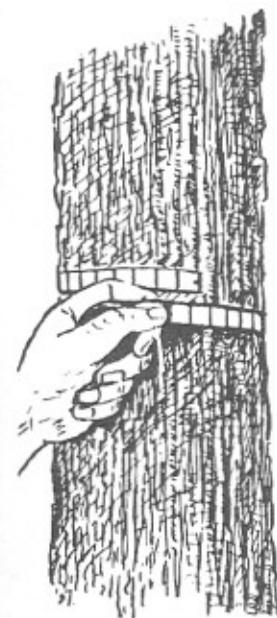
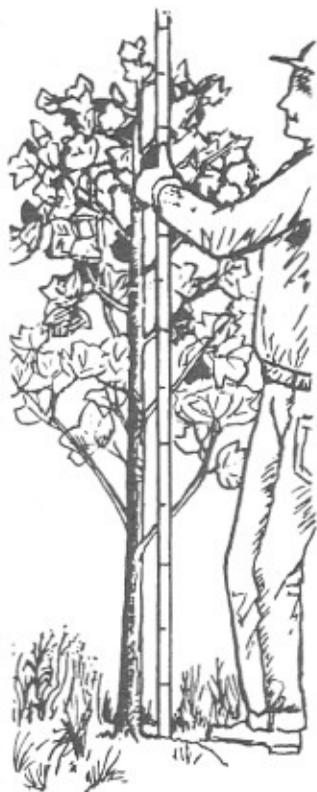


OCCASIONAL REPORT 97 AUGUST 1991

LOBLOLLY PINE RELEASE STUDY

REPORT NUMBER

22



Virginia
Department of Forestry



LOBLOLLY PINE RELEASE

Report #22

By: Thomas A. Dierauf

ABSTRACT

This study included four treatments: no release, hand-chopping, mist-blowing, and basal-spraying. The release treatments were applied in June, during the third growing season. Hardwood competition was light to moderate. At age 20, basal area averaged 7, 12, and 6 percent greater on the hand-chopped, mist-blown, and basal-sprayed plots than on the check plots; and cordwood yields averaged 9, 13, and 13 percent greater, respectively. There was only a weak relationship between cordwood yields and both hardwood basal area at age 20 ($r^2 = .141$), and a free-to-grow index estimated at age 8 ($r^2 = .092$).

INTRODUCTION

This is the twenty-second in a series of Occasional Reports concerning release of loblolly pine seedlings from hardwood competition. This study was installed on the Prince Edward State Forest, in Stand 6 of the Owens 5 Management Unit, in the central Piedmont of Virginia. The previous stand was mixed hardwood, which was harvested in 1967 and early 1968, and prescribed-burned in the summer of 1968. The 25-acre tract was machine-planted during the spring of 1969.

PROCEDURE

The following four treatments, including a control, were applied to swaths that were 2 chains wide during June 1971 (Figure 1).

1. Control
2. Hand-chopping, cutting off all hardwoods close to the ground.
3. Mist-blowing, using 1.5 gallons of 2,4,5-T (4 pounds a.i. per gallon) per acre in a total volume of 5 gallons per acre, applied with a tractor-mounted Potts mist blower.
4. Basal spraying, using a mixture of 1 gallon of 2,4,5-T (4 pounds a.i. per gallon) in 10 gallons of fuel oil and soaking the lower 6 to 8 inches of each hardwood stem.

The hand-chopping initially eliminated all shading from hardwood sprouts, but, as is always the case, resprouting was rapid, and the total number of hardwood stems was increased by this treatment. The results of the mist-blowing were probably average for this type of treatment. Many of the hardwood sprouts, particularly the oaks, which were the most serious competitors, were only partially killed back. Regrowth following the mist-blowing, however, was considerably slower than following the hand-chopping. The basal spraying was extremely effective, providing far superior hardwood control.

