United States Department of Agriculture
Forest Service
Southern Forest Experiment Station

Research Note

SO-301
December 1983

Nuttall Oak Direct Seedings Still Successful After 11 Years

Robert L. Johnson

SUMMARY

Forty-five hundred acorns of Nuttall oak (*Quercus nuttallii* Palmer) were either machine or manually sown at 2-, 4-, or 6-inch depths in a 20-acre, intensively site-prepared clearing within the Delta Experimental Forest located near Stoneville, Mississippi. Field germination averaged 36 percent; no significant differences in germination appeared among seeding methods or sowing depths. After 11 years, two-thirds of the Nuttall oaks, or 551 per acre, were free-to-grow; they averaged 2.1 inches dbh and 16.7 feet tall.

Additional keywords: *Quercus nuttallii,* sowing, seeding regeneration.

INTRODUCTION

Direct seeding is an attractive option for artificially regenerating Nuttall oak (*Quercus nuttallii* Palmer). Field-sowing acorns requires less time, effort, and expense than producing and outplanting seedlings. Most oak seeding efforts have failed, however, because rodents dig and destroy the acorns. Rodents were not a major problem in the successful test reported here.

METHODS

The study area, a Sharkey clay flat located on the Delta Experimental Forest, was disked in July and August 1970 following a commercial timber harvest and mechanical clearing. Five separate blocks were delineated within the 20-acre area. Each block contained nine 200-foot-long rows spaced 10 feet apart. At random, each row was assigned one combination of three sowing depths, 2, 4, or 6 inches, with one of three sowing methods, machine seeding, manual seeding in flat ground, and manual seeding in mounds. Experimental design was a randomized complete block, with testing at 0.05 level.

Nuttall oak acorns were collected in November 1970 from several parent trees located near the study area. Defective acorns were discarded following a series of float tests. Sound acorns were stored dry at 35 to 40°F until January 1971, then submerged in water until sowing time.

Machine seeding required one person to operate the tractor and another to ride a tractor-mounted unit and drop acorns into rows made with a 2-inch wide subsoiler blade. Row depth was regulated with gauge wheels.

Simple hand tools, a conduit pipe, a plunger with handle, and an adjustable foot piece, assured uniform sowing depth. Six-inch high mounds were constructed with a tractor-pulled, two-gang disk ridger.

One hundred acorns per row were sown in April 1971 at approximately 2-foot spacings (2178 acorns per acre). Ten-foot strips between rows were mowed once during the 1st, 2nd, 9th, 10th, and 11th years. Above-ground germination was checked 12 times during the first year, and seedling heights were taken at the end of the year. In February 1982, 11-year-old Nuttalls were measured for height, dbh, and classed as dominant (D), codominant (C), intermediate (I), or suppressed (S). D/C trees of species other than Nuttall were also measured for height and dbh. For the remainder of this report D/C Nuttall oaks will be referred to as free-to-grow.

RESULTS

First seedlings appeared in early May from acorns sown 2 inches deep. Seedlings from 6-inch deep acorns were delayed about 2 weeks. By mid-June germination

Southern Forest Experiment Station/T-10210 U.S. Postal Services Bldg., 701 Loyola Avenue, New Orleans, La. 70113
Forest Service, U.S. Department of Agriculture.
Serving Alabama, Arkansas, Louisiana, Mississippi, E. Oklahoma, Tennessee, E. Texas, Puerto Rico, U.S. Virgin Islands

was approximately half complete across all treatments. A month later three-fourths of the total crop had appeared.

Shallow-sown acorns were most susceptible to rodent damage that occurred soon after sowing. Although apparently less than 1 in 10 acorns were destroyed by rodents, reliable damage estimates were difficult because clearly visible digging did not always mean loss of seed. Some seeds were exposed but not injured.

Field germination ranged from 27 to 41 percent, depending on treatment. Transformed field germination percentages were not significantly different among treatments and there were no interactions. Averaged over depths, field germination percentages were 32, 38, and 38 for machine, manual, and manual in mounds, respectively. Combined over sowing methods, field germination for 2-, 4-, and 6-inch depths were 38, 35, and 35 percent.

Overall, 96 percent of the 1-year-old trees were still alive after 11 years, and no significant differences showed in survival among treatments.

