OCCASIONAL REPORT 101 AUGUST 1991

LOBLOLLY PINE RELEASE STUDY

REPORT NUMBER

26

Virginia
Department of Forestry

LOBLOLLY PINE RELEASE
Report #26

By: Thomas A. Dierauf

ABSTRACT

This study included two treatments: no release and aerial application of 2 pounds active ingredient of 2,4,5-T per acre during the third growing season. Hardwood competition was moderate. At age 19, released plots averaged 22 percent more basal area and 38 percent more volume in standard cords than check plots. Cordwood yields were related to both a free-to-grow index estimated at age 4 (r^2 = .765), and hardwood basal area at age 19 (r^2 = .669). Dominant and codominant loblolly pine height at age 19 was also related to the free-to-grow index estimated at age 4 (r^2 = .684).

INTRODUCTION

This is the twenty-sixth in a series of Occasional Reports concerning release of loblolly pine seedlings from hardwood competition. This study was installed on the privately-owned Burruss tract in Appomattox County, in the central Piedmont of Virginia. The previous stand, which was mixed hardwood with oak predominating, was harvested early in 1968 and prescribed-burned during the summer of 1968. The area was planted in the spring of 1969. The tract was released by aerial spraying in the summer of 1971, during the third growing season. Approximately 2 pounds active ingredient of 2,4,5-T per acre was applied in a total volume of 5 gallons per acre. A small area of less than an acre was missed, which permitted us to install a small release study (Figure 1).

GROWTH PLOT INSTALLATION

Permanent growth plots were installed in February 1973, at age 4. Six 1/10-acre plots were installed, three each in the released and unreleased areas (Figure 1). Volunteer shortleaf and Virginia pine were pulled up when the plots were installed. Hardwood competition was moderate, even though the "brush" was quite dense. There were considerable numbers of oak stump sprouts, but much of the "brush" was red maple and other species that do not sustain height growth as well as oak sprouts.

Measurements were made at age 4, when the plots were installed, and again at ages 8, 13, 17, and 19. We had intended to make the final measurement at age 21, but the landowner decided to thin the stand at age 19. At age 4, each loblolly pine was measured for total 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,

---

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

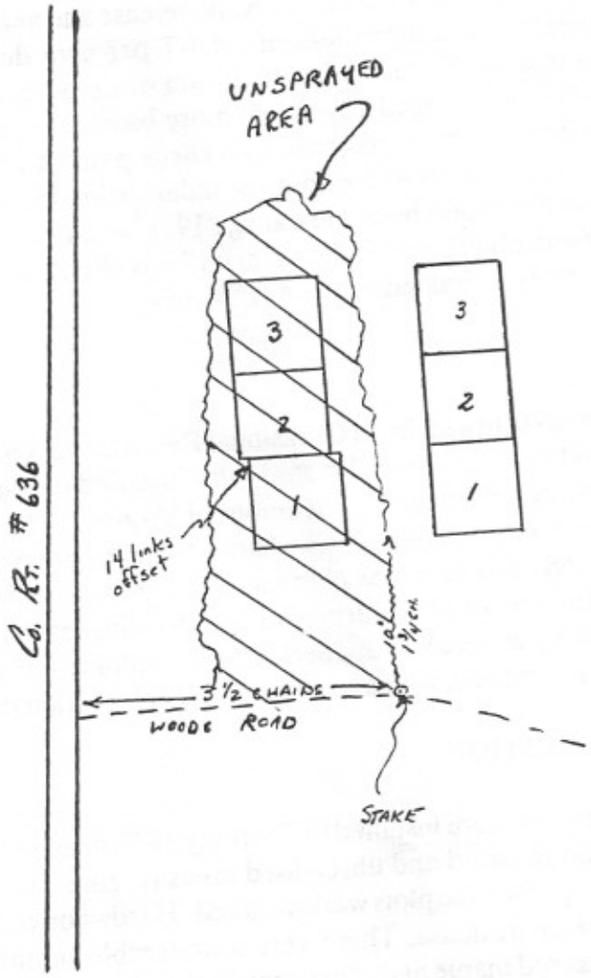

Figure 1. Layout of growth plots.

