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Research Note

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21-Year Growth and Development of Baldcypress Planted on a Flood-Prone Site

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SUMMARY

Baldcypress is a good species to plant on sites where prolonged flooding is common and few other species can survive. When planted on a site where flooding had repeatedly killed cottonwood plantations, cypress survival at age 21 averaged about 41 percent; average diameter was about 6.1 inches. Some of the cypress was suppressed by other hardwoods such as ash and boxelder. Diameters of the best 10 percent of the cypress trees averaged 11.1 inches at age 21. Thus, mean annual diameter growth of these trees was 0.53--considerably more than the 0.32 inch per year estimated for dominant trees in natural stands during their prime development period.

Additional keywords: *Taxodium distichum*, artificial regeneration, diameter increment.

Baldcypress (*Taxodium distichum* (L.) Rich) heartwood is used extensively in building construction in the South, especially where high decay-resistance is required. Its value as a source of rot-resistant wood has depleted many merchantable stands. Sapwood is not decay resistant. On sites where prolonged flooding is common, baldcypress may be one of the few species capable of surviving. This note describes growth of a 21-year-old cypress plantation in the Mississippi River Delta.

Site.--The plantation was established on the Delta Experimental Forest, in Washington County, Mississippi, in February 1955. The planting area was a difficult Sharkey clay site, which is about 20 percent ridge, 20 percent slope, and the rest flat-slough. There is about a 3-foot difference in elevation from ridge to slough. About 1 to 2 feet of water generally covers the slough in winter. Thus, the area can be considered as five micro-sites--ridge, slope, and three areas of flat-slough.

The site had been cleared and planted to cottonwood (*Populus deltoides* Bartr.) more than 15 years before cypress was installed, but the cottonwoods were immediately killed by flooding. Two more clearings and plantings to cottonwood were also lost to high water, and consequently, heavy vine competition developed. When it became evident that most fast-growing commercial species could not survive on the site, cypress was planted.

Planting and measurements. -A total of 896 1-year-old cypress seedlings were planted at 6 by 10 feet to test regular and deep plantings--with and without top clipping. The trees were cultivated three or four times each year for the first four growing seasons. After the fourth year, annual mowing for the next 6 years was the only cultural treatment. Mowing did not control the vines, so many of the developing trees were bent.

By age 4, there were no significant differences in height or survival (Krinard

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1959). Survival was 62 percent; average height was 6.6 feet (range 2.7 to 11 feet). No other measurements were made until age 21 when diameters of all 365 surviving trees (41 percent of the plantings) were measured (figure 1). In planting spots where other species (table 1) had become established in place of cypress, one stem per planting spot was tallied by diameter to determine the basal area of the present stand. For trees 3.0 inches dbh and larger, 38 percent of the planting spots were filled with cypress and 14 percent with other species. For trees less than 3.0 inches dbh only 18 cypress trees per acre were measured; all were in an extremely suppressed position and unlikely to survive. For species other than cypress, no attempt was made to tally trees less than 3 inches dbh or in a suppressed crown position.

Figure 1.—*General view of cypress planting showing 10-foot-within-row spacing and rows 6 feet apart.*

Heights of 30 cypress and seven green ash (*Fraxinus pennsylvanica* Marsh.) were taken to establish height-diameter relationships for these two species. Four cypress, three ash, and three boxelders (*Acer negundo* L.) were cut and measured at 4-foot intervals from 1 foot above the ground to the crown tip to supplement the height-diameter data and to obtain information on total cubic volume outside bark of the main stem.

Volume estimates for cypress, ash, and combined other species, predominantly boxelder but excluding black willow (*Salix nigra* Marsh.) and cottonwood, were obtained from D^2H equations using 1 inch diameter classes and heights from height-diameter curves (figure 2). Although only a small volume sample was obtained, the volume equations developed [1] were comparable to those published for cottonwood (Mohn and Krinard 1971).

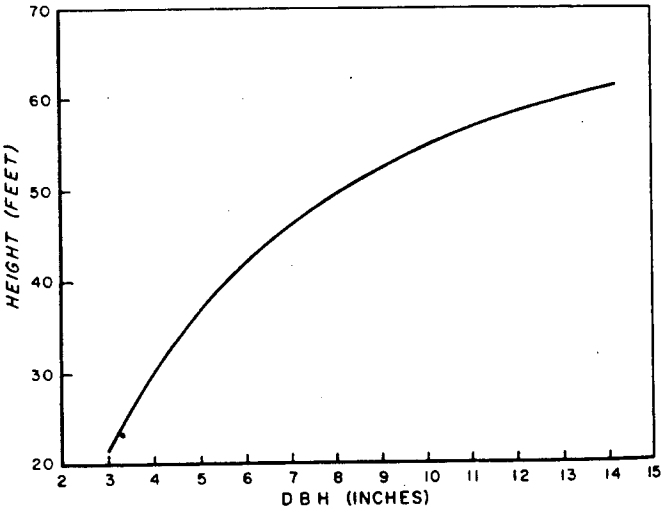

Figure 2.—*Height-diameter relationship of cypress after 21 years, where log H = 1.910840 − 1.736896 (1/D) (r^2=0.89; Sy.x=0.027).*

