

THIRD YEAR RESULTS OF THE IMPROVED PLANTING
STOCK-VEGETATION CONTROL STUDY

PLANTATION MANAGEMENT RESEARCH COOPERATIVE

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PMRC TECHNICAL REPORT 1991-3

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INTRODUCTION

A study was established in 1985-1987 with the objective of evaluating the impact of genetic improvement and vegetation control on growth and yield of loblolly and slash pine plantations. The genetic improvement program of most companies in the cooperative had progressed to the point that planting stock from rogued first generation orchards was available. The impact of this improved planting stock on yields was unknown and most predictions were based on single row progeny test results. The study was designed to compare the stand structure and yields of (1) unimproved bulk lot and improved bulk lot plantings, (2) improved bulk lot planting and single family plantings, and (3) to quantify the interaction of each type of plantation with vegetation control.

The study area chosen was Georgia, Alabama, western South Carolina, and north Florida. This area was divided into three regions and the best families for each region were chosen by cooperators. The tree improvement cooperatives at North Carolina State University and at the University of Florida double checked the selected families for loblolly and slash pine respectively. The region names and the selected families are shown below:

Coastal Plain <u>Loblolly</u>	Piedmont <u>Loblolly</u>	Coastal Plain <u>Slash</u>
7-34	12-12	106-56
10-5	5-5	6-56
17-5	12-9	35-60
10-25	12-7	56-56
7-56	1-14	261-56
7-2	15-42	187-57

Codes for families are those of the respective cooperatives.

METHODS

Seed from selected families in each region were mixed together to form a bulk lot. These seedlings, plus separate blocks for each family, and bulk

lots of unimproved seed obtained from International Forest Seed for each region were planted in the same nursery and grown at the same density and cultural practices. Seedlings were hand lifted and were planted within a week of lifting.

Fifty two installations of the study were planted over the regions: 15 Piedmont loblolly, 16 Coastal plain loblolly, and 2 slash installations were planted in 1986. Seventeen slash installations were planted in 1987. Each installation consisted of nine plots, each 0.4 acres in size. Seedlings were planted at a density of 700 to 750 per acre. Treatments for the study are listed below:

<u>Treatment</u>	<u>Description</u>
1	Unimproved stock, no vegetation control
2	Unimproved stock, complete vegetation control
3	Bulk lot improved stock, no vegetation control
4	Bulk lot improved stock, complete vegetation control
5	Single family improved stock, no vegetation control
6	Single family improved stock, complete vegetation control
7	Bulk lot improved stock, cooperatior choice vegetation control

Each treatment was randomly assigned to one plot at each installation. In addition, one of treatments 1-4 and one of treatments 5-6 were randomly assigned to the remaining two plots at each installation. Only one single family was assigned to an installation and the assignments were made at

random. Therefore, each family was planted on two to three installations on average.

The vegetation control plots have been visited by UGA field crews at least two times per growing season and sometimes three times. The first visit was to spray sulfometuron methyl (Oust) in the period February-mid April. The second visit was timed to occur shortly after green-up of broomsedge and consisted of a glyphosate (Accord) spray with occasional use of triclopyr (Garlon) where hardwoods were a problem. The third visit was only to problem sites.

After three growing seasons, the 1987 plantings were measured. An approximate 0.2 acre measurement plot was installed on each 0.4 acre gross plot to obtain a buffer area of two rows on each side and 20 feet on each end.

Every third tree on each measurement plot was measured for dbh, total height, and examined for fusiform rust.

RESULTS

Table 1 contains average values for dbh, total height and cronartium infection percent after three growing seasons. The results are presented for the two regions of loblolly pine and for slash pine separately. Not surprisingly, since these results are averaged over all single family installations, the single family improved results and the bulk lot improved results are very similar. For both coastal plain loblolly and piedmont loblolly pine use of genetically improved seedlings resulted in gains with or without vegetation control. For slash pine, vegetation control was necessary for the genetic improvement to manifest itself.

