

Direct-Seeded Sawtooth Oaks (*Quercus acutissima* Carruth.) Show Rapid Growth on Diverse Sites

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*Direct-seeded sawtooth oak (*Quercus acutissima* Carruth.) grew very well on the Mississippi River floodplain despite high soil pH, short-term flooding, and poor soil aeration. Early growth was more rapid than that of local oak species. Acorn production was general by the 14th growing season.*

In recent years, sawtooth oak (*Quercus acutissima* Carruth.) has been widely planted in the United States as an ornamental and wildlife food tree. The species occurs naturally through the Himalayas, China, Formosa, Korea, and Japan, and was introduced into the United States in 1862. Most forestry and conservation plantings are descended from trees growing on the University of Georgia campus and at the National Plant Introduction Station, Savannah, GA (3).

Sawtooth oak has shown broad adaptability and many good qualities. Sullivan and Young (5) report no restriction in planting sawtooth oak on well-drained upland soils of the Coastal Plain, Piedmont, or Appalachian areas. Spicer (4) recommends the species for planting in unfavorable urban environments. Schoenike (2) reports good survival and height growth in South Carolina after 5 years. Stem form was rela-

tively poor, however. Sawtooth oaks in small-scale plantings in Georgia and Mississippi produced acorns more prolifically than native oaks. Acorn production began the sixth year (1).

The purpose of this study was to test direct seeding as a way of establishing sawtooth oak and to test the species' performance on sites generally considered too wet for it.

Methods

Two sites were direct seeded. The Huntington Point site (Bolivar County, MS) had a Bruin soil (coarse-silty, mixed, thermic Fluvaquentic Eutrochrepts) with silty clay loam surface layer underlain by fine sandy loam. The soil has a pH of 7.4 and floods to a depth of 2 or 3 feet for 1 to 3 weeks in those springs when the Mississippi River overflows its banks. Otherwise, the site is well drained. The Delta Experimental Forest site (Washington County, MS) (fig. 1) had an Alligator soil (very fine, montmorillonitic, acid, thermic Vertic Haplaquepts) with clayey texture throughout and a pH of 5.2. Although it rarely floods, this soil is generally saturated during the winter and spring.

Both sites were cleared mechanically and disked before seeding. Acorns acquired from a Mississippi source were stored dry at 35 to 40 °F until planting in

April 1970. Two to four acorns were sown 1 to 2 inches deep in spots spaced 10 by 10 feet apart. The Huntington Point site had 80 seed spots and the Delta Experimental Forest site had 96 spots. The seed spots were hoed twice during the first year, and the plots were mowed between rows in the second and third years.

Nuttall oaks (*Q. nuttallii* Palmer) were seeded at the Delta Experimental Forest site in rows alternating with the sawtooth oak. The acorns were stored in water at 40 °F through the winter and planted in a manner similar to that of the sawtooth oaks.

During the winter after the 14th growing season, the diameters (breast height) of all trees were measured with a diameter tape. Total heights were measured with an altimeter. If more than one tree was present in a seed spot, the tallest was measured. A tree was considered to be an acorn producer if at least two acorns or two acorn caps could be found under its crown. Diameters and heights of sawtooth and Nuttall oaks on the Delta Experimental Forest site were compared by the unpaired t test ($P = .05$).

Results

Sawtooth oaks at the Huntington Point site at age 14 averaged 5.1 inches d.b.h. and 34 feet tall (table 1). The d.b.h. ranged from 1.8 to 10.2 inches,



Figure 1—Plantation of 14-year-old direct-seeded oaks. Nuttall oaks are in the row at left, sawtooth oaks in the row at the right.

Table 1—Total height, diameter at breast height, survival, and percentage acorn producers in 14-year-old sawtooth oaks on two sites and Nuttall oaks planted for comparison.

Trees	Height (ft)	d.b.h. (in)	Percent survival	Percent trees producing acorns
Sawtooth oak				
Huntington Point	34	5.1	59	85
Delta Experimental Forest	28	4.0	60	86
Nuttall oak				
Delta Experimental Forest	23	3.0	69	0

and the height ranged from 14 to 56 feet. Of the seed spots planted, 59 percent contained at least one living oak. (Two of the seed spots produced multiple stems.) Eighty-five percent of the stocked spots had produced acorns.

The Delta Experimental Forest sawtooth oaks averaged 4.0 inches d.b.h. and 28 feet tall. Their range was 0.8 to 6.6 inches d.b.h. and 8 to 34 feet tall. Seedspot survival was 60 percent. Nineteen percent of the live seed spots had two or more stems. Eighty-six percent of the stocked spots produced acorns.

The sawtooth oaks in these two plantings have very strong apical dominance and are straight except for occasional crooks about 3 feet from the ground. Many of their lower limbs are thick and persistent, however. Some of the larger trees appear to be heavy acorn producers.

Nuttall oaks averaged 3.0 inches d.b.h. and 23 feet tall. Diameters ranged from 1.8 to 6.3 inches, and heights ranged from 16 to 31 feet. Both diameters and heights of Nuttall oaks were significantly smaller than those of sawtooth oaks on the same site. Seed-spot survival was 69 percent. No acorns were observed.

Discussion and Conclusions

These plantings demonstrate the sawtooth oak's adaptability to

a wide range of sites. The species (or rather the genotypes represented) tolerated high pH, moderate flooding during the growing season, and poor soil aeration. It had previously been reported (3) that sawtooth oak could not tolerate floods or wet conditions during the growing season. Further, this study shows that the species may be successfully reproduced by direct seeding.

Sawtooth oaks exhibit rapid early height and diameter growth after establishment by direct seeding. The species has the potential to produce at least pulpwood and firewood. Its

growth exceeded that of Nuttall, one of the faster growing indigenous oak species. However, sawtooth oak had a lower survival rate and was more variable in height and diameter than Nuttall. Indigenous oak species normally grow slowly during the first 5 years. The Nuttall oaks will undoubtedly overtake the sawtooth oaks eventually.

One of the main attractions of sawtooth oak is its ability to produce acorns at an early age. Under plantation conditions, nearly all the average- and above-average-sized trees were producing acorns by the 14th growing season.

Literature Cited

1. Mercer, J., Jr. Sawtooth oak holds promise as wildlife plant for Southeast. *Soil Conservation* 34(8): 178; 1969.
2. Schoenike, R.E. Sawtooth oak--promising exotic tree species for the Piedmont. For. Bull. 6. Clemson, SC: Clemson University Department of Forestry; 1971. 2 p.
3. Soil Conservation Service. Planting guide for sawtooth oak (*Quercus acutissima* Carruthers). 4-L-20355. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service; 1965.
4. Spicer, G. Trees tough enough for the city. *American Nurseryman* 133(10): 7-8; 1971.
5. Sullivan, E.G.; Young, W.C. An exotic oak, *Quercus acutissima*, for wildlife food planting. In: Conner, E., Jr. (ed.). Proc., Fifteenth annual conference, Southwest Association of Game and Fish Commissions; 1961 October 22-25; Nashville, TN. Nashville, TN: Southwest Association of Game and Fish Commissions; 1961: 136-141.