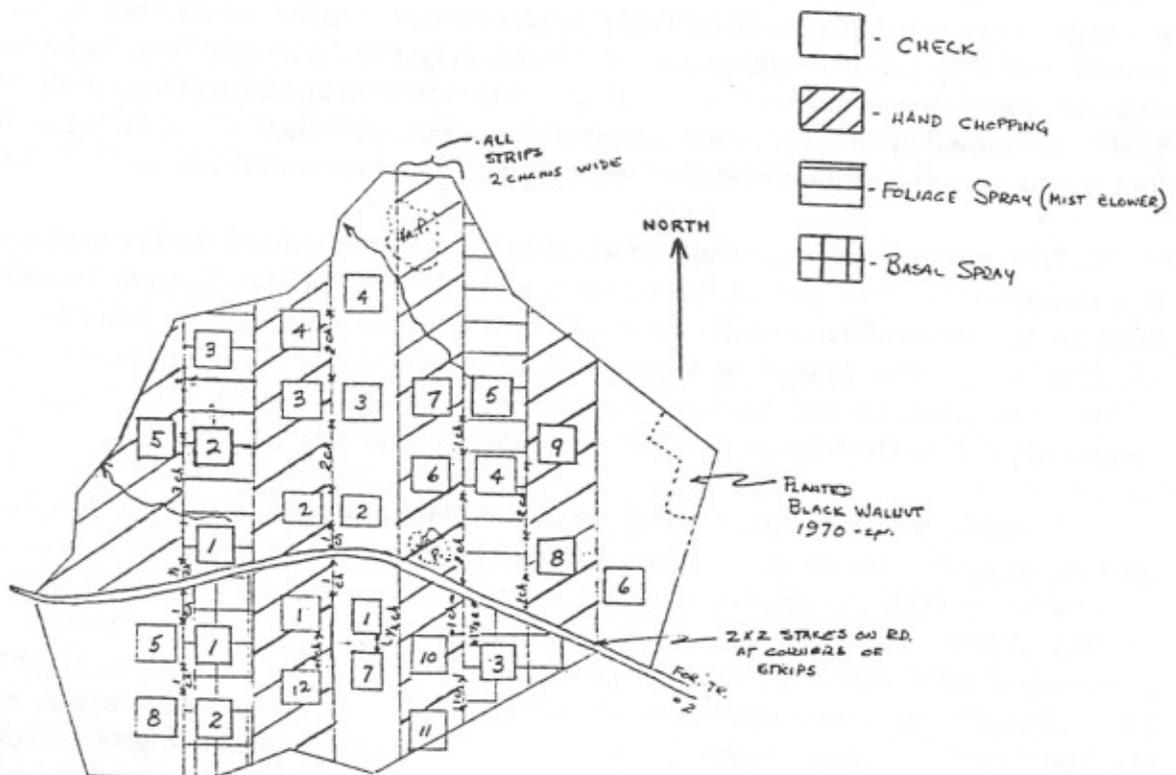


Figure 1. Layout of growth plots.

Hardwood competition was light to moderate on most of the tract. Only one plot, check plot 6, had hardwood competition that would be rated greater than moderate. On much of the tract, the need for release was questionable.

GROWTH PLOT INSTALLATION

Plots were installed during the winter following release, in February 1972, three growing seasons after planting. A total of twenty-eight 1/10-acre plots were installed: 8 in the control, 12 in the hand-chopped, 5 in the mist-blown, and 3 in the basal-sprayed swaths. Volunteer Virginia pine and shortleaf pine seedlings were pulled up when the plots were installed.

Measurements were made at age 3, when the plots were established, and at ages 8, 12, 16, and 20. At age 3, all loblolly pine seedlings were measured for height to the nearest foot, and classified as to free-to-grow status using a four-part classification system.¹ At later measurements, diameter at breast height of each loblolly pine was measured to the nearest inch, and a sample of trees in each diameter class was measured for total height to the nearest foot, noting which trees were dominant or codominant. For the final measurement at age 20, all hardwoods over .5 inch DBH were tallied by species, 1-inch diameter class, and crown class. Total height to the nearest foot was measured on all intermediate, codominant, and dominant hardwoods.

This was the first release study on which our free-to-grow classification system was used. In fact, this is the tract on which the system was finalized. When we classified each seedling, we did not note the species of hardwood causing each seedling to be a Class 2, 3, or 4, nor did we indicate which seedlings were Class 3 or 4 due to "pine competition." All later studies included this additional information, and, for the release studies published so far, we have always related pine cordwood yields to the free-to-grow rating with pine competition excluded.

When we made the first remeasurement of these plots at age 8, we again classified each seedling using the free-to-grow system. This time, however, we noted the hardwood species responsible for each seedling being Class 2, 3, or 4, and also noted seedlings which were Class 3 or 4 due to pine competition. The average free-to-grow rating at age 3 for all 28 plots was 1.54, and at age 8, after removing the seedlings that were Class 3 or 4 due to pine competition, it was 1.52. Normally, the free-to-grow assessment should be made well before age 8, before pine seedlings begin to compete for crown growing space. When the age 8 free-to-grow was plotted over the age 3 free-to-grow for each of the 28 plots, the correlation was not as good as we had hoped (correlation coefficient = .78). We decided to use the age 8 free-to-grow assessment, however, in order to be consistent with our other studies.

¹See Occasional Report No. 78 (Release Report No. 11) for a description and discussion of this classification system.

