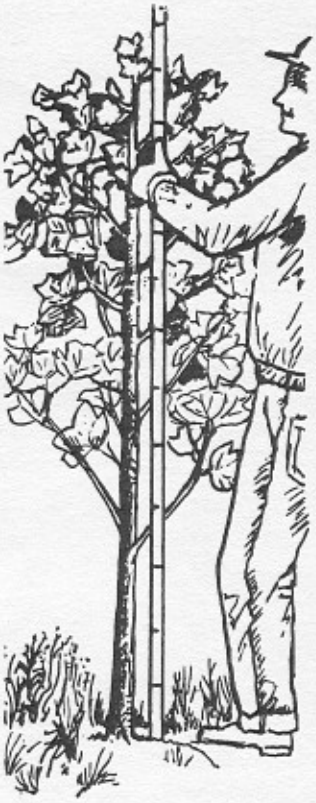

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LOBLOLLY PINE RELEASE STUDY

REPORT NUMBER

14

Virginia
Department of Forestry

LOBLOLLY PINE RELEASE
REPORT #14

By Thomas A. Dierauf

ABSTRACT

This study included two treatments: no release and aerial release using 2 pounds active ingredient of 2,4,5-T per acre during the fourth growing season. Hardwood competition was severe. At age 16, released plots averaged 22 percent more basal area and 35 percent more volume in standard cords than check plots. Cordwood yields were related to both hardwood basal area at age 16 (r^2 = .739), and a free-to-grow index estimated at age 4 (r^2 = .566).

INTRODUCTION

This is the fourteenth in a series of Occasional Reports concerning release of loblolly pine seedlings from hardwood competition. This particular study was installed on the privately-owned Sadler and Cole tract in Chesterfield County. This tract is located close to the fall line in central Virginia. The previous stand was mixed hardwood, with oak predominating. Following timber harvest, it was drum-chopped in the summer of 1971, prescribed-burned in October of 1971 and planted in the spring of 1972. Part of the tract was aerial sprayed in July of 1975, during the fourth growing season, applying 2 pounds per acre active ingredient of 2,4,5-T in a total volume of about 5 gallons per acre.

GROWTH PLOT INSTALLATION

Permanent 1/10-acre growth plots were installed, in February of 1976, during the winter following release. Ten plots were installed, 5 each in the released and unreleased portions of the tract (Figure 1). Volunteer Virginia pine and shortleaf pine seedlings were cut down when the plots were installed. Hardwood competition was severe, with white oak and scarlet oak stump sprouts providing the most serious competition.

Measurements were made at age 4, when the plots were installed, and again at ages 8, 12, and 16. The final measurement would have been made at age 20, but the tract was rapidly being sub-divided for housing, and we were lucky to get the 16-year measurement. At age 4, 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,

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

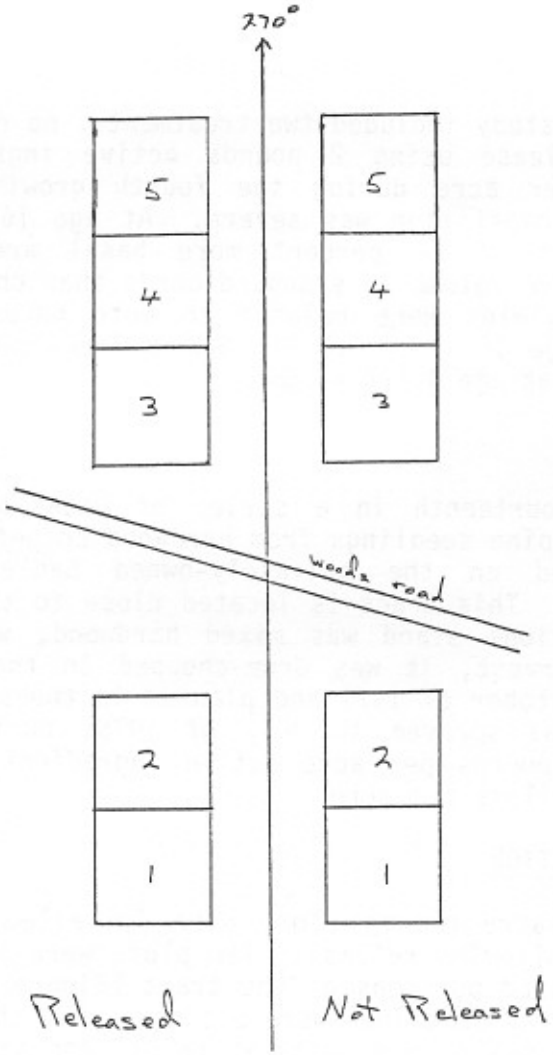

Figure 1. Layout of growth plots.