Figure 1.—*Row of 11-year-old direct-seeded Nuttall oaks on clay soil near Stoneville, Mississippi.*

About one-third of the 11-year-old Nuttalls were overtopped partially or completely; the other 898 trees were free-to-grow. The latter averaged 2.0 inches dbh, sd 0.6, and 16.7 feet tall, sd 2.6. Largest free-to-grow trees were between 3 and 4 inches dbh and 20 and 25 feet tall. Vines were common to the test site, but few trees were seriously deformed (fig. 1).

Growth of the Nuttall in this test parallels closely that from another study on the Delta Experimental Forest (Johnson 1981). On the same soil type and under similar environmental conditions, the largest 10-year-old direct-seeded Nuttall, one from each of 162 rows, averaged 1.8 inches dbh and 17.8 feet tall.

Intra-row spacing of free-to-grow Nuttall oaks averaged 7.9 feet, equivalent to 551 trees per acre at 10-foot spacing between rows. Average dbh of free-to-grow trees within a row ranged from 1.6 to 2.8 inches; diameter decreased as total number of trees within a row increased.

Main non-oak competitors within direct-seeded rows were green ash (*Fraxinus pennsylvanica* Marsh.), cottonwood (*Populus deltoides* Bartr. ex Marsh.), sugarberry (*Celtis laevigata* Willd.), sweetgum (*Liquidambar styraciflua* L.), American elm (*Ulmus americana* L.), persimmon (*Diospyros virginiana* L.), and water hickory (*Carya aquatica* Michx f. Nutt.). Except for two 6-inch dbh, 35-foot tall cottonwoods, largest non-oaks were about the same size as the free-to-grow Nuttalls.

DISCUSSION AND CONCLUSIONS

This study and others (Johnson 1981) show Nuttall oak can be successfully regenerated through direct seeding of viable acorns selected by a combination of float tests and visual checks. Seeding depths may vary from 2 to 6 inches, with the 2-inch depth giving faster germination and the 6-inch depth a little more protection from rodents.

Successful seeding can be achieved if severe rodent damage can be avoided. A relationship seems apparent between rodent damage and the amount of forest cover. Where oak seeding has been tried under a forest canopy, a very high percentage of the acorns have been destroyed. In 2-acre or larger forest openings where there has been complete stand removal, seeding has been successful and rodent damage insignificant.

Nuttall direct seeding is recommended on suitable sites where all commercial trees have been harvested and the remainder either cut, sheared, or chopped—combinations used on many National Forests and some

Robert L. Johnson 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.

industrial lands. The impact of rodents on seeding under various stocking levels of deadened, but standing, trees is not yet determined.

Assuming sound acorns, a field germination percentage of between 30 and 40 appears attainable. Although a high percentage of 1-year-old trees should survive through 10 years, many will be suppressed under sprout clumps of competing species. Considering acorn germination and subsequent tree survival and growth, a seeding rate of up to 1500 acorns or 500 well-spaced seed spots per acre should be adequate for most management objectives. Three acorns should be sown about 1 foot apart at each seed spot.

Spring sowing was used in this test, but sowing in the fall following seed collection has also been successful. Working conditions normally are much better in the fall because Nuttall oak sites are frequently very wet in the spring. Fall sowing avoids storing and stratifying. Extended flooding from January through April has no adverse effect on germination of Nuttall oak acorns; in fact, there is evidence that it will help.

Height growth of Nuttall oak trees starting from seed appears comparable over the first 10 years to that of 1-0 planted stock or <2-foot tall natural regeneration. On clay soils all three average about 1½ to 2 feet of annual height growth when free-to-grow (Johnson 1975, Krinard and Kennedy 1981). Such growth is less than that of some associated species; however, Nuttall appears more competitive than most associates.

LITERATURE CITED

Johnson, Robert L. Natural regeneration and development of Nuttall oak and associated species. Res. Pap. SO-104, New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1975. 12 p.

Johnson, R. L. Oak seeding—it can work. South. J. Appl. For. 5(1): 28–33; 1981.

Krinard, R. M.; Kennedy, H. E., Jr. Growth and yields of 5-year-old planted hardwoods on Sharkey clay soil. Res. Note SO-271, New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1981. 3 p.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1983-769-089:4