HILL FARM RESEARCH STATION
APRIL 24, 2008
FIELD DAY SUMMARY REPORT

COMMODITY: FORESTRY

TITLE: Managing pine and hardwood timber in retired pastures

CONTACT: Michael Blazier, Hill Farm Research Station, mblazier@agcenter.lsu.edu, (318) 927-2578

TAKE HOME MESSAGE: In the retired pasture of this study, a planting density for pine in excess of 300 trees per acre led to reductions in diameter growth by age 7 due to within-species competition for growth resources. Planting densities for sweetgum and cherrybark oak in excess of 200 trees per acre similarly led to reductions in diameter growth by age 8. Planting pines at 300 trees per acre and sweetgum or oak at 200 trees per acre is below conventional planting guidelines, but on this site these densities produced the best growth rates most likely due to the relatively high soil nutrition and low levels of competing vegetation of this former pasture. Pine and oak mixtures were the more ecologically viable mixture tested in this study. Sweetgum and pine mixtures had lower growth because these two species compete for rooting space, nutrients, and moisture in soil and light in the tree canopy. Pine and oak mixtures, by contrast, appeared to be complementary by ages 7 and 8 because growth of each species was comparable to growth in single-species plantings. As such, pine and oak mixtures may foster higher biomass growth than pure pine or pure oak plantings. In addition, pine appears to improve log quality of the hardwoods by providing shading that reduces the number of knots per log.

PROBLEM/TOPIC: Changing socioeconomic trends have led to conversion of some pastures in Louisiana and its surrounding states to forest plantations. Many landowners value the aesthetic and wildlife habitat values forests provide in addition to revenues from forest products. Emerging markets for environmental services such as wildlife habitat, watershed protection, and carbon sequestration can provide landowners with sources of income for these management objectives. In addition, hardwood product values are converging with those of pine. As such, mixtures and pine and hardwoods can provide landowners with an economically and ecologically favorable mixture of forest products and environmental services. However, optimum species mixtures and planting densities for upland retired pastures have not been well defined.

ACTION: A study was initiated at the Hill Farm Research Station in 1997 by planting a retired pasture with hardwood seedlings. In 1998, loblolly pine seedlings were planted in the research area as well. Treatments conducted included: (A) planting densities of 400, 300, and 200 trees per acre, and (B) plantings of pure pine, pure cherrybark oak, pure sweetgum, pine and sweetgum mixtures, and pine and cherrybark oak mixtures. Diameter and height of trees has been measured periodically since planting, and the height to the first live branch was measured in fall 2007.

IMPACT: Diameter growth of all three species from 2000 through 2005 was inversely related to planting density (Figure 1). For loblolly pine, the planting density of 400 trees per acre had lower diameter growth by age 7 than the 300 and 200 trees per acre planting densities. For sweetgum and cherrybark oak, the 300 and 400 trees per acre planting densities had lower diameter growth rates than the 200 tree per acre density by age 8. In mixtures of pine and sweetgum, diameter growth rates of both species were lower than those found in comparable single-species plantings. There were no significant differences in diameter growth of pine and oak trees in mixtures relative to comparable single-species plantings. Pine growth was lower in mixtures of sweetgum than in mixtures of oak (Figure 2). The height to live branches for pine averaged 20 ft. in pure-pine plantings as well as in mixtures with sweetgum and oak. The height to live branches of sweetgum and oak were 50% higher in mixtures with pine than in single-species plantings.

