Southern Forest Experiment Station
Research Note
1980
SO-254

Coppice Sycamore Yields Through 9 Years

Harvey E. Kennedy, Jr.

SUMMARY

Cutting cycle and spacing did not significantly affect sycamore dry-weight yields from ages 5–9 years (1974–1978). Longer cutting cycles usually did give higher yields. Dry-weight yields ranged from 2886 lb per acre (3233 kg/ha) per year in the 1 year, 4 × 5 ft (1.2 × 1.5 m) spacing to 4541 lb (5088 kg/ha) in the 4-year, 4 × 5 ft spacing. Survival averaged 67 percent in the 2 × 5 ft (0.6 × 1.5 m) spacings and 79 percent in the 4 × 5 ft spacings. Ratio of dry weight to fresh weight averaged 49 percent, and the stem accounted for 85 percent of the dry weight of the trees.

Additional keywords: *Platanus occidentalis*, sprouting, "silage concept"

INTRODUCTION

As demand for cellulose fiber grows, industrial needs will exceed the ability of natural and planted forests to supply it for pulp and fuel. Forest industries must find new methods to increase production rapidly. Intensive culture of hardwoods under short rotation cycles may help supplement conventional pulpwood and fuelwood sources. This technique is sometimes referred to as the "silage concept" because the cut wood resembles crops harvested for silage. This note reports how various cutting cycles and spacings affect growth and yield of coppice sycamore through nine growing seasons.

METHODS

In March 1970, nonrooted sycamore cuttings were planted vertically in subsoiled trenches at Huntington Point, near Greenville, Mississippi. The soil was Commerce silt loam, a good sycamore site.

Plots were eight rows wide (40 ft or 12.3 m) by 1 chain (66 ft or 20.3 m) long and were divided into two subplots, each four rows wide. Two spacings were randomly assigned on the subplots—2 × 5 (0.6 × 1.5 m) and 4 × 5 ft (1.2 × 1.5 m). Early in the first growing season, all blanks in the 4 × 5 ft spacings and consecutive blanks (two or more) in the 2 × 5 ft spacings were replanted with extra 16-inch (40 cm) cuttings established when the study was installed. Plots were weeded during the first growing season.

A randomized block split-plot design was used for this study. Cutting cycles were 1, 2, 3, and 4 years. Each combination of cutting cycle and spacing had four replications. The 1-year cycle has received eight cuttings; the 2-year cycle, four cuttings; the 3-year cycle, three cuttings; and the 4-year cycle, two cuttings. Cutting was done in January or February each year except 1974, when floodwaters delayed cutting until March.

For each subplot, growth and yield were measured on the central 50 ft (15.4 m) of the two center rows; the rest of the plot formed a border.

When trees were cut, stems plus branches of all trees within each measurement area were weighed on a balance at the study site (fig. 1). Fresh-weight yields per acre were calculated from this data.

Figure 1.—*Weighing freshly cut green trees at the plantation site.*

Fresh and dry weights of stems and branches separately, stump diameter at the point of cut, and stem length were measured on three trees (the northernmost trees on the west row) from each subplot. Dry weights were determined after plants were dried 48 hours in a forced-air oven at 105°C. Total aboveground weights were obtained, and ratios of total dry to fresh weight and of stems to branches (fresh and dry) were determined.

I calculated dry-weight yield per acre per year for each subplot by multiplying the fresh weight per acre by the ratio of dry weight to fresh weight in the sample. Data were analyzed with analysis of variance and Duncan's multiple range test at the 0.05 level of probability.

RESULTS AND DISCUSSION

Results through 4 years (1970–1973) were reported in Kennedy (1975). At that time the 2-, 3-, and 4-year cutting cycles yielded significantly more dry weight (slightly more than 7,000 lb) than the 1-year cutting cycle yielded (slightly more than 4,000 lb). The 2 × 5 ft spacing yielded significantly more than the 4 × 5 ft yielded. Interaction between spacing and cutting cycle was not significant. Ratio of dry weight to fresh weight averaged 43 percent, and the proportion of dry weight in the stem averaged 81 percent in the 1-year cutting cycle and 95 percent in the 4-year cutting cycle. Survival averaged 90 percent.

In the fifth through eighth growing seasons (1974–1977; 1-, 2-, and 4-year cutting cycle) and for the fifth through ninth growing seasons (1974–1978; 3-year cutting cycle), survival in the 2 × 5 ft spacing dropped to 67 percent, a reduction of 20–25 percent since the fourth growing season. The 4 × 5 ft spacing had 79 percent survival, a reduction of 5–10 percent. Other researchers have reported that stands planted at close spacings, 1 × 1 (0.3 × 0.3 m) to 4 × 4 ft (1.2 × 1.2 m), will gradually thin themselves to about 4 × 6 (1.2 × 1.9 m) to 5 × 5 ft (1.5 × 1.5 m) spacing. This self-thinning seems to be happening in the Huntington Point plantation; the original 2 × 5 ft spacing is now about 3 × 5 (1.0 × 1.5 m) and the 4 × 5 spacing is now about 5 × 5 ft.