RESULTS AND DISCUSSION

A summary of loblolly pine data for the five measurements is presented in Table 1. At age 20, yields on the released plots averaged only 2.1, 3.0, and 3.0 standard cords more than on the check plots for the hand-chopped, mist-blown, and basal-sprayed plots, respectively.² Differences due to release increased with time (Table 2), although basal area differences leveled off by age 16 for the hand-chopping and mist-blowing. Table 3 presents stand tables for loblolly pine at age 20.

A summary of average hardwood data at the final measurement at age 20 is presented in Tables 4 and 5, and individual plot data is presented in Table 6. Hand-chopped plots had the most hardwoods per acre, about 30 percent more than check plots. This is not unexpected, as hand-chopping usually increases the numbers of hardwood sprouts. Mist-blown plots had as many hardwoods as check plots and basal-sprayed plots had only half as many hardwoods as check plots.

There were not many hardwoods in the canopy (intermediate, codominant, or dominant) on any of the plots, with the exception of check plot 6. It contained the only dominant hardwood and five of the 11 codominants that occurred on all 28 plots. There were roughly twice as many intermediate hardwoods on the check plots, on the average, as on the hand-chopped and mist-blown plots. The basal-sprayed plots did not have a single hardwood still in the canopy.

Dominant and codominant hardwoods ranged in height from 42 to 47 feet and averaged 44 feet tall, about 4 to 5 feet shorter than the average height of dominant and codominant loblolly pine. We estimate that all plots, including check plot 6, will end up with pure, or nearly pure, loblolly pine in the canopy.

Cordwood yields of loblolly pine were related to the amount of hardwood present, but the relationship was weak. Figure 2 shows pine cordwood yields related to hardwood basal area at age 20, for the 28 plots. A simple linear regression fitted to these data accounted for only 14 percent of the variation in cordwood yields.³

Cordwood yields were also weakly correlated with the average free-to-grow index for each plot at age 8. Table 7 shows the percent of trees in each free-to-grow class for each plot, at age 8. In Figure 3, pine cordwood yields at age 20 are plotted over average free-to-grow index at age 8 for each plot. A simple linear regression fitted to these data accounted for only 8 percent of the variation in cordwood yields.⁴

²Standard cords at age 20 were subjected to an analysis of variance assuming a completely random design (caution should be used in interpreting the results of this analysis, because treatments could not be truly randomized). Yields on released plots were not significantly greater than on check plots (probability of a larger F = .578).

³Estimated standard cords = 28.15 - .2013 (hardwood basal area), $r^2 = .141$, probability of a larger F = .049.

⁴Estimated standard cords = 29.76 - 3.4243 (free-to-grow index at age 8), $r^2 = .085$, probability of a larger F = .133.

Table 1. Summary of loblolly data at ages 3, 8, 12, 16, and 20: number of trees per acre, average DBH, basal area per acre, standard cords per acre, and average height of dominant and codominant trees.*

Age	Check Plots						Hand-Chopped Plots						Mist-Blown Plots				Basal-Sprayed Plots								
	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.	
3	1	430	-	-	-	4.6	1	310	-	-	-	4.9	1	530	-	-	-	5.6	1	370	-	-	-	3.7	
	2	630	-	-	-	6.2	2	500	-	-	-	6.2	2	650	-	-	-	5.2	2	430	-	-	-	4.0	
	3	530	-	-	-	6.4	3	520	-	-	-	4.0	3	510	-	-	-	4.5	3	440	-	-	-	3.7	
	4	570	-	-	-	6.4	4	420	-	-	-	4.2	4	590	-	-	-	5.7							
	5	460	-	-	-	3.9	5	540	-	-	-	5.7	5	460	-	-	-	5.5							
	6	590	-	-	-	5.6	6	600	-	-	-	6.1													
	7	330	-	-	-	4.2	7	740	-	-	-	6.1													
	8	470	-	-	-	4.5	8	580	-	-	-	5.9													
							9	560	-	-	-	5.8													
							10	490	-	-	-	4.4													
							11	380	-	-	-	4.1													
							12	330	-	-	-	4.3													
Means		501	-	-	-	5.2		498	-	-	-	5.1		548	-	-	-	5.3		413	-	-	-	3.8	
8	1	420	3.63	31.3	-	22.4	1	310	4.23	31.6	-	23.7	1	530	4.32	56.2	-	23.8	1	370	3.70	29.0	-	20.1	
	2	630	3.75	51.5	-	25.7	2	500	4.58	58.6	-	24.9	2	650	4.15	63.5	-	24.6	2	430	3.93	37.5	-	23.1	
	3	530	4.04	50.0	-	26.1	3	520	3.31	32.4	-	20.9	3	510	3.30	32.5	-	20.2	3	440	3.84	37.4	-	22.9	
	4	570	3.58	43.1	-	24.8	4	420	3.05	22.4	-	19.8	4	590	3.80	48.3	-	23.8							
	5	460	3.22	27.5	-	21.2	5	540	4.11	52.4	-	25.7	5	450	3.67	35.1	-	23.0							
	6	590	3.24	39.3	-	24.8	6	600	4.25	61.7	-	27.0													
	7	330	3.82	27.4	-	22.3	7	740	3.81	60.8	-	25.4													
	8	470	3.64	36.5	-	23.6	8	580	3.94	51.9	-	25.0													
							9	560	4.23	57.5	-	25.4													
							10	490	3.76	39.4	-	22.4													
							11	370	3.76	29.7	-	21.7													
							12	310	3.81	25.2	-	23.3													
Means		500	3.62	38.3	-	23.9		495	3.90	43.6	-	23.8		546	3.85	47.1	-	23.1		413	3.82	34.6	-	22.0	