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 16, 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 about half of the intermediate and all of the codominant and dominant hardwoods.

RESULTS AND DISCUSSION

A summary of loblolly pine data for the four measurements is presented in Table 1. At age 16, released plots averaged 4.4 standard cords per acre more than check plots. Pine stocking was higher on the check plots than the released plots at age 4, 372 compared to 330 pines per acre (Table 1), and at age 16, final pulpwood yields were related to numbers of seedlings present at age 4 (Figure 2). The simple linear regression lines in Figure 2 were fitted separately to the check and released plots. When covariance analysis was used to adjust for the different numbers of seedlings present on each plot at age 4, the average difference in yields at age 16 was increased from 4.4 to 6.0 standard cords per acre.2/

Differences due to release increased with time (Table 2). Table 3 presents stand tables for loblolly pine at age 16.

A summary of average hardwood data at the final measurement at age 16 is presented in Tables 4 and 5, and individual plot data is presented in Table 6. There were almost as many hardwoods on the released plots as on the check plots, but the check plots had more hardwoods in the larger diameter classes, resulting in about one-third more hardwood basal area on the check plots (Table 5).

There were only two codominant hardwoods on all five released plots, and 12 codominant and dominant hardwoods on the five check plots (for an average of 4 and 24 per acre respectively). Of these 14 trees, 12 were oaks and 2 were sweetgum. The average height of these 14 hardwoods was 38 feet, with a range of 36 to 42 feet. Dominant and codominant heights of loblolly pine averaged 40 and 42 feet on the check and released plots respectively. On check plot 3 and release plot 5, pine distribution is not even, and there are fairly large holes in the pine canopy. A few hardwoods may be able to maintain a place in the crown canopy in these openings.

2/ Standard cords at age 16 were subjected to an analysis of variance for randomized blocks (caution should be used in interpreting the results of these statistical tests, because treatments could not be randomized). Yields on released plots were significantly greater than on check plots (probability of a larger F = .031). Pulpwood yields at age 16 were also subjected to an analysis of covariance adjusting for loblolly stocking at age 4 (probability of a larger F = .008).

Table 1. A summary of loblolly data for check and aerial-released plots at ages 4, 8, 12, and 16 years: number of trees per acre, average DBH, basal area per acre, standard cords per acre, and average height of dominant and codominant trees.*

	Check Plots					Released Plots					
Age	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.
4	1	360	-	-	-	7.9	1	390	-	-	-	7.0
	2	310	-	-	-	7.0	2	290	-	-	-	8.2
	3	380	-	-	-	9.2	3	370	-	-	-	7.1
	4	440	-	-	-	8.2	4	290	-	-	-	7.6
	5	370	-	-	-	8.4	5	310	-	-	-	7.6
Means		372	-	-	-	8.1		330	-	-	-	7.5
8	1	360	3.67	28.9	-	22.9	1	390	4.13	37.8	-	21.3
	2	310	3.39	21.4	-	20.7	2	270	4.63	32.6	-	22.3
	3	350	3.71	27.9	-	22.6	3	370	3.74	29.1	-	20.9
	4	410	3.66	31.6	-	21.0	4	290	3.76	23.6	-	19.2
	5	370	3.51	26.9	-	22.6	5	300	4.00	28.0	-	21.4
Means		360	3.59	27.3	-	22.0		324	4.05	30.2	-	21.0
12	1	350	5.40	59.2	6.2	34.6	1	390	6.00	79.4	9.4	33.5
	2	280	5.14	44.2	4.4	31.7	2	270	6.63	66.7	8.5	33.4
	3	350	5.37	57.4	5.7	32.0	3	370	5.92	76.4	9.2	32.8
	4	400	5.25	63.3	6.4	32.3	4	290	5.83	56.3	6.0	30.9
	5	360	5.39	59.8	6.7	34.1	5	290	6.31	65.0	8.0	32.8
Means		348	5.31	56.8	5.9	32.9		322	6.14	68.8	8.2	32.7
16	1	350	6.46	85.0	13.7	41.2	1	390	7.08	111.6	19.0	42.8
	2	260	6.38	62.8	9.9	40.3	2	270	7.63	88.5	15.0	40.0
	3	350	6.23	78.8	12.1	39.9	3	370	7.19	112.6	20.0	42.3
	4	380	6.42	90.2	13.7	39.3	4	290	6.90	78.5	13.3	41.9
	5	350	6.40	82.1	13.0	40.5	5	290	7.59	93.9	17.1	42.7
Means		338	6.38	79.8	12.5	40.2		322	7.28	97.0	16.9	41.9