Dbh Results

Average gain for dbh from genetic improvement in the coastal plain was .08 inches and average gain for dbh in the Piedmont was .17 inches without vegetation control for loblolly pine. Complete vegetation control alone resulted in a gain in dbh of 0.49 inches for coastal plain loblolly and 0.47 inches for piedmont loblolly pine. When used in conjunction with genetically improved stock, vegetation control resulted in additional gains for loblolly pine in both regions. In the coastal plain the additional gain was 100% or 0.59 inches. In the Piedmont the additional gain was about 107% or 0.57 inches. For slash pine there was virtually no gain from genetic improvement alone. The gain from vegetation control alone was 0.41 inches. With genetic improvement and vegetation control together, however, the total gain was 0.64 inches.

Height Results

Results for average height follow the same trends as for dbh. Genetic improvement alone resulted in increases of 0.4 feet and 0.8 feet for coastal plain loblolly and piedmont loblolly respectively. Increases for vegetation control were 2.0 feet for coastal plain and 1.8 feet for piedmont loblolly pine. Treatments involving both vegetation control and improved planting stock resulted in increases of 2.7 feet and 2.8 feet over the unimproved planting stock with no vegetation control treatments.

As with dbh, there was virtually no increase in slash pine average height from improved planting stock alone while there was a 1.4 foot increase from complete vegetation control. When both improved planting stock and vegetation control were used the increase over no improvement and no vegetation control was 2.5 feet, a gain comparable to the loblolly increases.

Cronartium Results

There were very small differences in cronartium infection percent across treatments for loblolly pine in both regions. In most cases, vegetation control resulted in a 1-6 percent higher infection rate. No differences were significant probably due to the high variability. Piedmont infection rates averaged considerably less than coastal plain rates.

Slash pine infection rates compared to coastal plain loblolly rates were markedly lower, but the trend was true even for unimproved planting stock. Genetic improvement plots for slash pine without vegetation control had an average infection rate (4%) about half that of unimproved plots (7%). Improved plots with vegetation control had essentially the same amount of cronartium (8 and 11% versus 9%) as unimproved plots. The big increase in growth from slash pine came from the plots with this combination, however, it is interesting to note that the increased new growth did not result in significantly higher infection levels.

SINGLE FAMILY RESULTS

Average dbh, total height, cronartium infection percent, and coefficient of variation (CV) in dbh by single family installations are tabulated in Tables 2 through 5 respectively. Reading horizontally along a line which begins with a single family identification, all values recorded on that line were obtained from installations where only that particular single family was represented in treatments 6, 7, and 8. Summarizing the data in this manner allows comparison of single family means with bulk lot improved and unimproved means from the same sites.

For both regions of loblolly pine there were 2 to 3 installations for each family. For slash pine, due to failure of 3 of the families in the nursery, only 3 families were planted on more than one installation. Those 3 families have 4, 5 and 7 installations each and they are the only slash pine families for which single family analyses can be made.

The single family means presented in Tables 2 through 5 show no particular trends. Some families have means higher than and some lower than the bulk lot values, but this was not unexpected since the bulk lot consisted of a mixture of the single families. It appears that some families (7-2, 17-5 and 7-56 are examples) grew at or slightly below the average without vegetation control and they grow much better than average with vegetation control. This may be a reflection of the care given to progeny tests when these families were chosen. With the small numbers of installations for any family, conclusions at age 3 should be made with caution.

The values in Table 5 represent the average coefficient of variation (CV) in dbh values within a plot. Small CV values represent very uniform stands with small dbh ranges. In some cases the single family CV values are larger and in some cases they are smaller than bulk lot plantings. Again, these values should be much more stable at older ages.

The one treatment which has a uniform effect on CV regardless of the genetic characteristics is vegetation control. Whether the treatment was unimproved, bulk lot improved, or single family improved, the addition of complete vegetation control resulted in a more uniform stand and a lower CV.