Table 1 (continued).

Age	Check Plots						Hand-Chopped Plots						Mist-Blown Plots				Basal-Sprayed Plots										
	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.			
12	1	420	5.34	66.7	7.0	32.3	1	310	5.84	59.6	7.4	34.5	1	510	5.61	91.5	12.0	37.3	1	360	5.47	60.9	6.4	31.5			
	2	610	4.89	84.1	8.9	35.2	2	500	5.70	90.9	11.5	36.4	2	650	5.31	103.9	12.8	35.6	2	430	5.77	80.3	9.3	34.5			
	3	520	5.06	77.2	9.3	37.1	3	520	4.73	65.9	5.6	33.0	3	510	4.86	70.1	6.6	31.6	3	430	5.44	72.5	8.0	34.4			
	4	570	4.61	72.0	7.5	36.0	4	420	4.38	45.9	2.8	28.4	4	590	4.93	82.8	8.7	35.2									
	5	460	4.76	60.0	5.1	33.7	5	530	5.34	87.0	11.2	38.4	5	440	4.95	63.2	6.7	33.7									
	6	550	4.42	66.3	6.5	34.2	6	600	5.30	97.0	12.3	37.7															
	7	330	5.73	60.8	7.3	33.9	7	740	4.73	93.8	8.2	34.9															
	8	470	5.11	70.9	8.4	36.0	8	570	5.12	84.8	8.9	34.1															
							9	550	5.31	89.2	10.6	36.0															
							10	490	5.29	77.1	8.2	33.8															
							11	370	5.22	57.5	6.0	32.8															
							12	310	5.68	55.6	6.5	34.2															
Means		491	4.99	69.8	7.5	34.8		492	5.22	75.4	8.3	34.5		540	5.13	82.3	9.4	34.7		407	5.56	71.2	7.9	33.5			
16	1	420	6.41	96.6	16.2	43.1	1	310	7.26	92.1	17.6	44.4	1	510	6.35	118.5	20.5	43.8	1	360	6.42	83.3	13.2	40.8			
	2	600	5.72	112.7	18.1	43.4	2	500	6.50	118.5	21.8	44.3	2	630	6.06	131.6	22.8	44.4	2	430	6.77	111.1	20.4	44.5			
	3	500	5.96	101.1	17.0	44.7	3	520	5.71	96.6	14.8	41.9	3	490	6.00	100.6	16.0	40.8	3	430	6.47	102.9	17.6	43.5			
	4	510	5.73	96.4	15.8	43.2	4	420	5.29	67.1	7.8	36.7	4	580	5.62	106.9	17.5	44.2									
	5	460	5.67	86.4	12.9	40.8	5	530	6.11	114.9	20.9	45.5	5	430	5.95	88.1	13.6	42.3									
	6	480	5.40	82.2	12.9	43.8	6	590	6.22	130.8	22.7	45.2															
	7	330	6.94	89.2	15.1	41.4	7	740	5.35	120.4	17.4	44.0															
	8	460	6.20	100.5	17.6	44.4	8	560	5.96	112.1	17.8	43.2															
							9	530	6.28	118.1	21.5	45.7															
							10	490	6.24	107.6	17.9	41.9															
							11	360	6.31	82.1	13.4	41.2															
							12	310	6.97	84.8	15.1	42.6															
Means		470	6.00	95.6	15.7	43.1		488	6.18	103.8	17.4	43.0		528	6.00	109.1	18.1	43.1		407	6.55	99.1	17.1	42.9			
20	1	420	7.21	125.5	26.4	49.0	1	310	8.00	112.4	24.8	49.9	1	480	7.02	134.3	27.2	48.8	1	350	7.34	106.0	22.1	49.1			
	2	600	6.22	133.9	25.0	46.9	2	490	7.02	135.6	28.8	50.3	2	620	6.71	158.1	33.4	50.3	2	420	7.52	134.8	29.3	50.7			
	3	490	6.43	116.0	21.9	47.8	3	520	6.23	115.1	21.5	47.2	3	490	6.65	124.2	24.5	46.7	3	430	7.12	125.3	25.9	49.4			
	4	500	6.28	113.7	22.0	47.2	4	420	6.02	87.6	13.7	42.8	4	550	6.25	125.3	24.7	49.5									
	5	450	6.20	101.2	19.1	48.4	5	520	6.83	139.6	29.3	51.0	5	420	6.50	103.0	19.3	47.7									
	6	460	6.11	100.3	19.3	49.4	6	580	6.66	147.5	30.3	49.7															
	7	330	7.82	113.7	24.1	49.4	7	740	5.74	140.4	25.2	48.2															
	8	440	6.95	119.6	24.8	49.8	8	550	6.36	125.9	23.6	47.0															
							9	520	6.98	142.1	31.3	50.3															
							10	490	6.84	129.5	25.4	46.9															
							11	360	7.03	102.2	20.3	47.6															
							12	300	8.00	107.6	24.2	50.7															
Means		461	6.65	115.5	22.8	48.5		483	6.81	123.8	24.9	48.5		512	6.63	129.0	25.8	48.6		400	7.33	122.0	25.8	49.7			