Figure 1. Diameter growth, 2000-2005

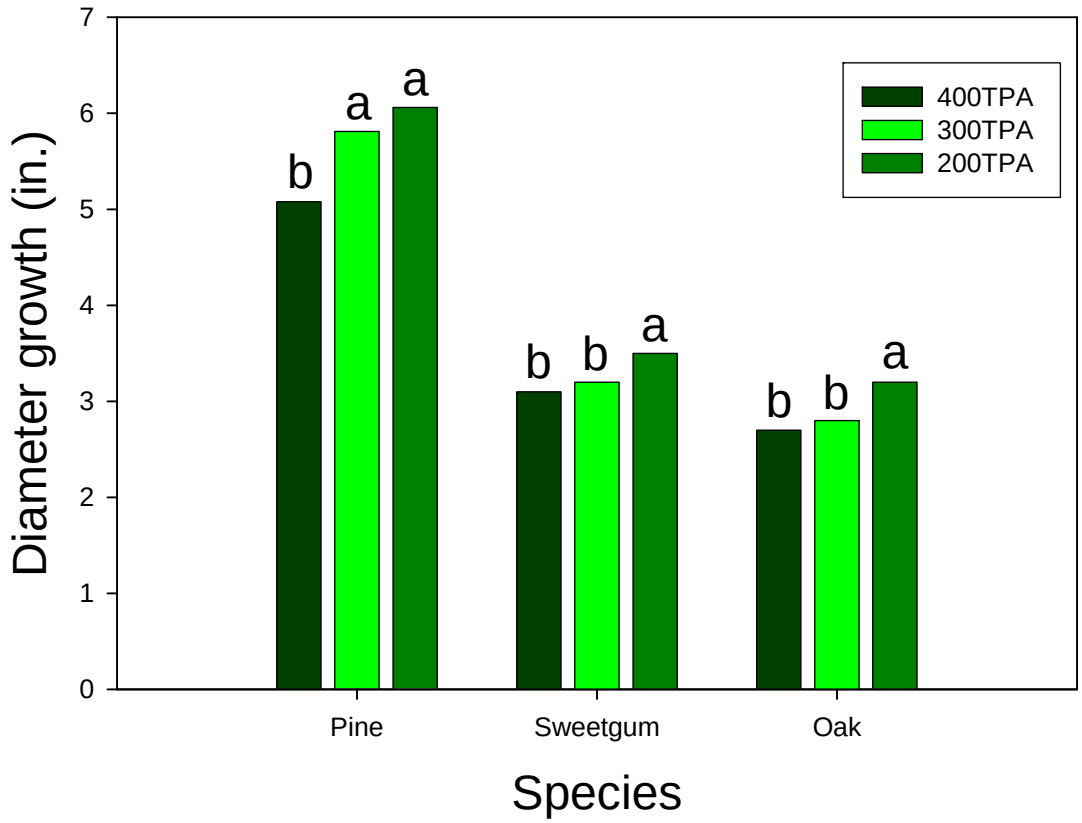
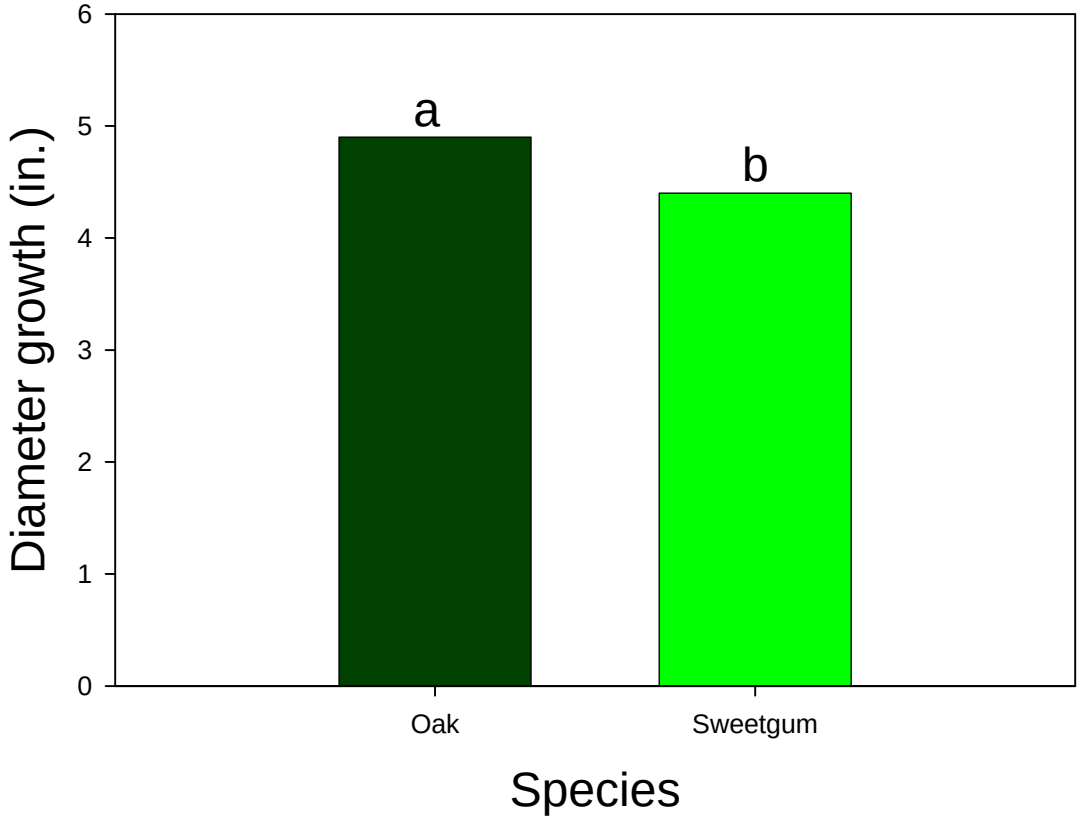