SUMMARY

Results of all three datasets at age 3 indicate that the combination of genetically improved planting stock and complete vegetation control results in

a larger increase than either treatment alone. For slash pine there is no increase from genetic improvement without vegetation control, but the increase from both genetic improvement and vegetation control is far greater than the increase from vegetation control alone. There are differences in infection rates across datasets, but as in many other studies the faster growing treatments generally had the higher infection rates. Single family results were mixed, but the single treatment which virtually always resulted in increased uniformity was vegetation control.

Analyzing and reporting these three year results was interesting but must be treated with caution. These data will have value in the future primarily as a base line for examining growth trends over time. In another year, the six year loblolly data will be available. At that time we will have a much clearer picture of whether or not the trends we see at age 3 are real.

Table 1. Average dbh (inches), average height (feet), and average cronartium infection (%) for each treatment (VC = Vegetation Control) by species and region.

	-----Treatment-----					
	Unimproved		Bulk Lot Improved		Single Family Improved	
	<u>Without VC</u>	<u>With VC</u>	<u>Without VC</u>	<u>With VC</u>	<u>Without VC</u>	<u>With VC</u>
	COASTAL PLAIN LOBLOLLY					
dbh	0.51	1.0	0.59	1.18	.60	1.25
height	6.1	8.1	6.5	8.8	6.5	8.9
cronartium %	26	28	25	25	26	29
	PIEDMONT LOBLOLLY					
dbh	.36	.83	0.53	1.1	.52	1.0
height	5.3	7.1	6.1	8.1	6.0	8.1
cronartium %	16	19	20	21	14	21
	COASTAL PLAIN SLASH					
dbh	0.94	1.35	0.96	1.58	0.96	1.56
height	6.3	7.7	6.4	8.8	6.5	8.8
cronartium %	7	9	4	8	5	11

Table 2. Average Dbh (inches) by single family installations for each treatment VC = Vegetation Control) by species and region.

Family	Number of Installations	-----Treatment-----					
		Unimproved		Treatment Bulk Lot Improved		Single Family Improved	
		Without VC	With VC	Without VC	With VC	Without VC	With VC
COASTAL PLAIN LOBLOLLY							
7-2	3	0.43	0.82	0.29	1.02	0.35	1.21
10-5	3	0.54	0.79	0.44	1.20	0.72	0.97
17-5	2	0.18	1.03	0.34	0.69	0.30	1.20
7-34	2	0.49	1.01	0.61	1.13	0.74	1.20
7-56	2	0.50	1.18	0.86	1.13	0.67	1.54
10-25	3	0.63	1.49	0.99	1.62	0.81	1.68
PIEDMONT LOBLOLLY							
5-5	2	0.50	0.83	0.85	1.14	0.52	
1-14	3	0.41	0.96	0.39	1.15	0.50	
12-7	2	0.24	0.59	0.29	0.98	0.25	
12-9	3	0.28	0.81	0.45	1.00	0.45	
12-12	3	0.36	0.84	0.68	0.97	0.74	
15-42	2	0.35	0.98	0.62	1.10	0.60	
COASTAL PLAIN SLASH							
106-56	4	0.67	1.43	0.71	1.37	0.94	
187-57	1	1.13	1.23	1.26	1.58	1.03	
261-56	7	1.00	1.27	0.94	1.57	0.94	
35-60	1	0.67	1.13	0.69	1.43	0.81	
56-56	1	1.92	2.15	2.07	2.31	2.02	
6-56	5	0.92	1.29	0.99	1.55	0.90	

Table 3. Average height (feet) by single family installations for each treatment VC = Vegetation Control) by species and region.

