

Loblolly Pine Stand Fertilization at Mid-rotation to Increase Small and Large Sawtimber Volume

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Introduction

There are over 600,000 private non-industrial forest landowners (NIPFLs) in Georgia who own approximately 67% (24.3 million acres) of the state's 36 million acres of forested land. The NIPFLs in the southeastern United States own from 49% (Florida) to almost 70% (South Carolina and Georgia) of the forestland in these states. Forest Industry has been fertilizing between 900,000 to 1.2 million loblolly and slash pine stand acres annually in the southeastern U.S. over the last 8 years. Fertilization on NIPFL acreage is well below that of Forest Industry. Yet, numerous loblolly and slash pine NIPFL stands are candidates for fertilization based on diagnostic tool use (leaf area index estimates or LAI, soil test-P, crown visual symptoms, and foliar N, P, K, Ca, Mg, S, Cu, Mn, and B concentrations). Financial returns ranging from 8% to 17% over an eight to twenty year period can be realized with each fertilizer application.

Private non-industrial forest landowners are very interested in fertilization of their pine plantations. Many own tractors and spreaders and are willing to apply fertilizers themselves. Very little information is available to NIPFLs on the magnitude and duration of response to NP, NPCu, NPKCu, or NPKSCu fertilization in thinned loblolly pine stands on marginal fertility cut-over sites. Current pine pulpwood versus chip and saw and small sawtimber price disparities (pulpwood is 1/5 chip and saw per cord and 1/8 sawtimber per cord) have many NIPF landowners wanting to shift wood to the more valuable product classes as well as grow more wood.

Case Study

There is an opportunity to install a replicated fertilizer study on Chuck Leavell's Charlene Plantation, located in Twiggs County, Georgia (45 minutes South of Macon). Seven of nine thinned loblolly pine stands on Chuck's property show NP, NPK, NPKS, or NPKSCu deficiencies based on soil and foliar sampling on 27 February 2004. Leaf area estimation will occur this summer (July - August) when leaf area is commonly at its peak to further determine which stands will respond to added N.

Methods

We installed a fertilizer trial in a randomized complete block design in two Charlane Plantation thinned loblolly pine stands (planted in 1978). These marginal fertility stands are the Bullard Bluff East tract (8 plots; 2 replications of NP, NPK, NPKSCu, and a control) and the Bullard Bluff West tract (15 plots; 3 replications of NP, NPCu, NPKCu, NPKCu, NPKSCu and a control). The major objectives: (1) quantify the magnitude and duration of wood volume response to the fertilizer combinations, (2) determine changes in product class distribution and (3) the cash flow and rate of return for each fertilizer combination compared to unfertilized control plots, and (4) discern when fertilizers are to be re-applied to maintain wood volume gain.

Project Duration

The proposed project duration is 5 years.

Project Layout and Experimental Design

Gross treated plots (147.6 x 147.6 feet, or 0.5 acres) and internal permanent measurement plots (104.5 x 104.5 feet or 0.25 acres) were installed in the delineated soil series area in the fall of 2004. Forty feet of untreated buffer is between each gross treated plot. Replications (blocks) were laid out on the contour and with basal area in mind to minimize differences. Baseline soil (10 core samples to make a composite sample, with one composite sample /plot @ 0-6") and foliar samples were taken in each plot prior to treatment. Initial stand and plot leaf area index (LAI) were estimated in July 2004 (pre-treatment) and August 2005 (1/2 year post treatment) using the NCSU protocol. Foliage samples (3 dominants/plot, upper 1/3 crown, south side, first flush of previous year's growth to represent each composite sample/plot) were taken each dormant season (February 2005 and 2006). Soil and foliage analysis includes N (foliage only), P, K, Ca, Mg, S, Cu, Mn, Zn, and B. Soil pH for each plot is also being determined. All living crop trees in each plot were aluminum tagged, numbered and measured for dbh and total height prior to treatment. Live crown ratio of all living trees/plot and stem defect were measured and noted prior to treatment.

We randomly assigned each plot an NP, NPK, NPKSCu (Bullard Bluff East) or NP, NPCu, NPKCu, NPKSCu (Bullard Bluff West) fertilizer treatment. Untreated control plots will serve reference plots. The one-time fertilizer application levels in the thinned loblolly pine stand were 200 lbs N/acre + 50 lbs elemental-P + 80 lbs elemental-K + 60 lbs S and 5 lbs Cu/acre. Fertilizer application occurred on 15-16 February 2005. Forest soil and foliage sampling will occur each subsequent winter following treatment (collection for 2006 is 1 February), and LAI estimated at peak expression in midsummer following treatment. Total height and dbh will be remeasured every other winter (Jan-Feb 2007, 2009) to determine diameter class distribution, volume/tree, and volume/acre by product class. Live crown ratio of all trees/plot will also be measured every other winter.

Table 1. Fertilizer treatments applied (15-16 February 2005) to Bullard Bluff East and Bullard Bluff West (1978 planted, thinned in 2001) loblolly pine on an Orangeburg soil.

| Stand name | Plot #'s | treatment |
|--------------------|-----------|-----------|
| Bullard Bluff East | 18, 19 | control |
| | 16, 23 | NP |
| | 17, 21 | NPK |
| | 20, 22 | NPKSCu |
| | | |
| Bullard Bluff West | 1, 4, 8 | control |
| | 5, 9, 15 | NP |
| | 6, 7, 11 | NPCu |
| | 2, 12, 14 | NPKCu |
| | 3, 10, 13 | NPKSCu |

Outcome - Goals

Field days will be planned in years 2-5 after the demonstration site has been installed. Private non-industrial forest landowners, Extension agents, forestry consultants, Georgia, Alabama, Florida, and South Carolina State Commission foresters, NRCS, and other interested individuals will be invited. Increases in diameter growth, crown and leaf area, volume/acre, and product class and cash flow changes will be addressed at these field days. Workshops, seminars, extension publications and other publications will also be generated from these demonstration sites and distributed to the same and made available on the WEB. Also addressed will be various ways for fertilizers to be applied to forest stands with tractor-spreader combinations (cyclone or pull behind), spreader calibration, how much urea, DAP, muriate of potash, S and Cu to apply per acre, and when to apply fertilizers for maximum benefit and minimum losses. It is anticipated that many forest landowners will be able to make educated and informed fertilization decisions in thinned loblolly pine plantations from this project.