Figure 2. Diameter growth of loblolly pine planted at 300 TPA with cherrybark oak or sweetgum planted at 400 TPA. 2000-2005



HILL FARM RESEARCH STATION
APRIL 24, 2008
FIELD DAY SUMMARY REPORT

COMMODITY: FORESTRY

TITLE: Nutrient dynamics and tree growth of silvopastoral systems: impact of poultry litter

CONTACT: Michael Blazier, Hill Farm Research Station, mblazier@agcenter.lsu.edu, (318) 927-2578

TAKE HOME MESSAGE: On the sandy Coastal Plain soil of this study, a loblolly pine and bahiagrass silvopasture was an ecologically viable land management system for poultry litter application. Four annual applications of 5 and 10 Mg broiler litter ha^{-1} stimulated growth of loblolly pine, and soil test P concentrations were maintained below runoff potential thresholds. However, these quantities of litter led to accumulation of several nutrients, notably P, in upper soil horizons. In addition, N and P leaching risks were likely increased by the annual applications of 10 Mg litter ha^{-1}. Subterranean clover may reduce P leaching risk by keeping more P sequestered in the upper soil horizon, and clover conferred some growth benefit to loblolly pine. Thus, although these silvopasture systems had a relatively high capacity for nutrient use and retention at this site, litter should be applied less frequently than in this study to reduce environmental risks.

PROBLEM/TOPIC: Fertilizing pastures with poultry litter has led to an increased incidence of nutrient-saturated soils, particularly on highly-fertilized, well-drained soils. Applying litter to silvopastures, in which loblolly pine (*Pinus taeda* L.) and bahiagrass (*Paspalum notatum*) production are integrated, may be an ecologically desirable alternative for upland soils of the southeastern U.S.A. Integrating subterranean clover (*Trifolium subterraneum*) into silvopastures may enhance nutrient retention potential.

ACTION: This study evaluated soil nutrient dynamics, loblolly pine nutrient composition, and loblolly pine growth of an annually fertilized silvopasture on a well-drained soil in response to fertilizer type, litter application rate, and subterranean clover. Three fertilizer treatments were applied annually for four years: (1) 5 Mg litter ha^{-1} (5LIT), (2) 10 Mg litter ha^{-1} (10LIT), and (3) an inorganic N, P, K pasture blend (INO).

IMPACT: Litter stimulated loblolly pine growth, and neither litter treatment produced soil test P concentrations above runoff potential threshold ranges. However, both litter treatments led to accumulation of several nutrients (notably P) in upper soil horizons relative to INO and unfertilized control treatments. The 10LIT treatment may have increased N and P leaching potential. Subterranean clover kept more P sequestered in the upper soil horizon and conferred some growth benefits to loblolly pine.