*Except at age 3, where heights presented are for all trees.

Table 2. Average differences between check and released plots at each measurement, for basal area and standard cords per acre.

<u>Age</u>	<u>Hand-chopped minus Check</u>		<u>Mist-blown minus Check</u>		<u>Basal-sprayed minus Check</u>	
	<u>Basal Area</u>	<u>Std. Cds.</u>	<u>Basal Area</u>	<u>Std. Cds.</u>	<u>Basal Area</u>	<u>Std. Cds.</u>
8	5.3	-	8.8	-	-3.7	-
12	5.6	.8	12.5	1.9	1.4	.4
16	8.2	1.7	13.5	2.4	3.5	1.4
20	8.3	2.1	13.5	3.0	6.5	3.0

Table 3. Average number of loblolly pine per acre by diameter class at age 20.

<u>DBH</u>	<u>Check Plots</u>	<u>Hand-chopped Plots</u>	<u>Mist-blown Plots</u>	<u>Basal-Sprayed Plots</u>
1	1	0	0	0
2	5	1	4	0
3	10	10	10	3
4	29	27	34	10
5	60	67	58	33
6	101	103	116	73
7	125	130	148	80
8	86	89	88	114
9	33	48	50	67
10	9	7	2	13
11	2	1	2	7
Totals	461	483	512	400

Table 4. Average numbers of hardwoods per acre by species and diameter class at age 20.

<u>Species</u>	Check Plots								<u>Totals</u>
	DBH								
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
Chestnut oak	161	83	49	19	6	1	1	1	321
White oak	40	17	3						60
Red oak	88	39	23	6					156
Red maple	148	48	25	9					230
Blackgum	236	19							255
Sweetgum	58	16	9	4					87
Hickory	35	2	1						38
Dogwood	21	4							25
Yellow-poplar	10	9	1						20
Sourwood	65	7	2						74
Persimmon	38	1							39
Black cherry	11	6	1						18
Sassafras	11								11
Misc.	6								6
Totals	928	251	114	38	6	1	1	1	1,340

<u>Species</u>	Hand-chopped Plots								<u>Total</u>
	DBH								
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	
Chestnut oak	333	81	29	4	1				448
White oak	83	22	3	1					109
Red oak	158	42	12	3					215
Red maple	201	49	4						254
Blackgum	298	4							302
Sweetgum	86	43	18	4			1		152
Hickory	38	4							42
Dogwood	52	9	1						62
Yellow-poplar	43	10							53
Sourwood	57	5	2						64
Persimmon	23								23
Black cherry	17	1							18
Misc.	26								26
Totals	1,415	270	69	12	1		1		1,768

Table 4 (Continued).

<u>Species</u>	Mist-blown Plots DBH					<u>Totals</u>
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	
Chesnut oak	182	42	20	8	6	258
White oak	64	16	12			92
Red oak	128	70	16	6	2	222
Red maple	190	64	14			268
Blackgum	58	2				60
Sweetgum	24	6	4	4		38
Hickory	134	26				160
Dogwood	132	32				164
Yellow-poplar	8	2				10
Sourwood	42	4		2		48
Persimmon	10					10
Black cherry	22	2		2		26
Sassafras	34					34
Totals	1,028	266	66	22	8	1,390

<u>Species</u>	Basal-sprayed Plots DBH					<u>Totals</u>
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	
Chestnut oak	3					3
White oak	23	3				26
Red oak	158	44	17			219
Red maple	117	23	7			147
Blackgum	110	10				120
Sweetgum	67	17	13			97
Hickory	23					23
Dogwood	13					13
Sourwood	3					3
Persimmon	53	3	3			59
Black cherry	3					3
Misc.	7					7
Totals	580	100	40			720

Table 5. Average numbers of hardwoods per acre by diameter class and crown class, and basal area by crown class, at age 20.