Family	Number of Installations	Treatment					
		Unimproved		Treatment Bulk Lot Improved		Single Family Improved	
		Without VC	With VC	Without VC	With VC	Without VC	With VC
COASTAL PLAIN LOBLOLLY							
7-2	3	5.6	7.0	4.9	7.9	5.4	8.3
10-5	3	6.2	7.3	5.9	9.0	6.8	7.4
17-5	2	4.7	8.3	5.4	6.9	5.1	8.6
7-34	2	5.8	7.9	6.6	8.4	7.1	8.8
7-56	2	6.2	8.6	7.6	8.6	7.0	10.4
10-25	3	6.7	9.8	8.3	10.7	7.3	10.8
PIEDMONT LOBLOLLY							
5-5	2	5.8	7.1	7.4	8.4	6.2	8.0
1-14	3	5.6	7.5	5.6	8.6	6.1	8.7
12-7	2	5.0	6.1	5.2	7.8	4.8	6.0
12-9	3	4.8	7.1	5.8	7.8	5.6	7.6
12-12	3	5.2	7.1	6.8	7.5	6.9	8.9
15-42	2	5.4	7.6	6.7	8.3	6.7	8.5
COASTAL PLAIN SLASH							
106-56	4	5.2	8.3	5.3	8.3	6.6	7.8
187-57	1	7.6	7.4	8.0	9.1	6.9	8.2
261-56	7	6.3	7.3	6.4	8.5	6.1	9.2
35-60	1	4.6	6.8	4.6	8.4	5.3	7.0
56-56	1	10.9	11.0	11.5	11.6	11.5	10.7
6-56	5	6.3	7.2	6.7	8.6	6.6	8.9

Table 4. Average Percent Cronartium Infection (%) by single family installations for each treatment (VC = vegetation control) by species and region.

Family	Number of Installations	Treatment					
		Unimproved		Treatment Bulk Lot Improved		Single Family Improved	
		Without VC	With VC	Without VC	With VC	Without VC	With VC
COASTAL PLAIN LOBLOLLY							
7-2	3	29	32	29	28	38	35
10-5	3	32	33	27	37	35	18
17-5	2	17	40	18	36	17	34
7-34	2	24	22	25	10	22	29
7-56	2	30	27	32	19	22	44
10-25	3	20	14	16	18	19	20
PIEDMONT LOBLOLLY							
5-5	2	10	18	30	23	12	21
1-14	3	18	25	17	12	19	16
12-7	2	27	29	16	17	16	26
12-9	3	14	25	23	33	15	32
12-12	3	13	10	19	23	12	17
15-42	2	16	10	14	14	7	6
COASTAL PLAIN SLASH							
106-56	4	12	23	1	8	10	25
187-57	1	10	0	2	10	6	6
261-56	7	19	4	4	6	3	5
35-60	1	4	7	5	4	6	6
56-60	1	6	2	2	11	2	9
6-56	5	9	8	6	9	5	10

Table 5. Average coefficient of variation (%) of dbh by single family installations for each treatment (VC = Vegetation Control) by species and region.

Family	Number of Installations	Treatment					
		Unimproved		Treatment Bulk Lot Improved		Single Family Improved	
		Without VC	With VC	Without VC	With VC	Without VC	With VC
COASTAL PLAIN LOBLOLLY							
7-2	3	62	49	138	35	77	38
10-5	3	55	54	91	38	44	57
17-5	2	106	39	78	58	95	38
7-34	2	57	35	47	36	45	35
7-56	2	89	34	77	40	74	30
10-25	3	55	30	42	28	59	26
PIEDMONT LOBLOLLY							
5-5	2	71	48	45	37	69	41
1-14	3	88	49	79	40	71	39
12-7	2	113	56	91	37	99	51
12-9	3	133	51	102	41	218	44
12-12	3	92	61	60	45	56	47
15-42	2	79	42	47	49	63	42
COASTAL PLAIN SLASH							
106-56	4	52	25	136	31	45	37
187-57	1	17	36	27	27	36	31
261-56	7	29	27	33	26	36	26
35-60	1	20	32	30	28	33	32
56-56	1	17	17	20	18	16	21
6-56	5	11	23	40	31	21	26