/1	3/1	3.2 ab	4.5 a	1.5 ab	3.0
		4/1	3.0 ab	4.2 a	1.6 ab	2.9
		5/1	3.0 ab	4.3 a	1.2 ab	2.8
	Means		3.0	4.2	1.3	2.9
1983-84	11/15	11/15	2.5 ab	3.0 a	3.5 a	3.0
		12/1	2.5 ab	2.5 a	3.6 a	2.9
		3/1	2.3 bc	2.7 a	3.4 a	2.8
	12/1	12/1	2.6 a	2.6 a	3.5 a	2.9
		3/1	2.6 a	2.6 a	3.5 a	2.9
	3/1	3/1	2.3 abc	2.6 a	3.3 a	2.7
		4/1	2.4 abc	2.7 a	3.0 a	2.7
		5/1	2.1 c	2.8 a	3.1 a	2.7
	Means		2.4	2.7	3.4	2.8

^{1/}After 4 seasons for Region 6 study in 1982-83.

Table 3 (Continued).

<u>Year</u>	<u>Lift</u>	<u>Plant</u>	<u>Region</u>			<u>Means</u>
			<u>5</u>	<u>6</u>	<u>7</u>	
1984-85	11/15	11/15	2.0 a	2.5 ab	-	2.2
		12/1	2.1 a	2.2 ab	-	2.2
		3/1	2.2 a	2.1 c	-	2.1
	12/1	12/1	2.1 a	2.2 c	-	2.1
		3/1	2.2 a	2.3 bc	-	2.2
	3/1	3/1	2.2 a	2.7 a	-	2.4
		4/1	2.2 a	2.5 ab	-	2.4
		5/1	2.1 a	2.1 c	-	2.1
		Means	2.1	2.3	-	2.2

Table 4. Overall average height.

<u>Lift</u>	<u>Plant</u>	<u>Means</u>
11/15	11/15	2.9
	12/1	2.7
	3/1	2.6
12/1	12/1	2.7
	3/1	2.7
3/1	3/1	2.8
	4/1	2.7
	5/1	2.6