Check Plots					
DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	928				928
2	251				251
3	99	15			114
4	15	23			38
5		1	5		6
6			1		1
7			1		1
8				1	1
Totals	1,293	39	7	1	1,340
B.A.	16.7	2.9	1.2	.3	21.1
Hand-chopped Plots					
1	1,415				1,415
2	270				270
3	62	7			69
4	5	7			12
5		1			1
6					
7			1		1
Totals	1,752	15	1		1,768
B.A.	17.1	1.1	.3		18.5
Mist-blown Plots					
1	1,028				1,028
2	266				266
3	56	10			66
4	8	12	2		22
5	2		6		8
Totals	1,360	22	8		1,390
B.A.	15.1	1.5	1.0		17.6
Basal-sprayed Plots					
1	580				580
2	100				100
3	40				40
Totals	720				720
B.A.	7.3				7.3

Table 6. Numbers of hardwoods by diameter class and crown class, and basal area by crown class, on each 1/10-acre plot.

	DBH	Q	I	CD	D	Totals		DBH	Q	I	CD	D	Totals
Check #1	1	115				115	Check #6	1	93				93
	2	38				38		2	22				22
	3	11				11		3	13	4			17
	4	4	1			5		4	1	6			7
									5		1	3	
	Totals	168	1			169		6			1		1
	B.A.	2.34	.09			2.43		7			1		1
								8				1	1
								Totals	129	11	5	1	146
								B.A.	1.71	.86	.87	.35	3.80
Check #2	1	87				87	Check #7	1	54				54
	2	26				26		2	22				22
	3	6				6		3	8				8
	4	1	2			3		4	2	1			3
	5			1		1							
	Totals	120	2	1		123		Totals	86	1			87
	B.A.	1.42	.18	.14		1.73		B.A.	1.34	.09			1.43
Check #3	1	104				104	Check #8	1	77				77
	2	16				16		2	21				21
	3	7	5			12		3	8	1			9
	4	3	3			6		4		1			1
		Totals	130	8				138		Totals	106	2	
	B.A.	1.52	.51			2.03		B.A.	1.27	.14			1.41
Check #4	1	142				142	Check #5	1	70				70
	2	33				33		2	23				23
	3	14	2			16		3	12				12
	4	1	2			3		4		2			2
		Totals	190	4				194		Totals	105	2	
	B.A.	2.27	.27			2.54		B.A.	1.47	.18			1.65

Table 6 (continued).

	<u>DBH</u>	<u>Q</u>	<u>I</u>	<u>CD</u>	<u>D</u>	<u>Totals</u>		<u>DBH</u>	<u>Q</u>	<u>I</u>	<u>CD</u>	<u>D</u>	<u>Totals</u>
Hand-chopped #1	1	115				115	Hand-chopped #7	1	170				170
	2	27				27		2	40				40
	3	5				5		3	4				4
	4	3				3		<hr/>					
	Totals	150				150		Totals	214				214
B.A.	1.72				1.72	B.A.	2.00				2.00		
Hand-chopped #2	1	101				101	Hand-chopped #8	1	145				145
	2	12				12		2	22				22
	3	3				3		3	4	1			5
	<hr/>							<hr/>					
	Totals	116				116		Totals	172	3			175
B.A.	.96				.96	B.A.	1.55	.22			1.77		
Hand-chopped #3	1	203				203	Hand-chopped #9	1	220				220
	2	35				35		2	33				33
	3	5	2			7		3	11	3			14
	4		1			1		4		1			1
	<hr/>							<hr/>					
Totals	243	3			246	Totals	264	5			269		
B.A.	2.12	.18			2.30	B.A.	2.46	.37			2.83		
Hand-chopped #4	1	191				191	Hand-chopped #10	1	80				80
	2	32				32		2	9				9
	3	10				10		3	2				2
	<hr/>							<hr/>					
	Totals	233				233		Totals	91				91
B.A.	2.23				2.23	B.A.	.73				.73		
Hand-chopped #5	1	155				155	Hand-chopped #11	1	74				74
	2	46				46		2	31				31
	3	5	2			7		3	11				11
	4		1			1		4	1	2			3
	<hr/>							<hr/>					
Totals	206	3			209	Totals	117	2	1		120		
B.A.	2.09	.19			2.28	B.A.	1.71	.18	.27		2.15		
Hand-chopped #6	1	167				167	Hand-chopped #12	1	77				77
	2	20				20		2	17				17
	3	9				9		3	5	1			6
	4		1			1		4	1				1
	<hr/>							<hr/>					
Totals	196	1			197	Totals	100	1			101		
B.A.	1.79	.09			1.88	B.A.	1.12	.05			1.17		

Table 6 (continued).