*Except at age 4, where heights presented are for all trees.

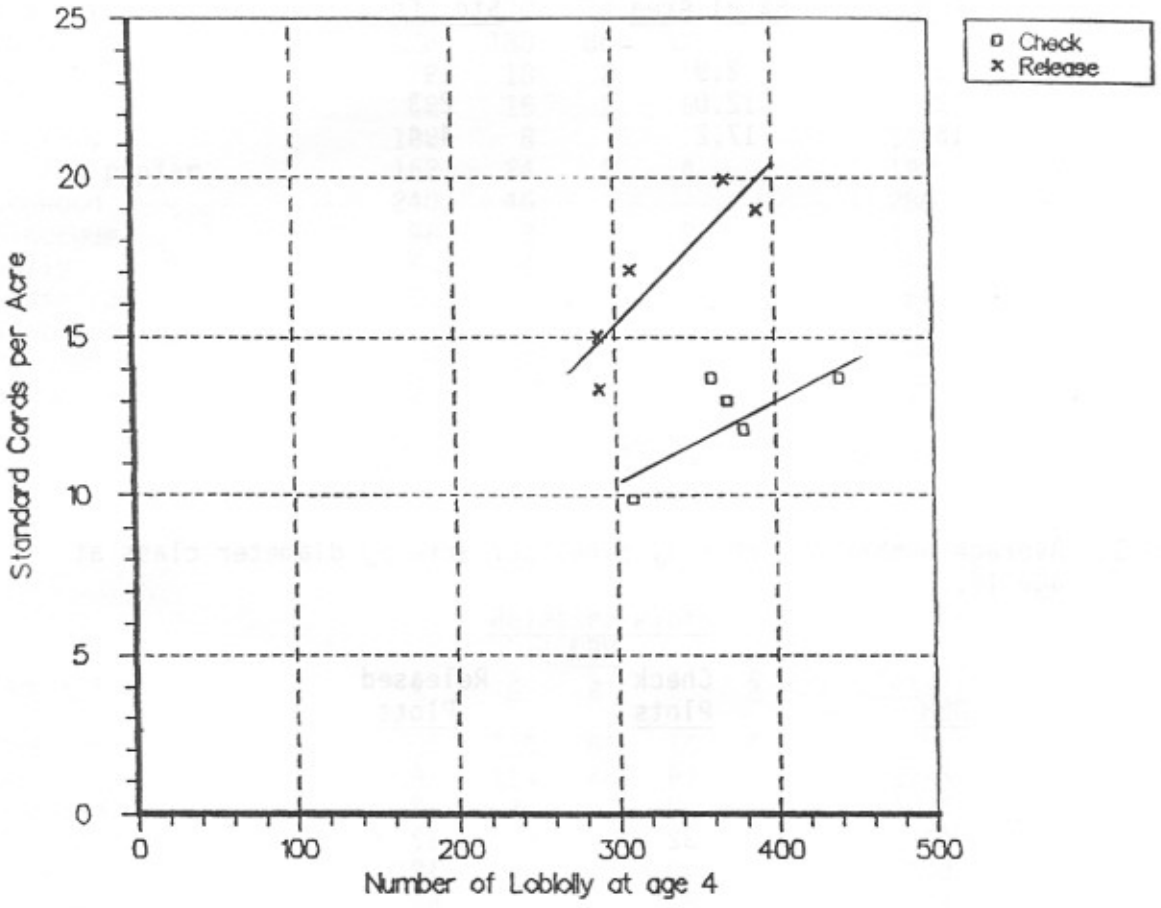

Figure 2. Pine cordwood yields at age 16 related to number of loblolly at age 4.