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 19, 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 34 of 40 intermediate hardwoods (there were no codominant or dominant hardwoods on any of the plots).

RESULTS AND DISCUSSION

A summary of loblolly pine data for the five measurements is presented in Table 1. At age 19, released plots averaged 6.8 standard cords per acre more than check plots.[2] Differences due to release increased and then leveled off, by age 13 for basal area and by age 17 for standard cords (Table 2). Table 3 presents stand tables for loblolly pine at age 19.

A summary of average hardwood data at the final measurement at age 19 is presented in Tables 4 and 5, and individual plot data is presented in Table 6. Check plots, on the average, had almost twice as many hardwoods and almost twice as much hardwood basal area as released plots. Considering hardwoods still in the canopy at age 19, check plots had almost five time as many intermediate hardwoods (there were no codominant or dominant hardwoods on any of the plots).

Cordwood yields of loblolly pine at age 19 were related to the amount of hardwood present. Figure 2 shows pine cordwood yields related to total hardwood basal area (trees greater than .5 inch DBH) at age 19, for the 6 plots. A simple linear regression fitted to these data accounted for 67 percent of the variation in cordwood yields.[3]

Cordwood yields also correlated well 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 3, pine cordwood yields at age 19 are plotted over average free-to-grow index at age 4, for each plot. A simple linear regression fitted to these data accounted for 76 percent of the variation in cordwood yields.[4]

---

[2]Standard cords at age 19 were subjected to an analysis of variance for randomized blocks (caution should be used in interpreting the results of this analysis, because treatment plots could not be truly randomized). Yields on released plots were not significantly greater than on check plots (probability of a larger F = .111).

[3]Estimated standard cords = 31.66 - .3710 (hardwood basal area), r^2 = .669, probability of a larger F = .047.

[4]Estimated standard cords = 37.61 - 8.2533 (free-to-grow index at age 4), r^2 = .765, probability of a larger F = .023.

Table 1. A summary of loblolly data at ages 4, 8, 13, 17 and 19: 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	720	-	-	-	5.6	1	650	-	-	-	6.2
	2	610	-	-	-	5.3	2	760	-	-	-	6.1
	3	630	-	-	-	5.9	3	450	-	-	-	5.2
Means		653	-	-	-	5.6	Means	620	-	-	-	5.8
8	1	690	2.39	25.6	-	21.3	1	650	3.42	44.3	-	24.0
	2	560	2.58	23.7	-	22.0	2	760	3.49	53.1	-	22.6
	3	630	2.56	27.9	-	22.1	3	450	3.42	30.7	-	21.7
Means		627	2.51	25.7	-	21.8	Means	620	3.44	42.7	-	22.8
13	1	660	3.90	64.1	5.2	34.1	1	650	5.03	94.8	9.7	35.3
	2	550	4.42	64.3	5.3	33.4	2	760	5.01	109.6	11.6	35.7
	3	610	4.28	71.7	6.8	35.3	3	450	5.31	73.4	8.5	34.8
Means		607	4.20	66.7	5.8	34.3	Means	620	5.12	92.6	9.9	35.3
17	1	630	5.00	97.0	14.1	41.8	1	650	5.83	128.9	21.5	43.3
	2	540	5.50	96.7	15.8	43.9	2	730	5.79	141.6	24.7	44.7
	3	580	5.31	101.8	16.1	42.8	3	440	6.27	101.1	18.8	45.3
Means		583	5.27	98.5	15.3	42.8	Means	607	5.96	123.9	21.7	44.4
19	1	620	5.34	107.6	17.2	44.6	1	630	6.03	133.8	24.5	46.1
	2	540	5.72	104.2	17.9	45.3	2	720	6.03	151.2	28.8	47.8
	3	570	5.60	110.3	19.2	46.1	3	430	6.63	109.1	21.5	47.6
Means		577	5.55	107.4	18.1	45.3	Means	593	6.23	131.4	24.9	47.2

*Except at age 4, 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.

