FOR188

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# Pre-Commercial Thinning Loblolly Pines – Does It Pay?[1]

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## What Is Pre-Commercial Thinning?

Pre-commercial thinning is performed before trees reach merchantable size, which is typically around 4.5 inches dbh (diameter at breast height, measured at 4.5 ft. above the ground) for southern pines. The objective of a pre-commercial thinning is to reduce densities in overstocked stands to improve the growth of the remaining trees. Overstocked stands can result from natural regeneration when a stand is managed with seed tree or shelterwood techniques or from artificial regeneration by direct seeding. Many southern pine species regenerate by producing a great deal of seed, resulting in thousands of seedlings per acre. Loblolly pine, for example, can be a prolific seed producer under ideal conditions. Natural regeneration practices in even-aged systems through seed-tree or shelterwood methods often results in extreme overstocked conditions that, left untreated, can stagnate growth and lengthen rotation ages (Mann and Lohrey 1974).

The decision to pre-commercially thin a stand is often difficult for many landowners because of the costs involved with implementing this treatment. However, allowing trees to continue growing in overstocked conditions will ultimately result in a stand of trees with small diameters and small crowns. Pine trees generally need at least one-third of the total height in live crown to sustain effective growth rates throughout the stand rotation (see Figure 1). Pine trees with as little as one-quarter to one-third live crown are capable of producing good tree growth, but this is not the case with trees having less than 15 percent live crowns. Even when adequate growing space is provided, those trees do not have enough needles to respond to the available light.

Current guidelines suggest that pre-commercial thinning be done when stand densities are in excess of 5000 stems/acre or when projected live crown ratio at the first commercial thin will be less than 35 percent (Moorhead, Dangerfield and Edwards 1997). Pre-commercial thinning is generally recommended within the first 3-4 years of stand establishment to maintain a rotation length under 35 years. As treatments are delayed, treatment costs increase and growth responses after the thinning can decrease (Mann and Lohrey 1974). Mechanically thinning stands at an early age allows the use of smaller, more

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**Figure 1.** This pine tree has 32 ft. of live crown and a total height of 80 ft. for a live crown ratio of 40 percent. Credits: Photo by Jarek Nowak, FL DOF

fuel efficient machinery, which is generally more practical and cost effective than large equipment (Grano 1969). Other research suggests that when managing for high quality products on a long rotation, pre-commercial thinning manually on an operator-select basis at an advanced age (13 years in this case) could also be economically viable (Moorhead, Dangerfield, and Edwards 1997).

## How Is Pre-Commercial Thinning Accomplished?

Pre-commercial thinning can be conducted using a variety of techniques. Spraying herbicides in a band to kill the sprayed seedlings is one method of reducing the number of stems per acre. Early in the year (May – June) use Accord® XRT at 6 to 7 quarts per acre in 25– 30 gallons of water. Late season (July – September) applications use Krenite® S at 4 – 5 qts. per acre with a nonionic surfactant or Accord® XRT plus Milestone DMT at 1 gallon of each per acre in 25 – 30 gallons of water. These herbicides only remove the seedlings that are directly sprayed leaving unsprayed seedlings that are free to grow. If the seedlings are less than 3 feet tall, sprayers mounted on small tractors or 4-wheelers or even backpack sprayers can be effectively used for the herbicide application.


**Figure 2.** Pre-commercial thinning a young natural stand of loblolly pine. Credits: David J. Moorhead, University of Georgia, Bugwood.org

Mechanical methods are also effective in reducing the number of seedlings per acre. Young seedlings less than 3 feet tall can be cut with most heavy-duty bush hogs or disks pulled with a small tractor (Figure 2). If the pine seedlings are taller than 3 feet, then a Brown tree cutter or Seppi_m® mower would be a better choice to cut rows through the dense pine seedlings (Figure 3). A Brown tree cutter is like a bush hog except the cutting blades are much thicker and the frame is heavier as well. In fact, Brown tree cutters can cut down trees up to 6 inches in diameter, which is much larger than trees being cut in a pre-commercial thinning operation.

Another mechanical method is to pull a rolling drum chopper in rows through the dense seedlings. Rolling drum choppers are generally pulled with a small to medium-size dozer. The rolling drum has cutting edges that sever the seedlings as the drum rolls over them (Figure 4).


**Figure 3.** Pre-commercial thinning naturally regenerated loblolly pine using a Seppi_m® mower. Credits: David J. Moorhead, University of Georgia, Bugwood.org


**Figure 4.** A small rolling drum chopper used to conduct a pre-commercial thinning. Credits: David J. Moorhead, University of Georgia, Bugwood.org

All of the pre-commercial thinning operations discussed so far generally leave a lot of trees between the treated rows. To reduce the competition from dense trees in the residual rows, the mechanical or herbicide operations can be conducted perpendicular to the leave rows, reducing the number of seedlings per acre. It's also possible to reduce the number of residual trees manually using chainsaws or backpack sprayers to achieve the desired number of leave trees.