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

	Released minus Check	
Age	Basal Area	Std. Cds.
8	2.9	-
12	12.0	2.3
16	17.2	4.4

Table 3. Average number of loblolly pines per acre by diameter class at age 16.

DBH	Check Plots	Released Plots
2	4	4
3	12	2
4	32	12
5	40	18
6	80	56
7	84	88
8	66	72
9	12	50
10	8	14
11		6
Totals	338	322

Table 4. Average numbers of hardwoods per acre by species and diameter class at age 16.

	Check Plots					
	DBH					
Species	1	2	3	4	5	Totals
Red oak	314	170	74	32	14	604
White oak	128	180	86	32	2	428
Red maple	72	18	2			92
Sweetgum	18	16	2	6	4	46
Hickory	108	8				116
Yellow-poplar	162	24	2	4		192
Dogwood	240	46				286
Blackgum	98	2		2		102
Holly	64	4				68
Sassafras	54	4	2			60
Black cherry	2	2	4			8
Persimmon	8	2				10
Miscellaneous	10					10
Totals	1,278	476	172	76	20	2,022

	Released Plots					
	DBH					
Species	1	2	3	4	5	Totals
Red oak	226	116	64	16	6	428
White oak	188	134	48	4		374
Red maple	296	70	28	4		398
Sweetgum	16	2				18
Hickory	144	6				150
Yellow-poplar	56	8				64
Dogwood	158	22				180
Holly	118	8	2			128
Black cherry	6	6	10	4	4	30
Persimmon	6					6
Miscellaneous	10					10
Totals	1,224	372	152	28	10	1,786

Table 5. Average numbers of hardwoods per acre by diameter class and crown class, and basal area by crown class, at age 16.

Check Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	1,278				1,278
2	474	2			476
3	98	74			172
4	2	68	6		76
5		2	16	2	20
Totals	1,852	146	22	2	2,022
B.A.	22.3	9.9	2.7	.3	35.2

Released Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	1,224				1,224
2	362	10			372
3	88	64			152
4	6	20	2		28
5		8	2		10
Totals	1,680	102	4		1,786
B.A.	19.4	6.2	.4		26.1

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

Check Plot #1

DBH	O	I	CD	D	Totals
1	120				120
2	35				35
3	6	10			16
4		7	1		8
5			2		2
Totals	161	17	3		181
B.A	1.71	1.10	.36		3.17

Check Plot #2

DBH	O	I	CD	D	Totals
1	124				124
2	35				35
3	12	6			18
4		8	1		9
5			2	1	3
Totals	171	14	3	1	189
B.A.	2.03	.99	.36	.14	352

Check Plot #3

DBH	O	I	CD	D	Totals
1	136				136
2	50				50
3	7	9			16
4		5	1		6
5			1		1
Totals	193	14	2		209
B.A.	2.18	.88	.22		3.28

Check Plot #4

DBH	O	I	CD	D	Totals
1	99				99
2	54				54
3	8	9			17
4	1	5			6
5					
Totals	162	14			176
B.A.	2.20	.88			3.08

Check Plot #5

DBH	O	I	CD	D	Totals
1	160				160
2	63	1			64
3	16	3			19
4		9			9
5		1	3		4
Totals	239	14	3		256
B.A.	3.03	1.09	.41		4.53

Released Plot #1

DBH	O	I	CD	D	Totals
1	84				84
2	24	2			26
3	6	4			10
4					
5		1			1
Totals	114	7			121
B.A.	1.28	.38			1.65

Released Plot #2

DBH	O	I	CD	D	Totals
1	84				84
2	25	1			26
3	10	6			16
4	1	2			3
5		1			1
Totals	120	10			130
B.A.	1.58	.63			2.21