	Released minus Check	
Age	Basal Area	Std. Cds.
8	17.0	-
13	25.9	4.1
17	25.4	6.4
19	24.0	6.8

Table 3. Average number of loblolly pine per acre by diameter class at age 19.

DBH	Check Plots	Released Plots
2	37	3
3	50	40
4	80	50
5	103	90
6	130	133
7	96	154
8	47	100
9	27	20
10	7	3
Totals	577	593

Table 4. Average numbers of hardwoods per acre by species and diameter class at age 19.

Check Plots
DBH

Species	1	2	3	4	5	Totals
Red oak	313	150	60	24	7	554
White oak	70	47	3	3		123
Chestnut oak	10	3				13
Red maple	737	176	30		6	949
Blackgum	927	17				944
Sourwood	613	137		3		753
Hickory	3	3				6
Black cherry	17	7				24
Dogwood	17					17
Totals	2,707	540	93	30	13	3,383

Released Plots
DBH

Species	1	2	3	4	Totals
Red oak	290	57	26	7	380
White oak	67	33			100
Chestnut oak	13				13
Red maple	623	143	7		773
Blackgum	10				10
Sourwood	557	83			640
Hickory	13				13
Black cherry	27	13	7	3	50
Dogwood	43	7			50
Blackhaw viburnum	7				7
Totals	1,650	336	40	10	2,036

Table 5. Average numbers of hardwoods per acre by diameter class and crown class, and basal area by crown class, at age 19.

Check Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	2,707				2,707
2	540				540
3	23	70			93
4	3	27			30
5		13			13
Totals	3,273	110			3,383
B.A.	27.9	7.6			35.5

Released Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	1,650				1,650
2	336				336
3	27	13			40
4		10			10
Totals	2,013	23			2,036
B.A.	17.7	1.5			19.2

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

	DBH	O	I	CD	D	Totals
Check #1	1	264				264
	2	45				45
	3	3	8			11
	Totals	312	8			320
	B.A.	2.57	.39			2.96
Check #2	1	317				317
	2	58				58
	3	1	8			9
	4	1	4			5
	5		2			2
	Totals	377	14			391
	B.A.	3.13	1.01			4.14
Check #3	1	231				231
	2	59				59
	3	3	5			8
	4		4			4
	5		2			2
	Totals	293	11			304
	B.A.	2.69	.87			3.56

	DBH	O	I	CD	D	Totals
Released #1	1	145				145
	2	40				40
	3	4	2			6
	4		1			1
	Totals	189	3			192
	B.A.	1.86	.19			2.05
Released #2	1	138				138
	2	33				33
	3	1	1			2
	4		1			1
	Totals	172	2			174
	B.A.	1.52	.14			1.66
Released #3	1	212				212
	2	28				28
	3	3	1			4
	4		1			1
	Totals	243	2			245
	B.A.	1.91	.14			2.05