HILL FARM RESEARCH STATION
APRIL 24, 2008
FIELD DAY SUMMARY REPORT

COMMODITY: FORESTRY

TITLE: Stock type, subsoiling, and density impact productivity and land value of a droughty site

CONTACT: Michael Blazier, Hill Farm Research Station, mblazier@agcenter.lsu.edu, (318) 927-2578

TAKE HOME MESSAGE: This study provided evidence that forest managers may have greater flexibility in managing loblolly pine plantations on well-drained, low site-index sites than conventional guidelines suggest. A low-density management regime in which container seedlings was planted was a viable alternative to a conventional regime in which a higher number of container seedlings was planted. Because the conventional regime had the capacity to produce proportionally more pulpwood, it may be the better alternative for tracts in regions with abundant pulpwood mills in close proximity and/or for landowners with commitments to provide trees to pulpwood production facilities. The low-density container regime had the capacity to produce a higher proportion of sawtimber, so this regime may be the better alternative for tracts in regions without an abundance of mills in close proximity, landowners that have commitments to provide trees to sawmills, or for tracts with land area too small for pulpwood to be marketed easily.

PROBLEM/TOPIC: The potential for good returns on investment makes loblolly pine plantation management attractive to landowners, but profitably establishing and managing loblolly pine plantations on the sandy, gravelly soils common in the upland areas of Louisiana and its surrounding states can be problematic. These soils are poor at holding water and nutrients, so seedling mortality can be high, particularly in a droughty year, and the long-term growth of the surviving trees is often relatively low. Poor tree survival and slow growth reduces timber yields and economic returns of loblolly pine plantations. The conventional management tactic for overcoming survival and growth problems on droughty sites is to plant extra seedlings, sometimes more than twice the number planted on better sites, in hope that enough "leftovers" will remain to produce an adequate plantation. However, seedlings rarely die in an evenly distributed pattern. The resulting plantation often has sections of tightly-spaced, low-value trees and other sections with few trees. Thus, the tendency to plant higher numbers of seedlings on droughty sites negatively impacts economic success because it increases planting costs and reduces the value of the surviving trees.

ACTION: This study was established to explore tree and stand growth trends, potential forest product yields, and land expectation values of loblolly pine on a droughty site in response to: (1) seedling stock type, (2) subsoiling, and (3) stand density regime. In winter 1993, container and bareroot seedlings were planted with or without subsoiling at 302 trees ac^{-1}. Bareroot seedlings were planted without

subsoiling at 605 trees ac^{-1} to provide a comparison between low-density treatment combinations and a conventional management regime for this site type. Tree growth was monitored periodically through age 13. Yield trajectories were estimated by predicting forest product yields with FASTLOB using age 13 stand characteristics, and land expectation value was determined from revenue predictions and costs associated with each treatment.

IMPACT: Low-density regimes that included container seedlings or subsoiling prior to bareroot seedling planting improved tree growth through mid-rotation and had yield estimates comparable to that of a conventional regime. However, land expectation values associated with subsoiling were lower than those of low-density container and conventional regimes due to its cost and negligible benefits for seedling survival.

APRIL 24, 2008
FIELD DAY SUMMARY REPORT

COMMODITY: FORESTRY

TITLE: Mid-rotation fertilization and vegetation control increase sawtimber production and enhance wildlife browsing vegetation

CONTACT: Michael Blazier, Hill Farm Research Station, mblazier@agcenter.lsu.edu, (318) 927-2578

TAKE HOME MESSAGE: Fertilizing and using herbicides after thinning pine stands growing on nutrient-poor soils can increase the value of the stand in terms of sawtimber production and wildlife habitat.

PROBLEM/TOPIC: Many forests in the Ark-La-Tex region grow on soils that are low in nutrients due to either past land use practices or to the inherent geology of the soils. If landowners wish to increase the value of their timber, increasing nutrient availability to trees through modest investments in fertilizer, herbicides, and/or prescribed burning are viable management options. In addition, the value of loblolly pine plantations as wildlife habitat can be increased through understory control and fertilizer treatments.

