

The Impact of Competition Control and Fertilization on an Infertile Deep Sand Cut-Over Slash Pine Site - Six Year Results

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Introduction

Slash pine stands have been established on a large number of acres in Wheeler County, Georgia. Some of these stands were planted on infertile, deep sand sites that are not well suited to be productive slash pine stands. In 2002, a study was implemented to measure the impact of fertilization and competition control on a deep sand site that was planted in slash pine (*Pinus elliottii*). This paper details stand response six years after treatment.

Site Characteristics

The site was on an unthinned 18-year-old slash pine stand that was planted in 1984. The soils were delineated as predominately Foxworth and Lakeland series (excessively well drained Typic Quartzipsamments) (Paulk, 1973). The understory and midstory hardwood competition species were hawthorn, water oak, post oak, turkey oak, sparkleberry, persimmon and black cherry. No thinning had occurred as the majority of slash pines had not reached merchantability due to the poor growing conditions.



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

Study Design

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 with an aluminum tag. All trees were measured for diameter at breast height (dbh), live crown length, and total height prior to fertilizer or herbicide application. Plot treatments were: control (no treatment), fertilization only (465 lbs NH₄NO₃, 250 lbs DAP, 100 lbs muriate of potash per acre = 200 N, 50 P and 50 K per acre), herbicide only (Velpar L at 2.1ml/spot in a 4x6 feet grid pattern), and the fertilization + herbicide combination. Treatments were randomly assigned to the plots. All treatments were applied on 22 March 2002 (Hayes et al. 2007). Soil and foliage nutrient values were measured annually for the first four years. Tree measurements were taken prior to establishment as well as 2, 4 and 6 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).

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 excessively well drained soils 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 excessively well drained soils 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 excessively well drained soils 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 ft³ ≈ 1 ton wood+bark.

Table 4. Six year growth increment (age 18- to age 24-years-old) in a cut-over unthinned slash pine stand on excessively well drained soils 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 | -25 a | 0.68 | 7.8 | - 1 | 14 | 502 | 1.3 |
| NPK Fertilizer | -15 a | 1.15 | 9.8 | - 1 | 18 | 538 | 1.8 |
| Herbicide | -25 a | 0.79 | 8.3 | - 1 | 16 | 577 | 1.6 |
| Herb+fert | -70 b | 1.15 | 9.3 | + 1 | 14 | 501 | 1.7 |

Means followed by a different letter within a column are significantly different at the 5% alpha level using Duncan's Multiple Range Test. 32 ft³ ≈ 1 ton wood+bark.

Summary

Results after four years indicate there were no significant increases in soil available P or foliar nutrient status with the fertilizer, herbicide or herbicide + fertilizer treatments (Table 2). Pine mortality through six years was excessive in the herbicide + fertilizer treatment (14%) compared to the other treatments (3% to 5%; Tables 3 and 4). Six year diameter growth in the fertilizer and herbicide + fertilizer treatments were not significantly different but were numerically greater than those in the control and herbicide treatments.

In this instance, the low site index and poor growth rates of all treatments, indicate that this slash pine stand would not be a suitable candidate for intensive management practices. This study also indirectly indicates that longleaf or sand pine are the most suitable pine species to plant on low fertility, excessively well drained sandy soils such as Lakeland, Kershaw, Alpin, and Foxworth.

Literature Cited

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