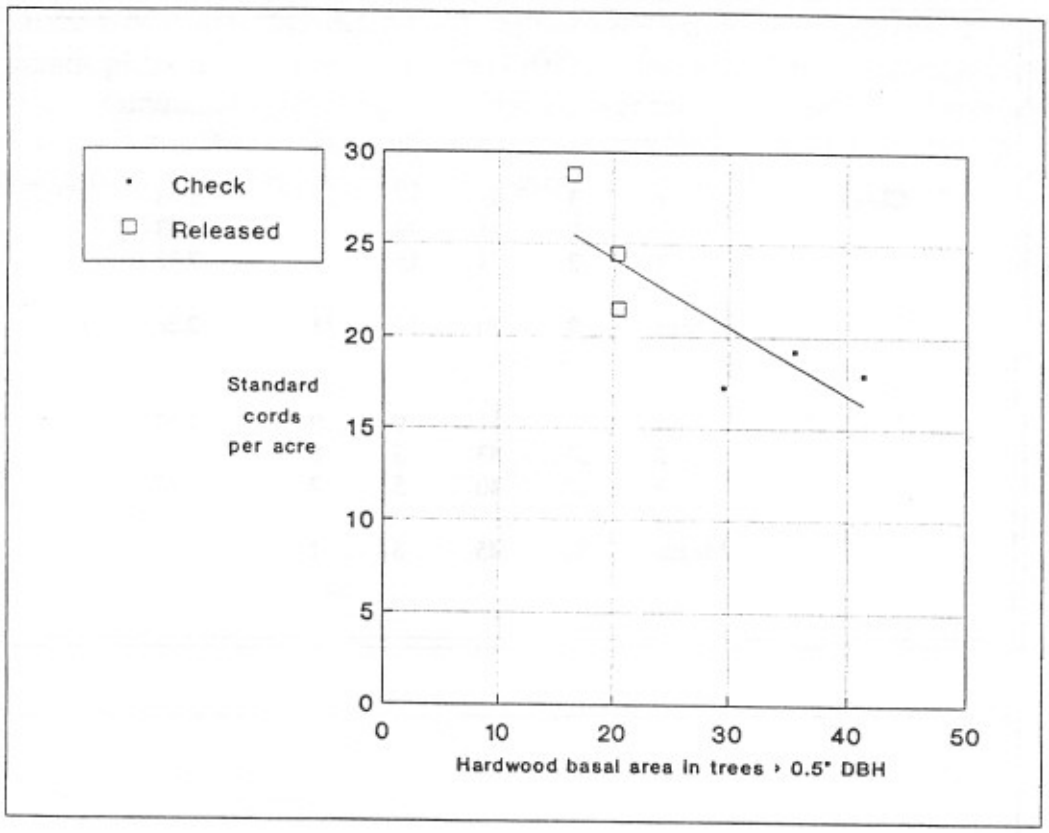

Figure 2. Pine cordwood yields at age 19 related to hardwood basal area.

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

		FTG Class				
	Plot	1	2	3	4	Means
Check	1	3	63	17	17	2.48
	2	0	74	19	7	2.33
	3	2	74	15	9	2.32
	Means	2	70	17	11	2.38
Released	1	49	51	0	0	1.51
	2	54	43	3	0	1.49
	3	52	40	5	2	1.57
	Means	52	45	3	1	1.52

