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Competition Control and Fertilization in an Unthinned, Cut-over Slash Pine Stand Growing on a Droughty, Infertile Deep Sand – Four Year Results

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ABSTRACT

Slash pine does not grow well on the deep sands in the Coastal Plain region of Georgia. However, many acres of these droughty, infertile soils are planted in slash pine. A research site was established on an unthinned stand of 18-year-old slash pines growing on a deep sand soil type to see if intensive management practices would increase growth. Results after four years indicate: (1) two and four year mortality was excessive in the herbicide+fertilizer treatment compared to other treatments, (2) four year diameter growth was significantly greater in the fertilizer and herbicide+fertilizer treatments than in the control and herbicide treatments and (3) there were no significant differences in other types of tree measurements. In this case, NPK fertilization, the herbicide application, and the combination did not pay.

INTRODUCTION

Slash pine has been planted over a large number of acres in Wheeler County Georgia. Some of these sites may not be well suited to produce a quality slash pine stand. A study was designed to address the impact of fertilization and competition on slash pine production on a deep sand site (Photo 1).

Photo 1. Typical soil profile for unthinned slash pine study area in Wheeler County, Georgia

SITE CHARACTERISTICS The site was a slash pine stand planted in 1984. The soils were delineated as predominately Foxworth and Lakeland series (excessively well drained Typic Quartzipsamments). The most common understory and midstory hardwood competition species were hawthorne, water oak, post oak, turkey oak, sparkleberry, persimmon, and black cherry. Due to the poor growing conditions, the stand has not been thinned (Photo 2).

Photo 2. Wheeler County Georgia eighteen-year-old unthinned slash pine stand study area

STUDY DESIGN

Soil and foliage nutrient values were measured annually. Tree measurements were taken prior to establishment, 2 and 4 years after treatment. Foliar sampling and analysis taken prior to fertilization and herbicide application indicated N (0.93 to 0.96%), P (0.085 to 0.095%), and K (0.17 to 0.20%) concentrations at or below sufficiency (Table 1). Soil available P was slightly above sufficiency (14 to 26 lbs/ac) prior to treatments (Table 1). Twelve gross treated plots (96x96 feet) were installed with an interior 66x66 feet measurement plot to follow tree growth. All living trees within each measurement plot were numbered and aluminum tree tagged and measured for d.b.h., live crown length, and total height prior to fertilizer or herbicide application. Plot treatments were: control (no treatment), fertilization only (465 lbs NH_4NO_3, 250 lbs DAP, 100 lbs muriate of potash per acre = 155 N, 50 P and 50 K per acre), herbicide only (Velpar L @ 2ml/spot in a 6x6 feet grid pattern), or the fertilization+herbicide combination. Treatments were randomly assigned to the plots. All treatments were applied on 22 March 2002.


Photo 3 (left). Typical leaf area from the unthinned slash pine stand in Wheeler County Georgia
Photo 4 (right). Wheeler County Agent, Mike Hayes, collecting a foliage sample from one of the unthinned 18-year-old slash pine stand's plots

SUMMARY

Results after four years indicate the following: (1) there were no significant increases in soil available P or foliar nutrient status with the NPK fertilizer, herbicide, or herbicide+fertilizer treatments (Table 2), (2) two and four year mortality was excessive in the herbicide+fertilizer treatment (14%) compared to the other treatments (2 to 3%, Table 3 and 4), (3) four year diameter growth was significantly greater in the fertilizer and herbicide+fertilizer treatments (0.76 and 0.78 inches) than in the control and herbicide treatments (0.48 and 0.59 inches, Table 4), and (4) there were no significant gains in height, live crown ratio, volume per tree, total volume (Table 4), pulpwood, or superpulp volume/ac growth with the fertilizer, herbicide, or herbicide+fertilizer treatments compared to the control.