Released Plot #3

DBH	O	I	CD	D	Totals
1	150				150
2	36	2			38
3	9	1			10
4					
5					
Totals	195	3			198
B.A.	2.04	.09			2.14

Released Plot #4

DBH	O	I	CD	D	Totals
1	117				117
2	43				43
3	12	15			27
4	2	3			5
5		2			2
Totals	174	20			194
B.A.	2.34	1.27			3.61

Released Plot #5

DBH	O	I	CD	D	Totals
1	177				177
2	53				53
3	7	6			13
4		5	1		6
5			1		1
Totals	237	11	2		250
B.A.	2.46	.73	.22		3.42

Cordwood yields of loblolly pine were related to the amount of hardwood present. Figure 3 shows pine cordwood yields relative to hardwood basal area in intermediate, codominant, and dominant trees at age 16, for the 10 plots. A simple linear regression fitted to these data accounted for 74 percent of the variation in yields.3/ A regression of yields over hardwood basal area in all trees over .5 inch DBH accounted for 48 percent of the variation in yields.4/

Cordwood yields were also correlated with the average free-to-grow index for each plot at age 4. Table 7 shows the percent of trees in each free-to-grow class, for each plot, at age 4. In Figure 4, cordwood yields for each plot at age 16 are plotted over average free-to-grow index at age 4. A simple linear regression fitted to these data accounted for 57 percent of the variation in cordwood yields.5/

3/ Estimated standard cords = 20.09 - .5541 (I, CD, and D hardwood basal area), r^2 = .739, probability of a larger F = .0014.

4/ Estimated standard cords = 22.55 - .2570 (hardwood basal area), r^2 = .476, probability of a larger F = .022.

5/ Estimated standard cords = 28.10 - 7.3134 (free-to-grow index at age 4), r^2 = .566, probability of a larger F = .012.