	DBH	Q	I	CD	D	Totals		DBH	Q	I	CD	D	Totals
Mist-blown #1	1	40				40	Basal-sprayed #1	1	59				59
	2	5				5		2	10				10
	3	1				1		3	4				4
	4	1				1							
	5	1				1							
	Totals	48						48	Totals	73			
B.A.	.60					.60	B.A.	.74				.74	
Mist-blown #2	1	84				84	Basal-sprayed #2	1	58				58
	2	15				15		2	11				11
	3	2				2		3	5				5
	Totals	101				101		Totals	74				74
	B.A.	.88				.88		B.A.	.80				.80
	Mist-blown #3	1	154					154	Basal-sprayed #3	1	57		
2		47				47	2	9					9
3		10				10	3	3					3
4			1			1	Totals	69					69
Totals		211	1			212	B.A.	.65					.65
B.A.		2.36	.09			2.44							
Mist-blown #4	1	114				114							
	2	30				30							
	3	6				6							
	4	2	3			5							
	Totals	152	3			155							
	B.A.	1.75	.26			2.01							
Mist-blown #5	1	122				122							
	2	36				36							
	3	9	5			14							
	4	1	2	1		4							
	5			3		3							
	Totals	168	7	4		179							
B.A.	1.98	.42	.50		2.90								

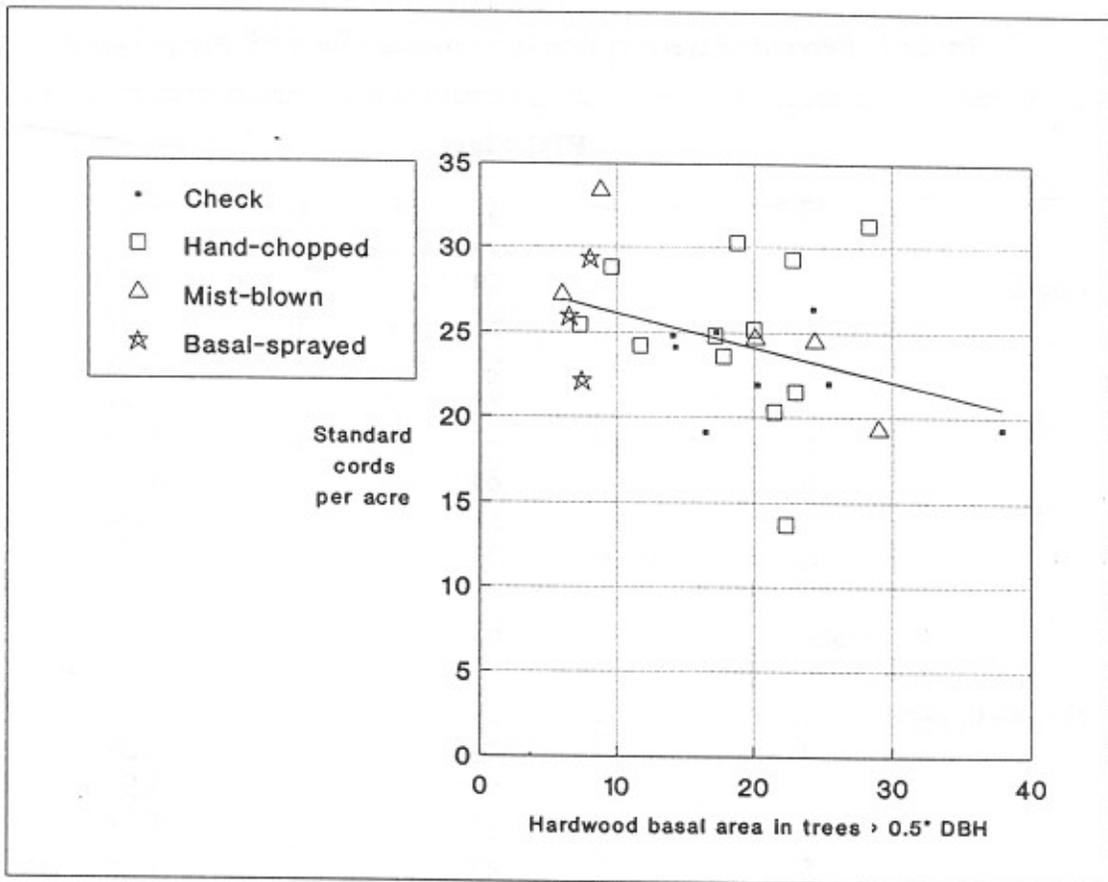


Figure 2. Pine cordwood yields at age 20 related to hardwood basal area.