An additional concern with pre-commercial thinning is the increased dead fuel available on the site for several years. This dead fuel would cause fires occurring in the stand to burn hotter and quicker compared to similar pine stands without pre-commercial treatments. After a couple of years, the fire hazard decreases because the dead woody material decomposes.

The earlier you decide on pre-commercial thinning, the more options are available for you to select from. Dense pine seedlings less than 3 feet tall could be thinned using any of the methods mentioned above. Young trees over 3 feet tall require the use of heavier equipment to pre-commercially thin the trees and thus eliminate the use of smaller tractors, bush hogs and 4-wheelers. The smaller tractor equipment results in lower costs compared to Brown tree cutters and rolling drum choppers.

## What Are the Silvicultural Benefits?

When implemented properly and in a timely fashion, pre-commercial thinning increases diameter growth of residual trees, and an increase in tree diameter correlates to an increase in tree volume. Additionally, pre-commercial thinning prevents the stand from stagnating, which could eventually lead to excessive tree mortality, increase the potential for pine beetle invasions, or extend the rotation length of the stand to 40 or 50 years. A stagnated pine stand is one where the numerous trees per acre have small live crown ratios, small diameters and low volumes per acre.

For this paper, data were taken from 3 study sites receiving a pre-commercial thinning. The stand was naturally regenerated in 1977 and ten years later received the pre-commercial thinning treatments. Figure 5 shows the difference in tree diameters ten years (1997) after three intensities of pre-commercial thinning. Before age 10, the stand had regenerated naturally with over 3,000 seedlings per acre and after ten years of self-thinning and mortality, it still had 2,000 seedlings per acre. The pre-commercial thinning treatments included: 1) no treatment; 2) a "single chop," which included a pass of the roller chopper in one direction; 3) a "chop and thin," which, in addition to the roller chopper, included a light thinning with 6 ft. of space between trees in residual rows; and 4) a "double thin," which, in addition to the roller chopper pass, included a heavy thinning with 10 ft. of space between trees in residual rows. By age 20, trees in the untreated control plots were still primarily too small to be merchantable. In all of the plots that were thinned at age 10, diameter growth increased enough that by age 20 the average stand diameters were within pulpwood sizes. More intense treatments resulted in greater diameter growth, and in the "double thin" treatment, many of the trees had even reached sawtimber size.

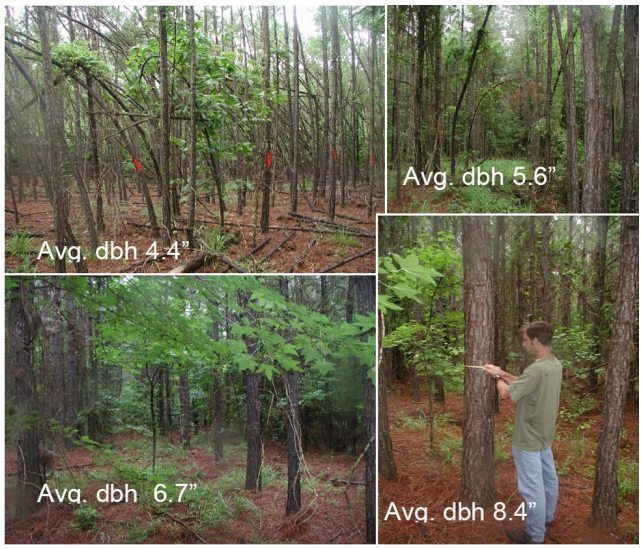


**Figure 5.** Photos showing the various pine stands at age 20. The top left received no pre-commercial thinning. The top right had a single pass rolling chop (single chop). Lower left had the chopping plus 6 feet of space between residual trees (chop + thin). Lower right received the chopping plus 10 feet of space between residual trees (double thin). Credits: Photos by Rick Williams.

## What Are the Economic Benefits?

Although pine trees in pre-commercially thinned areas have a great deal more volume than untreated stands, financial analyses must weigh the cost of the initial treatment against the potential future returns. A financial decision criterion called net present value (NPV) is often used to make the determination of returns and to select between mutually exclusive projects. Net present value is defined as the present value of expected future returns minus the present value of expected future costs plus initial costs discounted with the appropriate interest rate or required rate of return (Gunter and Haney 1984). For any project or activity, a positive NPV will indicate that the project will earn more than the selected interest rate. Projects with the highest NPV are most desirable. In these analyses, a real (net of inflation) interest rate of 5% is considered typically an average comparison to investing in money market or other savings accounts.