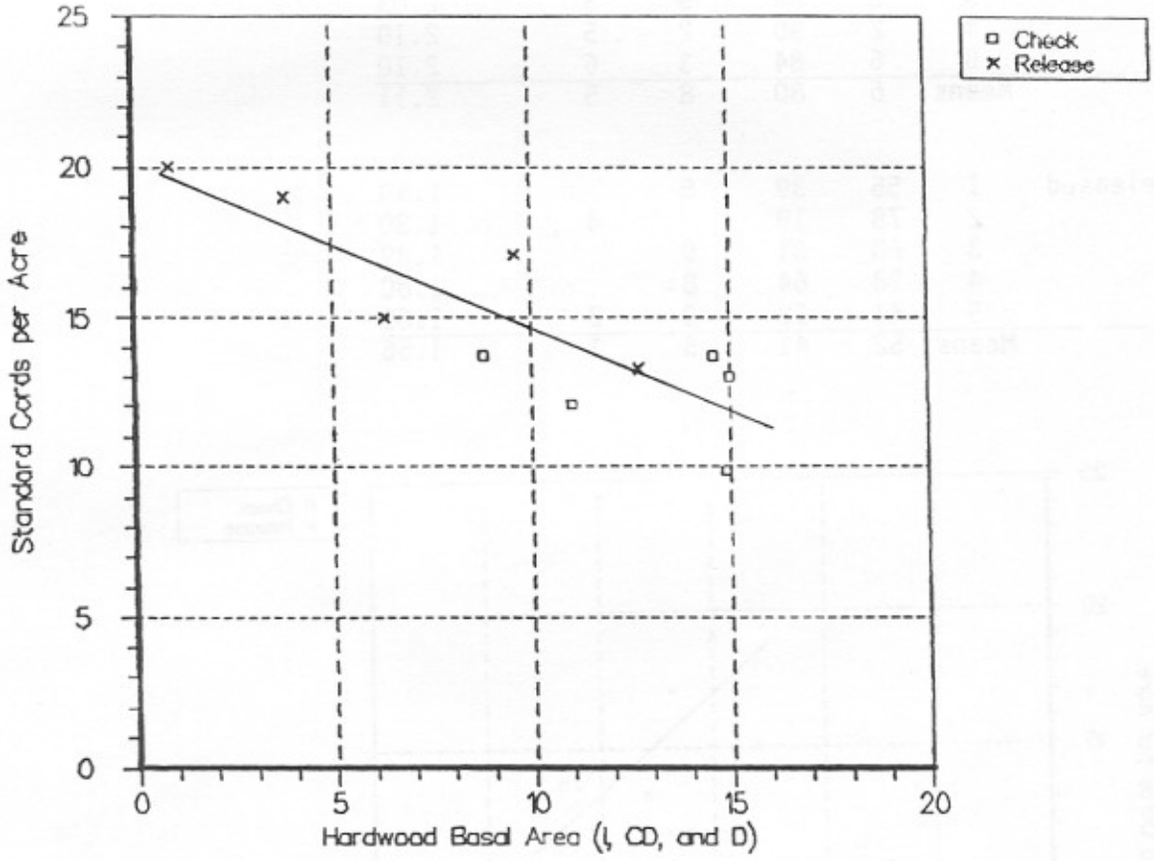

Figure 3. Pine cordwood yields at age 16 related to hardwood basal area.

Table 7. Percent of loblolly seedlings by free-to-grow class, for each plot, at age 4.

Plot		Free-to-grow Status 1	2	3	4	Means
Check	1	6	74	17	3	2.17
	2	10	69	14	7	2.17
	3	8	84	5	3	2.03
	4	2	90	2	5	2.10
	5	6	84	3	6	2.10
	Means	6	80	8	5	2.11
Released	1	55	39	5		1.50
	2	78	19		4	1.30
	3	60	31	9		1.49
	4	28	64	8		1.80
	5	41	52	3	3	1.69
	Means	52	41	5	1	1.56

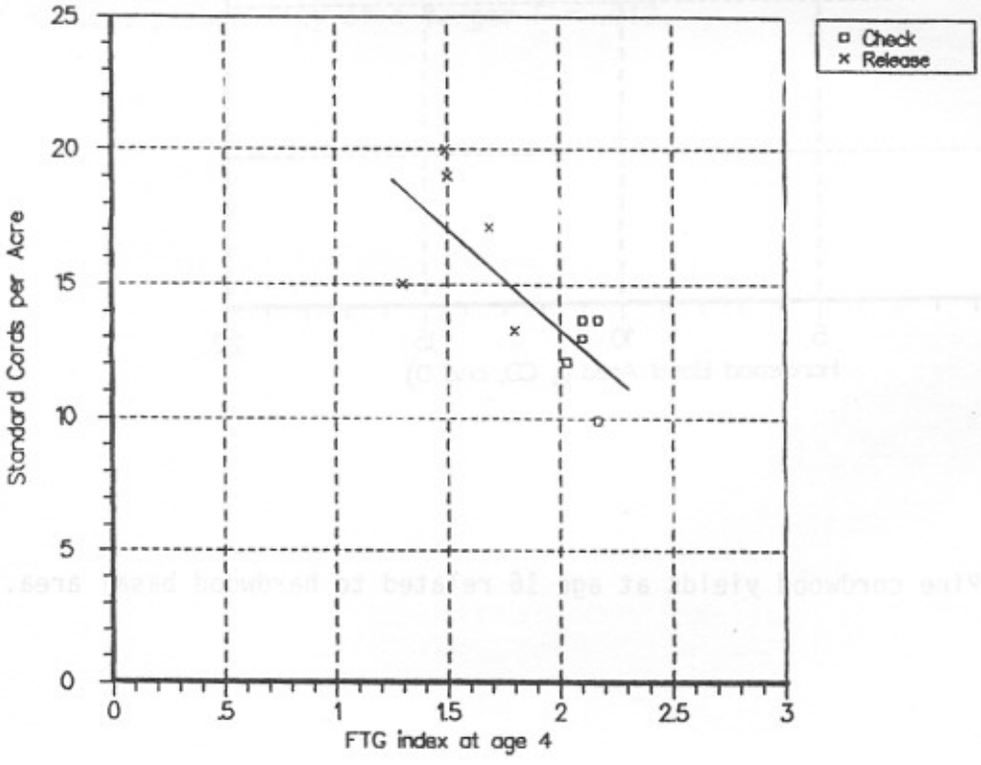

Figure 4. Pine cordwood yields at age 16 related to FTG index.