Table 7. Percent of trees by free-to-grow class for each plot, at age 8.

		FTG Class				
	Plot	1	2	3	4	Means
Check	1	42	58			1.58
	2	36	55	4	5	1.79
	3	28	68		4	1.80
	4	6	82	4	8	2.14
	5	50	47		3	1.55
	6		64	16	20	2.55
	7	68	32			1.32
	8	69	24	2	5	1.43
	Means	37	54	3	5	1.77
Hand-chopped	1	62	38			1.38
	2	77	23			1.23
	3	45	55			1.55
	4	69	31			1.31
	5	35	63		2	1.69
	6	42	55	2	2	1.64
	7	27	73			1.73
	8	20	76		4	1.87
	9	40	56	2	2	1.65
	10	91	9			1.09
	11	58	39		3	1.48
	12	83	17			1.17
	Means	54	45	0	1	1.48
Mist-blown	1	89	11			1.11
	2	88	12			1.12
	3	30	63	2	4	1.80
	4	38	56	2	4	1.73
	5	35	59	3	3	1.74
	Means	56	40	1	2	1.50
Basal-sprayed	1	97	3			1.03
	2	95	5			1.05
	3	93	7			1.07
	Means	95	5			1.05

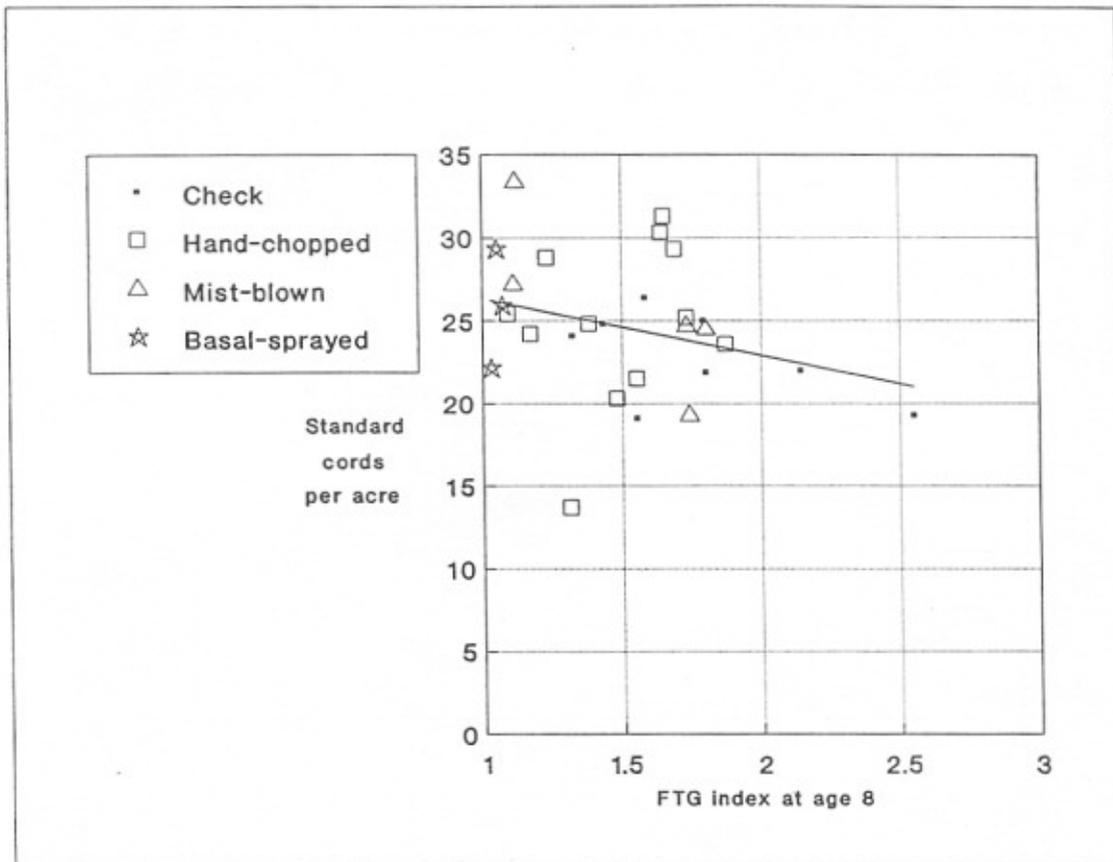


Figure 3. Pine cordwood yields at age 20 related to FTG index.