[1] Cypress: Volume = 0.523 + 0.00183 D^2H; r^2 = 0.99, Sy.x = 0.40
Ash: Volume = 0.894 + 0.00166 D^2 H r^2 = 0.98, Sy.x = 0.84;
Boxelder: Volume = 0.320 + 0.00219 D^2H; r^2 = 0.99, Sy.x = 0.30

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Average survival and diameter growth of cypress varied by micro-site. Survival after 4 years was 58, 64, 67, 62, and 60 percent, respectively, for trees on ridge, slope, and the three flat-sloughs; after 21 years, survival was 48, 47, 45, 33, and 31 from the most elevated to the lowest site; average survival was 41 percent. Average diameter for all cypress after 21 years from highest to lowest site was 5.5, 7.2, 6.3, 5.9, and 5.8 inches; average diameter was 6.1 inches.

Half of the cypress ≥ 3.0 inches dbh (141 stems per acre) were 6.0 inches dbh or larger, which reflects a total growth rate of about 3 inches every 10 years. The two largest cypress trees were both 14.0 inches dbh; one was 60 feet tall and the other 63 feet. There was no indication of stagnation within the stand, even in spots where survival was high and competition intense. Dominance of individual cypress trees was shown by the wide range in diameters (table 1).

One cottonwood tree and one black willow were the fastest growers in the entire planting area. Both were in the 15-inch diameter class and were 70 to 75 feet tall. The largest ash measured was 10.3 inches dbh and 54 feet tall. Although the largest boxelder was 12.6 inches dbh, it was only 46 feet tall and was of poor form.

When basal area was measured at five random prism points (basal area factor 10) based on all stem sizes, basal area ranged from 70 to 150 square feet per acre and averaged 112 square feet. When planting-spot trees 3.0 inches dbh and larger were considered, basal area of the stand was 95 square feet per acre. Cypress basal area was 72 square feet, ash 7, boxelder 11, and other species 5.

Total volume outside bark per acre in trees ≥3.0 inches dbh was 1,786 cubic feet or 85 cubic feet per acre per year. Cypress volume was 1,299 cubic feet (62 cubic feet per acre per year). Volumes for other species were: green ash, 131 cubic feet; boxelder, 230 cubic feet; sugarberry and persimmon combined, 44 cubic feet; and cottonwood and black willow combined, 82 cubic feet.

Total volume per acre for all species for trees with a 6.0-inch threshold diameter was 1,403 cubic feet (67 cubic feet per

Table 1.—*Trees per acre by species and 1-inch diameter classes*

Dbh classes	Cypress	Ash	Box-elder	a/ Sugar-berry	b/ Per-simmon	Black willow	Cotton-wood	Total
				Stems/acre				
15.0-15.9	--	--	--	--	--	0.8	0.8	1.6
14	1.6	--	--	--	--	--	--	1.6
13	1.6	--	--	--	--	--	--	1.6
12	0.8	--	0.8	--	--	--	--	1.6
11	10.5	--	--	--	--	0.8	--	11.3
10	13.8	0.8	--	0.8	--	--	--	15.4
9	16.2	1.6	1.6	--	--	0.8	--	20.2
8	28.4	2.4	3.2	0.8	--	--	--	34.8
7	29.2	1.6	4.1	--	0.8	--	--	35.7
6	38.9	10.5	15.4	--	0.8	--	--	65.6
5	46.2	4.9	14.6	2.4	1.6	--	--	69.7
4	47.8	5.7	11.3	2.4	--	--	--	67.2
3	42.9	2.4	8.1	0.8	--	--	--	54.2
2	17.0	--	--	--	--	--	--	17.0
1.0-1.9	0.8	--	--	--	--	--	--	0.8
Total	295.7	29.9	59.1	7.2	3.2	2.4	0.8	398.3

a/ *Celtis laevigata* Willd.

b/ *Diospyros virginiana* L.

acre per year); volume of cypress in this diameter class would be 19 percent smaller or 1,051 cubic feet (50 cubic feet per acre per year).

Although there were more than 400 trees per acre at age 21, most of the cypress trees are very limby. The majority of the lower limbs--those 8 to 10 feet up the main bole--were dead but not easily broken off. By comparison, ash, which are naturally pruning, were of much better quality; they were generally limb-free from the ground to a height of 16 feet.

Results reveal that plantation-grown cypress may grow as well as or better than other hardwood species growing in loess soil in small, unthinned plantings for a similar period of time (Broadfoot and Krinard 1961). The top 10 percent or 30 cypress trees per acre in this study ranged from 9.8 to 14.0 inches dbh and averaged 11.1 inches after 21 years. Thus, mean annual diameter growth was 0.53 inch, considerably more than the 0.32 inch per year estimated for dominant trees in natural stands during their prime development period (20 to 28 inches dbh) (Putnam, Furnival, and McKnight 1960).

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