Dry-weight yields did not differ significantly among treatments during 1974–1978 (table 1), probably because yields within replications differed greatly. Yields were much smaller than 1970–1973 yields (11 percent in the 1-year, 2 × 5 ft

Kennedy is Principal Silviculturist at the Southern Hardwoods Laboratory maintained at Stoneville, Mississippi, by the Southern Forest Experiment Station, Forest Service—USDA, in cooperation with the Mississippi Agricultural and Forestry Experiment Station and the Southern Hardwood Forest Research Group.

spacing to 42 percent in the 3-year, 4 × 5 ft spacing). During the second 4 years, longer cutting cycles still usually produced higher yields.

Yields during 1974–1978 were lower than ones reported by other researchers (Belanger and Saucier 1975, White and Hook 1975). Yet, even though yields in this study were lower, the highest yields were still in the longer cutting cycles.

Trees were significantly shorter in the 1974–1978 period than in the 1970–1973 period; diameters were not significantly smaller (table 2). A significant interaction among treatments for heights and diameters was caused by varying degrees of growth differences.

Trees were smaller and yields lower during 1974–1978 than during 1970–1973 for several reasons. Reduced survival could have led to lower yields because fewer trees were available. But the remaining trees should have grown more because of more growing space per tree. Climatic and insect conditions at the site might also have lessened yields. The Mississippi River flooded the plantation for several weeks early in the 1974 and 1975 growing seasons. Then the 1976 growing season was dry, and the 1977 growing season was extremely dry. Also, the sycamore tussock moth (*Halisidota harrisii* Walsh) completely defoliated plantation trees during July and August in 1976 and 1977. Results over the next 4 years should answer whether the reduction was caused by climatic and insect conditions at the study site or by the imposed treatments or by a combination of all these factors.

Ratios of dry weight to fresh weight and proportion of dry weight in stems were not affected by cutting cycle and spacing (table 1). Dry to fresh weight ratios average 49 percent, a gain of about 5 percentage points from the average after four growing seasons. These percentages are similar to the 50 percent dry to wet weight ratios reported by Steinbeck and May (1971). The proportion of dry weight in stems was probably not affected much by treatments. Over all treatments, proportion of dry weight in stems averaged 85 percent. This proportion is about 5 percent smaller than it was in 1970–1974, probably because the trees had more branches, as each tree had more growing space.

If forest managers are considering using short rotations and close spacings for sycamore, they should probably plant at 4 × 6 ft to 5 × 5 ft spacings and use cutting cycles of 4 to 5 years to maximize yields.

Table 1.—*Average annual dry weight, ratio of dry to fresh weight, and dry weight percentages of stems by spacing and cutting cycle for 1970–1973 and 1974–1978*

Spacing (*feet*) and cutting cycle (*years*)	Dry weight		Ratio dry to fresh weight		Proportion of dry weight in stem	
	1970-73	1974-78	1970-73	1974-78	1970-73	1974-78
	------*lb/acre/yr. (kg/ha/yr.)*------		--------------*percent*--------------			
2 × 5						
1	4349 (4875)	3702 (4149)	44	49	81	83
2	7001 (7847)	4260 (4775)	45	49	90	87
3	7210 (8081)	4164 (4667)	41	47	92	83
4	7161 (8026)	4448 (4986)	46	51	95	92
4 × 5						
1	3229 (3619)	2886 (3235)	46	47	85	84
2	5167 (5791)	3347 (3752)	41	48	86	83
3	6175 (6921)	4278 (4795)	43	50	91	79
4	6441 (7219)	4541 (5090)	42	49	95	88

Table 2.—*Diameters and heights by spacing and cutting cycle for 1970–1973 and 1974–1978*

Spacing (*feet*) and cutting cycle (*years*)	Diameters		Heights	
	1970-73	1974-78	1970-73	1974-78
	--------*inches (cm)*--------		---------*feet (m)*---------	
2 × 5				
1	1.0 (2.54)	0.9 (2.29)	9.4 (2.87)	9.3 (2.84)
2	1.8 (4.57)	1.3 (3.30)	17.0 (5.18)	12.6 (3.84)
3	2.1 (5.33)	1.5 (3.81)	20.4 (6.22)	13.2 (4.02)
4	2.0 (5.08)	1.8 (4.57)	23.6 (7.19)	17.7 (5.40)
4 × 5				
1	0.9 (2.29)	1.0 (2.54)	8.7 (2.65)	9.5 (2.90)
2	1.8 (4.57)	1.3 (3.30)	16.6 (5.06)	12.8 (3.90)
3	2.4 (6.10)	1.7 (4.32)	23.1 (7.04)	11.4 (3.47)
4	2.4 (6.10)	2.7 (6.86)	23.6 (7.19)	22.8 (6.95)

LITERATURE CITED

Belanger, Roger P., and Joseph R. Saucier.
1975. Intensive culture of hardwoods in the South. Iowa State J. Res. 49: 339–344.

Kennedy, Harvey E., Jr.
1975. Influence of cutting cycle and spacing on coppice sycamore yield. U.S. Dep. Agric. For. Serv. Res. Note SO-193, 3 p. South. For. Exp. Stn., New Orleans, La.

Steinbeck, K., and J. T. May.
1971. Productivity of very young *Platanus occidentalis* L. plantings grown at various spacings. *In* Forest Biomass Studies, Maine Agric. Exp. Stn. Misc. Rep. 132, p. 153–162. Life Sci. and Agric. Exp. Stn., Univ. Maine, Orono.

White, Edwin H., and Donal D. Hook.
1975. Establishment and regeneration of silage plantings. Iowa State J. Res. 49: 287–296.