COMPARING SECOND YEAR GROWTH OF AMERICAN SYCAMORE, BLACK WILLOW, AND EASTERN COTTONWOOD WITH AND WITHOUT FERTILIZATION

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Interest in developing domestically produced bio-based fuel systems has been responsible for a large increase in short rotation woody crop (SRWC) research. Much of this work has been used in developing regional production estimates for woody crops like cottonwood (*Populus deltoides* Bartr. ex Marsh.) and eucalyptus (*Eucalyptus* spp.) in the Southeast. SRWC systems are designed as purpose-grown bioenergy crops that are intensively managed and utilize fast-growing tree species (White 2010). These systems are characterized by high planting densities of advanced genetic material with high inputs (e.g., fertilizer, irrigation) and short rotations to produce yields that can exceed 50 oven dry tons/ha/yr (Adegbidi and others 2003).

The advantages of this system are the very high yield potential, short rotations, and rapid returns. Despite the numerous reports of extremely high yields, SRWCs typically yield 7.5-15 oven dry tons/ha/yr in commercial plantings (Volk and others 2006). Also, if one considers the land available for SWRCs, most planting is expected to occur on "marginal agriculture lands", which generally refers to non-irrigated, non-leveled lands with restricted internal drainage. Yields associated with SRWCs on these sites are not well-represented in the literature. A study was initiated in 2009 to address questions related to productivity on these marginal sites.

The study site was located in St. Francis County near Colt, AR. The site had been under long-term cultivation for row crops (for example, soybeans, rice). Dominant soil series include Henry silt loam and Calloway silt loams. Soils have restricted drainage due to both a plow pan and a natural fragipan that occurs within 18 inches of the soil surface. The site was disked and ripped on rows 8 feet apart in the fall 2008 after a soybean crop was harvested. Trees were planted in February 2009 on 8 feet by 8 feet spacing. Goal 2XL™ herbicide was applied at 96 ounces/acre following planting for pre-emergence weed control. Disking and directed sprays of herbicides were used to control vegetation for two growing seasons.

Two treatment factors were arranged in a split plot design with four replications. Whole plots consisted of two levels of fertilization. The fertilization treatments were 0 or 56 kg N/ha/yr as urea. A 50 foot grass buffer was maintained between fertilized and non-fertilized plots. Whole plots were divided into three split plots, with three tree species planted in 196-tree single species plots. The tree species utilized were American sycamore (*Platanus occidentalis* L.), black willow (*Salix nigra* Marsh.), and eastern cottonwood. American sycamore was purchased as 1-0 bareroot seedlings from a large private nursery in Arkansas and represented an unimproved and unknown source. Black willow was planted using 35-cm unrooted cuttings that were collected from a natural population along a tributary of the Arkansas River. The eastern cottonwood was planted as a single clone (ST-66) using 46-cm unrooted cuttings that were purchased from a Louisiana state nursery.

The measurement plots consisted of the center 36 trees in each treatment plot. Total height and stem diameter were measured at the end of the second growing season. Stems with heights less than 137 cm had dbh recorded as zero. Growth was assessed using Analysis of Variance (SAS 9.2 software) at a significance level of alpha=0.05.

Species was the only significant factor influencing year two diameter ($P=0.0005$) and height growth ($P<0.0001$), respectively). At a minimum, American sycamore diameter growth was 90 percent greater and height growth was 49 percent greater than both eastern cottonwood and black willow (Table 1). No differences were detected between the later two species. Even though fertilization generally produced greater diameter and height growth, no significant effect was detected for second year growth rates on any species (Table 1).

My current recommendation for these kinds of sites is to plant sycamore combined with early fertilization. Even though fertilization has yet to demonstrate a significant growth response, the competition control has been much

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easier due to their expanding crowns. Operationally, these stands may not require second year weed control, whereas non-fertilized stems almost certainly will.

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Table 1—Average height and diameter growth for the second growing season for each species grown with and without fertilization

	Non-fertilized			Fertilized		
	Cottonwood	Sycamore	Willow	Cottonwood	Sycamore	Willow
Dbh (mm)*	4.0	9.9	5.4	9.4	15.4	6.3
Height (cm)	54.3	91.7	70.7	78.8	119.0	70.7

*Diameters of stems less than 137 cm were recorded as “0”.