Economically wood value increases were $136/ac for the control ($272/ac in 2002 and $408/ac in 2006), $184/ac for the NPK fertilizer treatment ($159/ac in 2002 and $343/ac in 2006), $193/ac for the herbicide treatment ($248/ac in 2002 and $441/ac in 2006), and $158/ac for the herbicide+fertilizer treatment ($188/ac in 2002 and $346/ac in 2006 using $18/cd for pulpwood and $32/cd for superpulp) over the four year period. In this case, NPK fertilization, the herbicide application, and the combination did not pay. If fertilization and/or herbicide application had occurred at an earlier age would we have seen a benefit? It is possible. This case illustrates that slash pine is not the best choice on these infertile deep sands. Longleaf and sand pine are the best choices on these soils. It did not pay to fertilize (NPK), herbicide (Velpar L) or the combination on a deep sand growing slash pine. The cost of the treatments was more than the value of the increase in volume.

Table 1. Cut-over unthinned 18-year-old slash pine baseline surface (0-6") soil pH and phosphorus (P) and foliar N, P, K, Ca, Mg, B, and Cu means (December 2001) prior to treatments on an excessively well drained soil (Foxworth) in Wheeler County, Georgia

Treatment	Surface soil		---------- Foliar concentration ----------						
	pH	P (lb/ac)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	B (ppm)	Cu (ppm)
Control	4.6	27	0.96	0.10	0.17	0.16	0.05	4	3
NPK Fertilizer	4.7	14	0.94	0.10	0.19	0.11	0.04	5	2
Herbicide	4.7	23	0.93	0.09	0.18	0.14	0.06	5	2
Herb+fert	4.6	15	0.93	0.09	0.20	0.23	0.07	5	2

There were no significant differences between treatments prior to treatments at the 5% alpha level using Duncan's Multiple Range Test. Minimum sufficiency guidelines for slash pine are: soil P =12 lbs/ac, foliar N=1.0%, P=0.09%, K=0.25%, Ca=0.10%, Mg=0.06%, B=4-8ppm, Cu=2-3ppm.

Table 2. Cut-over unthinned slash pine surface (0-6") soil pH and available-phosphorus (P) and foliar N, P, K, Ca, Mg, B, and Cu means 4-years after treatments on an excessively well drained soil (Foxworth) in Wheeler County, Georgia

Treatment	Surface soil		---------- Foliar concentration ----------						
	pH	P (lb/ac)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	B (ppm)	Cu (ppm)
Control	4.7	16	0.89	0.09	0.33	0.14	0.07	5	1
NPK Fertilizer	4.5	23	1.03	0.10	0.39	0.13	0.08	9	2
Herbicide	4.6	15	0.98	0.08	0.34	0.15	0.09	8	1
Herb+fert	4.4	17	0.97	0.08	0.35	0.11	0.06	6	1

There were no significant differences between treatments prior to treatments at the 5% alpha level using Duncan's Multiple Range Test.

Table 3. Cut-over unthinned 18-year-old slash pine baseline growth parameter means (December 2001) prior to treatments on an excessively well drained soil (Foxworth) in Wheeler County, Georgia

Treatment	Trees per acre	Dbh (inches)	Height (feet)	Live crown ratio (%)	Basal area (ft^2/ac)	Total volume (ft^3/ac)	Volume per tree (ft^3)
Control	505	5.0	35.3	33	73	1363	2.7
NPK Fertilizer	430	4.5	31.8	33	51	897	2.1
Herbicide	480	5.0	37.3	32	68	1323	2.8
Herb+fert	500	4.5	32.8	32	59	1069	2.1

There were no significant treatment mean differences prior to treatments. 32 $ft^3 \approx$ 1 ton wood+bark.

Table 4. Four year growth increment (age 18- to age 22-years-old) in a cut-over unthinned slash pine stand on an excessively well drained soil (Foxworth) in Wheeler County, Georgia

Treatment	Trees per acre	Dbh (inches)	Height (feet)	Live crown ratio (%)	Basal area (ft^2/ac)	Total volume (ft^3/ac)	Volume per tree (ft^3)
Control	-10 a	0.48 b	1.9	- 2	13	151	0.90
NPK Fertilizer	-10 a	0.76 a	2.9	- 2	17	217	1.3
Herbicide	-15 a	0.59 b	2.5	- 1	15	137	1.2
Herb+fert	-70 b	0.78 a	3.3	- 2	11	54	1.2

Means followed by a different letter within a column are significantly different at the 5% alpha level using Duncan's Multiple Range Test. 32 $ft^3 \approx$ 1 ton wood+bark.

ABOUT THE AUTHORS

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CITATION

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