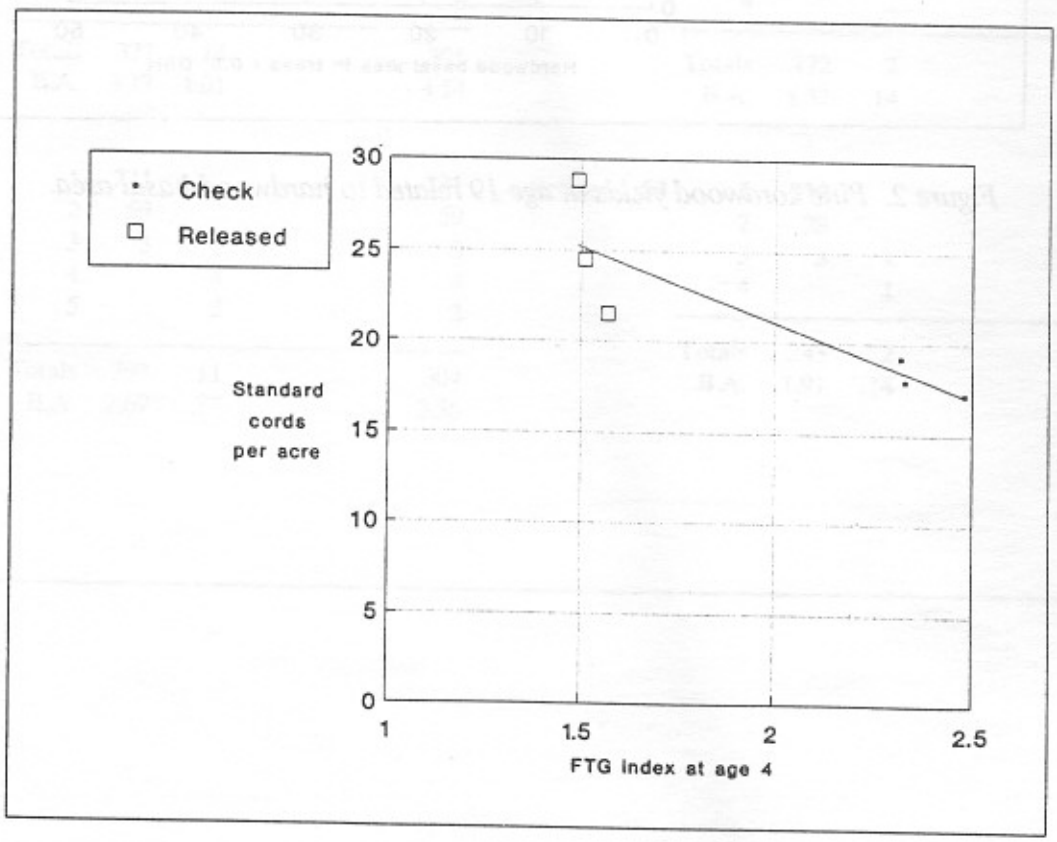

Figure 3. Pine cordwood yields at age 19 related to FTG index.

Dominant and codominant loblolly pine have grown faster on the released plots than on the check plots (Table 1). Average height differences were .2, 1.0, 1.0, 1.6, and 1.9 feet at ages 4, 8, 13, 17, and 19, respectively. There is nothing to suggest that site index should be higher on the released plots than on the check plots. Hardwood competition seems to have affected height of dominant and codominant pines, as we have noticed in other release studies.[5] Average loblolly pine dominant and codominant height at age 19 is plotted over total hardwood basal area in Figure 4, and over free-to-grow rating in Figure 5. The relationship with hardwood basal area was not statistically significant, but that with the free-to-grow rating was. [6]

---

[5] See Occasional Report No. 75 (Release Report No. 8) for a discussion of this relationship and its probable cause.

[6] Estimated D & CD pine height = 50.55 - 2.2045 (free-to-grow index at age 4), r^2 = .684, probability of a larger F = .042.