ACTION: A study site was established on a nutrient-poor soil to test the effects of fertilization and understory control treatments on the growth and development of pine and browsing vegetation. The stand was thinned in 1998 and has been burned every 3 years since thinning. In 1999 and 2002, two treatments were applied: (1) 250 lbs of diammonium phosphate (DAP) fertilizer per acre, and (2) 48 oz. of Chopper® per acre. Some plots were left untreated as a basis for comparison. Growth of loblolly pine trees has been measured biennially, and in August 2004 growth of herbaceous vegetation was measured.

IMPACT: On this site, all herbicide and fertilizer treatments increased pine growth relative to a burning-only treatment (Figure 1). Fertilizer treatments increased pine growth by 25%, and the Chopper® treatments increased pine growth by 12%. The best increase in growth has been in response to the combination of DAP + Chopper®, but this treatment cost twice as much as the DAP or Chopper® applied alone. The superior performance of DAP in promoting pine growth relative to Chopper® is likely due to both prescribed burning and herbicide re-allocating existing nutrients of the soil to trees whereas fertilizer adds new nutrients to the soil. Nevertheless, it appears that Chopper® is more effective in promoting pine growth than prescribed burning. The timing of fertilization and herbicide treatments relative to thinning appears to be an important factor, since trees responded more quickly to the DAP and Chopper® applied 3 years after thinning vs. the same treatments applied 1 year after thinning. This is likely because trees can better take up nutrients after they have time to adjust to growing in less dense stands. Using Chopper®, which targets hardwoods, increased the browsing vegetation in the

understory of stands by 40 to 55% (Figure 2). By reducing the shading produced by hardwoods, more browsing vegetation flourished in the understory.

Figure 1. 5-year diameter growth responses to fertilizer and herbicide treatments applied to a mid-rotation forest in northwest Louisiana. Homer, LA. 1999-2004.

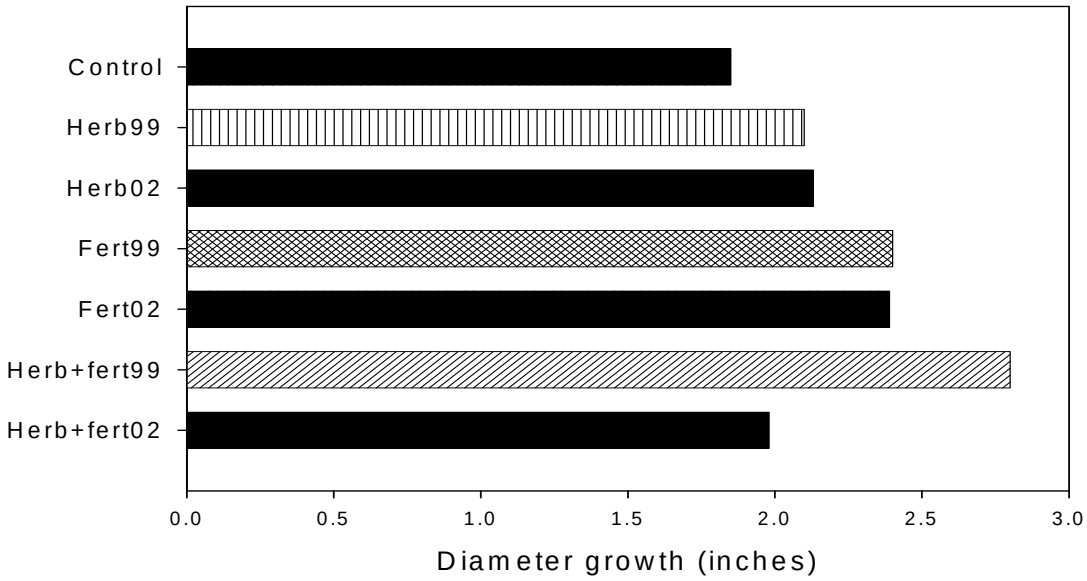


Figure 2. Browse vegetation biomass in response to Chopper herbicide treatments applied to a loblolly pine plantation at age 16 vs. age 19 vs. a no-herbicide treatment.