Lime, Fertilizer Cottonwood Tests

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As eastern cottonwood is cut increasingly for pulp and other wood products, efforts to boost its production in Mississippi are growing. To learn more about fertilizer requirements of the species, the Southern Hardwoods Laboratory at Stoneville recently tested four common bottomland soils in which cottonwood grows.

The soils were tested under greenhouse conditions; hence, conclusions must be regarded as tentative, since the conditions vary from those of the natural enviroment.

Soils tested were Sharkey clay and Commerce loam from the Mississippi River flood plain; Adler silt loam from a stream bottom in the Silty Uplands; and Bibb sandy loam, a poorly aerated soil from the Coastal Plain river bottom (Table 1). Bulk samples of each soil type were collected down to 9 inches from the surface in forested areas. After air drying and screening, the soils were placed in 3-gallon glazed crocks. Various combinations of nitrogen, phosphorus, and potassium were added to the Sharkey, Commerce, and Adler soils. The strongly acid Bibb soil received applications of complete fertilizer, lime, and combination of the two. All treatments were replicated at least three times.

Seeds from a single cottonwood tree were planted in each pot. Seedlings were thinned to one per pot. All plants received demineralized water during the study. After 3 months, the seedlings were measured for height, harvested, dried at 70°C, and weighed.

Results of tests on Sharkey, Commerce, and Adler soils which received identical treatments, are shown in Table 2. Seedlings in Sharkey and Adler soils did not respond to fertilizer, while plants

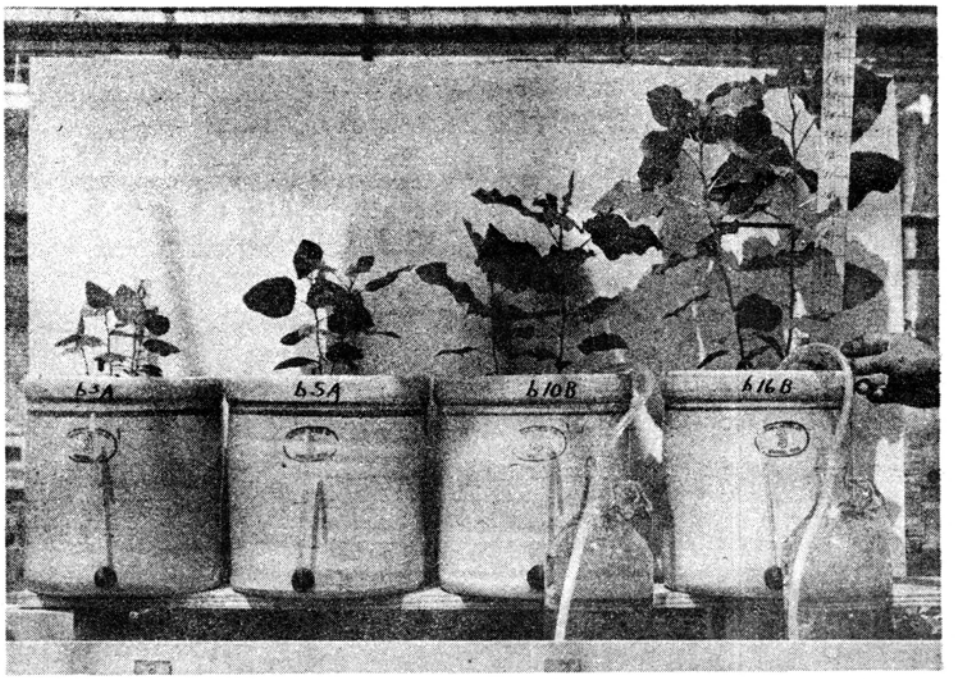

Figure 1. Fertilizer and lime increased growth of cottonwood seedlings grown in Bibb sandy loam. Treatments (left to right) are control, NPK, lime, and lime plus NPK.

Table 1. Properties of soils.

Soil	pH	Organic matter	Sand	Silt	Clay	N	P	K
		% by weight				Lbs./acre		
Sharkey	6.2	4.5	8	34	58	5,840	26	887
Commerce	7.5	0.8	57	35	8	1,087	15	597
Adler	6.5	2.4	30	60	8	2,673	18	344
Bibb	5.0	0.5	68	26	6	578	7	51

Table 2. Growth of cottonwood seedlings 3 months after fertilization.[a]

Fertilizer treatment	Sharkey clay		Commerce loam		Adler silt loam	
	Height	Weight	Height	Weight	Height	Weight
Lbs./acre N-P-K	Ft.	Gm.	Ft.	Gm.	Ft.	Gm.
0-0-0	3.9	36	3.3	27	3.7	30
100-0-0	3.6	36	3.3	32	3.5	32
0-50-0	3.7	34	3.3	24	3.4	31
0-0-100	3.7	36	3.5	26	3.5	32
100-50-0	3.7	36	3.1	28	2.8	24
100-0-100	3.8	38	3.3	33	3.9	33
100-50-100	3.9	40	3.7	34	3.8	37
Average	3.7	36	3.3	29	3.5	31

[a]Each value is the mean of three replications.

Table 3. Cottonwood seedling growth and pH of Bibb sandy loam 3 months after treatment.[a]

Fertilizer and lime	Height	Weight	Soil reaction
Lbs./acre	Ft.	Gm.	pH
Control	1.2	3	5.0
100N-50P-100K	1.7	6	4.8
4,000 lime	2.6	11	7.4
NPK plus lime	2.8	16	7.3

[a]Each value is the mean of four replications.

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in Commerce displayed a slight but significant response to high rates of nitrogen.

In Commerce loam, best growth in terms of seedling weight was attained on soils treated with N-P-K, N-K, and N fertilizer. A response to nitrogen was not surprising, since this soil is relatively low in organic matter and total nitrogen content (Table 1). A field experiment has been installed in the Mississippi Delta to see if cottonwood on Commerce soil will respond to high levels of N.

The drying and screening procedures apparently created a fine, fragmental structure in the Sharkey soil. This "buckshot" condition, which was maintained throughout the study, provided better aeration than ordinarily occurs in the field. This study indicates that Sharkey soil has sufficient nutrients. Apparently its physical condition in the field often retards growth. Fertilization probably will not increase the productivity of Sharkey clay or Adler loam in uncleared lands; however, heavily cropped old fields may require fertilizer.

In Adler loam treated with N-P, seedling height and weight were significantly less than in the check and other treatments (Table 2). The reason for the decrease in growth is not known.

Although seedlings tested in Bibb soils grew considerably less than those in the other soils, they responded markedly to fertilizer, lime, and a combination of the two (Table 3). Liming increased soil pH from 5.0 to 7.4. The beneficial effect of lime may result from improved calcium nutrition, decreased soil acidity, or both. Eastern cottonwood is best adapted to neutral to mildly alkaline soils. In the field, Bibb sandy loam normally is poorly drained. By improving drainage and thus aeration, land managers can probably increase productivity of this soil.

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