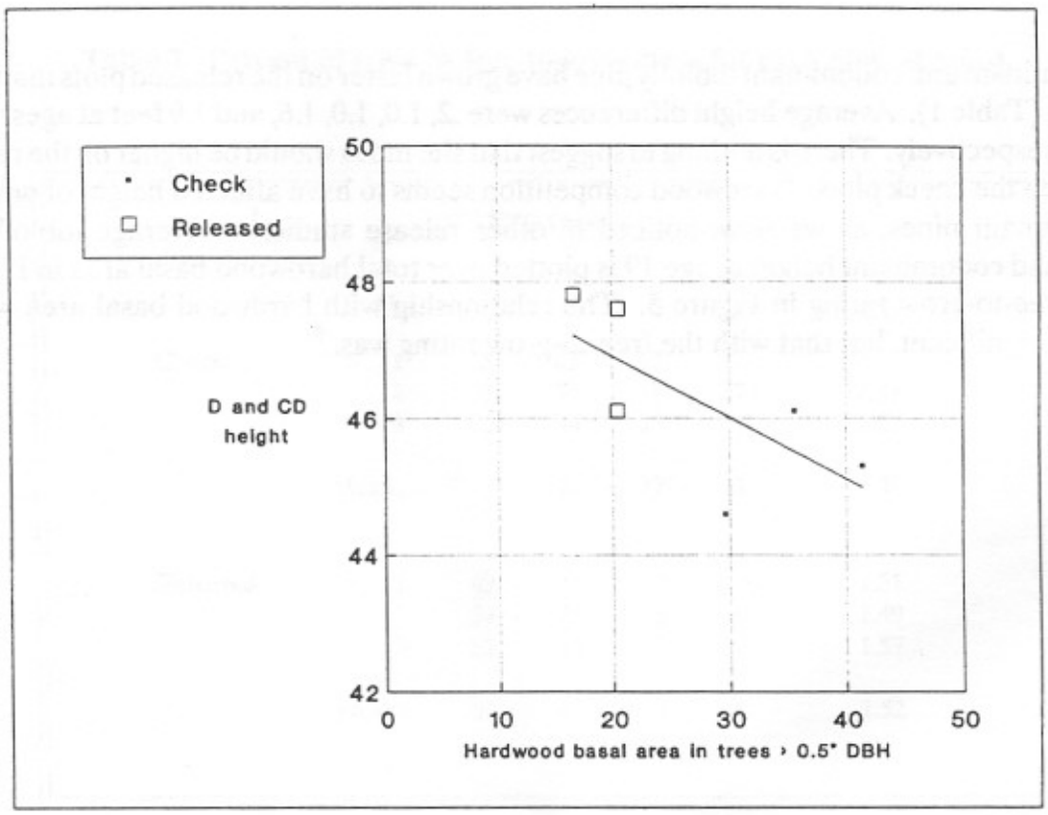

Figure 4. Pine dominant and codominant height at age 19 related to hardwood basal area.

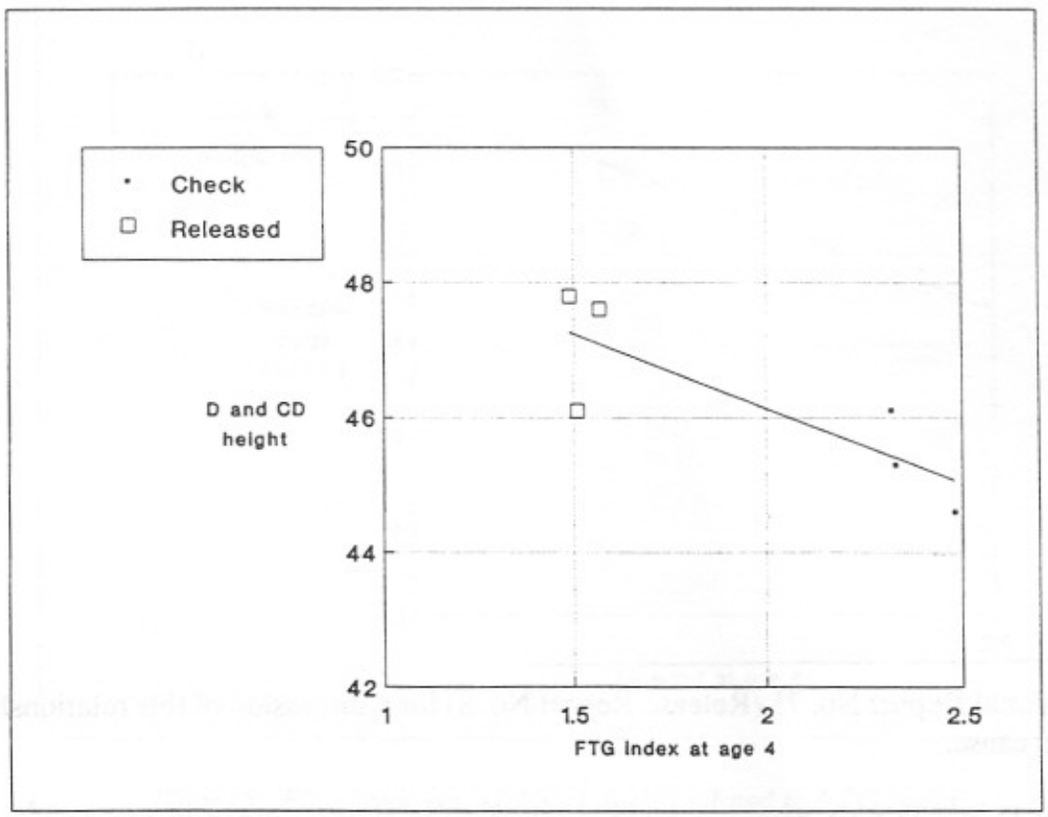

Figure 5. Pine dominant and codominant height at age 19 related to FTG index.