

Surface and Subsurface Tillage Effects on Soil Properties and Tree Growth at an East Texas Lignite Surface Mine¹

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Abstract. Luminant has planted over 38.7 million trees on its reclaimed lignite surface mine operations in Texas since 1974. For decades, the use of improved reclamation techniques on Luminant's mined lands have resulted in quality reclamation with over 31,160 hectares reclaimed to forests, wildlife habitat, and pastures with productivity levels similar to that found on undisturbed lands. Development of new reclamation methodologies offers opportunities to further improve productivity potential of planted trees at Luminant's Martin Lake Oak Hill Mine in east Texas. The conventional haulback or 'truck-shovel' reclamation method uses haul trucks for the selective transport and placement of oxidized overburden to serve as the reforestation growth medium. Overburden transport and placement can also be accomplished using tractor pulled scraper pans; however, there is a lack of information regarding the effects of scraper pans on mine soil compaction and tree growth. To address the potential compacting effects of scraper pans, four soil tillage techniques (n=5) were implemented in August 2015: 1) no tillage (control); 2) disking (30-35 cm depth); 3) single ripping (90 cm depth) and disking (30-35 cm depth); and, 4) cross ripping (90 cm depth) and disking (30-35 cm depth). Soil physical and chemical properties were investigated at 0-30, 30-60, and 60-90 cm. Vegetative response was measured for the winter cover crop in May 2015 and for loblolly pine (*Pinus taeda*) tree seedlings in October 2016 after one growing season. Aboveground biomass production of the winter cover crop was higher for the ripped treatments. When compared to control plots, tillage significantly decreased soil bulk density at 0-30 cm and increased tree seedling survival. Cross ripping was superior in terms of lowering bulk density at all three depths and increasing tree seedling volume index. Above and belowground biomass of loblolly pine seedlings followed similar trends.

Additional Key Words: Reclamation, soil, compaction, bulk density, vegetative response

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