FIRST YEAR RESULTS FOR A BIOMASS PRODUCTION SYSTEM COMPARING BLACK WILLOW, EASTERN COTTONWOOD, AND AMERICAN SYCAMORE UNDER TWO LEVELS OF FERTILITY

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Introduction

Many areas in the lower Mississippi Alluvial Valley are considered "marginal" agricultural lands. Generally, this term is used to describe land that has not been precision leveled, lacks irrigation, and offers significant problems for early operability due to high water tables and reduced drainage (i.e., somewhat poorly to poorly drained soils). There is much interest in evaluating the potential conversion of these sites into short rotation woody crops for bio-feedstock production and carbon sequestration.

Site Description

The study site is located in St. Francis Co., Arkansas (Fig. 1). The study site has a long history of rice and soybean cultivation. The soil is classified as Henry silt loam (Coarse-silty, mixed, active, thermic Typic Fragiaqualfs) and characterized as being very deep and poorly drained with a slowly permeable fragipan in the subsoil.

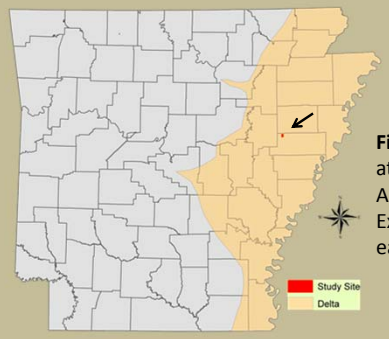

Fig. 1. The study is located at the University of Arkansas Pine Tree Experiment Station in east-central Arkansas.

Study Layout

American sycamore (*Platanus occidentalis* L.), black willow (*Salix nigra* Marsh.) and eastern cottonwood (*Populus deltoides* Bartr. ex Marsh.) (clone ST66) were each planted in eight ≈0.13 ha plots in Feb. 2009. Plots were arranged in a split-plot design with 4 replicate blocks. The whole plot factor consisted of 2 levels of fertilization (0 and 56 kg N ha^{-1}). The split plots included 1 replicate of each species. All trees were planted at 2.4 x 2.4 m spacing with the center 36 trees $plot^{-1}$ used for all stem measurements. Normal procedures (e.g., subsoiling, pre- and post-emergent weed control) were used for establishment (Fig. 2).

Results and Discussion

After 1 growing season, species was the only significant treatment factor ($P<0.05$) affecting stem height and diameter (Fig. 3). Sycamore stems were 37 and 29 % larger in height and diameter, respectively, compared to both black willow and cottonwood. A 25% increase in stem diameter due to fertilization was marginally significant ($P=0.06$).

Survival across all species ranged from 75 – 100 % (Fig. 3). Fertilization had no effect on survival. Among the species, sycamore and black willow averaged 99.7 and 94.4 % survival, respectively, which were greater than the 77.4% for cottonwood. The survival of all three species corresponds well with established site adaptability estimates (e.g., Baker and Broadfoot 1977; Burns and Honkala 1990).

A 3-wire deer fence was installed in June to reduce deer browsing on the cottonwood and willow stems (Fig 2c). Following installation, minimal browsing was observed; however, the effects of early season browsing on the newly established seedlings is unknown.

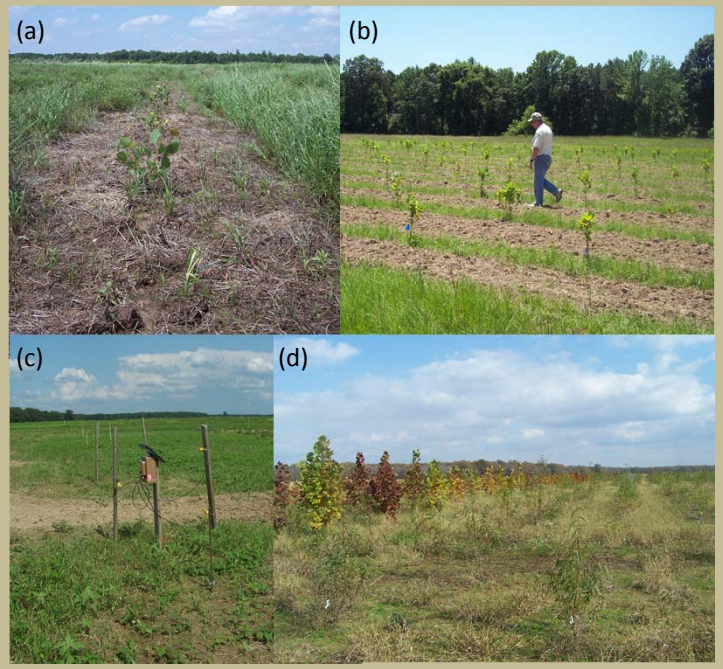

Fig. 2. (a) banded Goal 2XL providing pre-emergent control in spring; (b) between row cultivation when site conditions allow; (c) 3-wire electric fence using Parmak Solar Pak 12 charger; and (e) end of year 1 fertilized sycamore and willow.

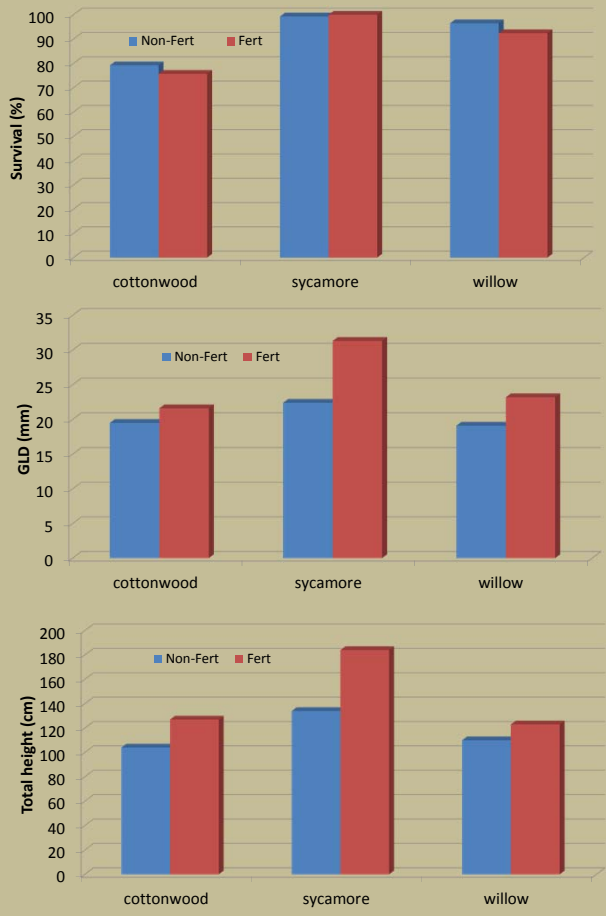

Fig. 3. Total height, groundline diameter and survival by fertilization and species treatment factors.

Additional and Future Research

This experiment is expected to continue for 8-10 years. Periodic harvesting within borders and additional sampling will provide data for aboveground and belowground biomass estimates. Soil carbon levels have been quantified for the time of establishment and year 1, and we will continue sampling it over time.