Figure 6 shows the NPV per acre for control (no thin) and three pre-commercial treatments applied in the loblolly pine stand depicted in Figure 5 as well as for two additional locations. This financial analysis used treatment costs of $40 per acre for single chop, $52 per acre for chop and thin, and $62 per acre for double thin (Watson, Straka and Bullard 1987). These are the appropriate pre-commercial thinning costs at the time this operation was undertaken in 1987. The value of the stand at age 20 (1997) was based upon average stand diameter and number of trees per acre. Volume was calculated in cords per acre and multiplied by Timber Mart-South stumpage values ($10.00/cord for pulpwood size trees). An approximate value was derived similarly for the merchantable trees in the untreated control plots. In this example, the two most intensive treatments resulted in the greatest returns, which were more than double than no thinning and single were also better than no thinning but significantly lower in returns compared to the chop and thin and double chop treatments.

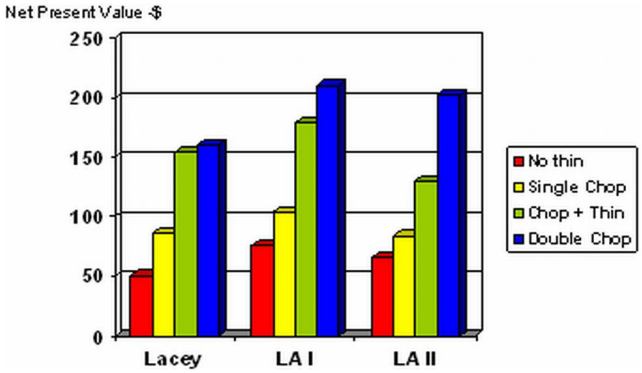


**Figure 6.** Pre-commercial thinning NPVs. The assumption is to tin or not thin a 10 year old pine stand with over 1,500 tree per acre.

The data for this analysis came from three locations that received the same pre-commercial thinning treatments. The treatments included double chop, chop and thin, single chop and no thinning. In each of these areas, 4 1/10$^{th}$-acre permanent plots were established, for a total of 48 measurement plots. Every tree in the plots was measured for dbh and total height. These growth measurements and the number of trees on each plot provided the data used for this analysis. Thus for each treatment an average dbh, total height and number of trees per acre was determined and used to calculate volumes per acre. The volume per acre by treatment provided the necessary information to calculate each stand's value.

In considering if pre-commercial thinning is a viable option from stand establishment, one must also consider stand initiation costs to prepare the area for

seed fall, annual property taxes, and other costs that would be associated with planting. Figure 7 shows the graph of NPV at age 20 recalculated using a cost of $35 per acre to prepare the area before natural regeneration occurred. In this case, areas left untreated will return less than 5% interest to the landowner, resulting in a negative return. The more intense treatments are economically viable alternatives, though the value is significantly less when site preparation costs are included in the treatments for stand establishment. The primary reason for lower returns in evaluating the stand from establishment is that costs are carried forward for a longer period of time and the returns are the same. Thus, the costs are greater when carried for more years.

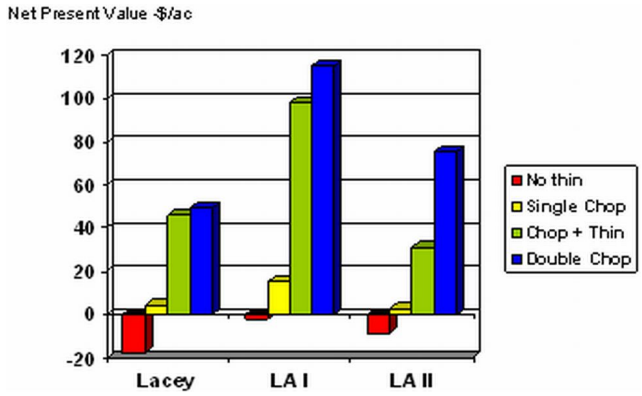


**Figure 7.** Pre-commercial thinning rates NPVs. The assumption is naturally regenerating a loblolly pine stand after conducting a site preparation treatment and considering a pre-commercial thin at age 10 with over 1,500 TPA.

## Summary

Pre-commercial thinning could be, when applied properly, a financially attractive investment. Once natural regeneration is in place, determine the number of seedlings growing per acre. Stands in excess of 2,000 seedlings per acre should receive a pre-commercial thinning. Pre-commercial thinning can be accomplished by mechanical or chemical methods, but the primary goal is to reduce the numerous seedlings down to 400 to 800 trees per acre. Pre-commercial thinning can be implemented as early as age 3 or 4, but additional gains in tree growth can also be achieved in treatments applied as late as age 10.

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