MISSISSIPPI STATE UNIVERSITY EXTENSION

Managing Hardwood Stands for Acorn Production

One of the questions natural resource professionals who work in hardwoods regularly encounter is, "How do I increase acorn production in my forest?" While management of an existing hardwood stand for acorn production is not an overly complicated process, the current year's acorn crop cannot be influenced. Land managers' influence over acorn production is a lengthy process and must be tackled months or years before significant increases will be observed.

Oak species are one of the most economically and ecologically important species found in the hardwood forests of Mississippi. In addition to providing high-quality, valuable wood, oaks serve critical roles for watershed health and recreation, as well as provide cover and food for wildlife. Although older oak stands can provide cavities for a wide range of wildlife species, many people are more interested in the fruit of these species. Hard mast is a term that applies to the fruit (nuts) of oak (acorns), hickory, pecan, walnut, and beech trees. Hard mast is an important food source used by a variety of wildlife species, including white-tailed deer, wild turkeys, squirrels, ducks, and many nongame birds and mammals. While available primarily during fall and winter months, acorns and nuts are an important source of food for wildlife due to their widespread occurrence, palatability, nutritive quality, and availability during a time when other food sources are not available.

Most individuals concerned with increasing mast production for wildlife food are only concerned with increasing acorn production (oak species) and pay relatively little attention to other hard mast species (e.g., hickories, walnuts, beeches, etc.). Many of these landowners attempt to supplement their properties with nonnative oak species such as sawtooth oak (native to eastern Asia) in an effort to produce greater quantities of acorns during hunting seasons. These landowners tend to be drawn to the species' fast growth, early acorn production, and heavy mast crops. While sawtooth oak has these attributes, the tree may not serve in this role as suitably as many believe. Mississippi hunting seasons typically start in early October, and, by this time, the typical sawtooth acorn crop will be either gone or in the last stages of acorn drop. Most sawtooth trees start acorn drop in mid-August to early September and are finished by the time hunters enter the woods to hunt over the year's crop. Additionally, sawtooth oak wood is prone to splitting, is characteristically branchy, and does not form quality single-stem logs as it matures. Such characteristics make sawtooth an undesirable timber species.

Figure 1. Stand of red oaks thinned to increase growth and improve browse availability for deer. Photo by Cody Rainer.

Figure 2. Nuttall and cherrybark acorns. Both are eaten by many species of wildlife. Photo by Brady Self.

Several native oak species can provide desired wildlife food goals while providing acorns during periods of the year more beneficial to both hunters and wildlife. For example, Nuttall oak is one of the fastest-growing oak species in Mississippi, drops acorns late in the fall and winter (October to December), and has relatively heavy mast crops. In addition, Nuttall oak can be planted using wide spacings so that more acorn-generating branches will be produced and retained

as stems age. With fertilization and irrigation, acorns can be produced in as little as 5–10 years (more typically 25–30 years). If timber management is part of the overall property management strategy, Nuttall can form quality logs while providing desired wildlife benefits. Other oak species that should be considered as alternatives to sawtooth include swamp chestnut oak, white oak, willow oak, cherrybark oak, Shumard oak, and others. All are native and fully capable of providing good mast crops and quality timber simultaneously.

This publication describes methods that can be implemented by landowners in their efforts to increase acorn production in their existing forests.

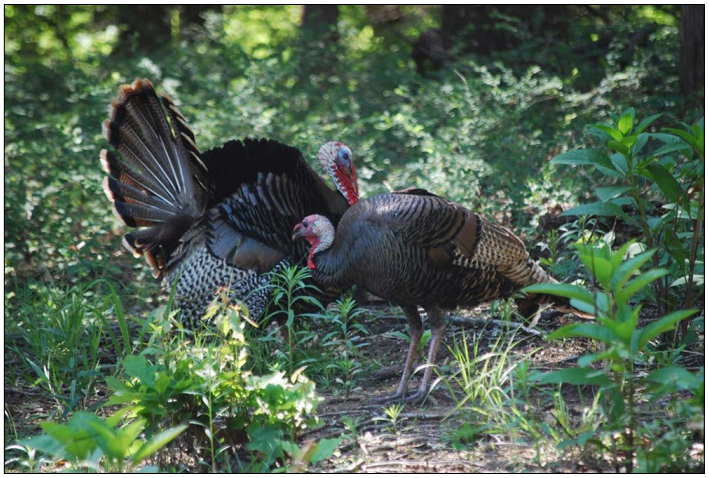

Figure 3. Oaks provide habitat and food for a variety of wildlife species, including white-tailed deer and wild turkeys. Photo by Amber Floyd, U.S. Fish and Wildlife Service.

Figure 4. Sawtooth oak acorns on a tree. Photo by Brady Self.

Acorn Production

Members of the oak genus (Quercus) are monoecious, meaning both male and female flowers are on the same tree. However, wind pollination and some variation in the timing of male and female flowers on an individual tree ensures cross-pollination among nearby trees. Male flowers are pollen-producing stamens on catkins, and female flowers are the short spikes on leaf axils (Figures 5 and 6). For this reason, acorns are produced near the ends of twigs. Consequently, trees with large, well-developed, exposed dominant or codominant crowns have a greater likelihood of

Figure 5. Male oak flowers located on catkins of a Shumard oak. Photo courtesy of Steven J. Baskauf, bioimages.vanderbilt.edu.

Figure 6. Female oak flowers located on short, rounded spikes on axils of leaves. Photo by Robert Pierce, University of Missouri.

Figure 7. Shumard oak acorns. Note older maturing acorns on the right and currently forming immature acorns on the left. Photo by Brady Self.

being good acorn producers compared to smaller-crowned, shaded individuals.

In natural settings, oaks usually take somewhere in the neighborhood of 25–30 years to produce acorns consistently. However, acorn crops are highly variable. This variability results from a multitude of factors including poor pollination, late spring freezes/frosts, drought, acorn weevil population levels, soil productivity, and the genetic makeup of individual trees. While annual acorn production is difficult to predict, larger diameter trees with large crowns typically produce greater amounts of acorns than smaller diameter trees with smaller crowns.

Oak Subgroups and Differences within Species

Thirty-four different native oak species (and numerous hybrids) are found in Mississippi. Oaks are divided into two groups: red oak species and white oak species (Table 1). There are several physiological differences between the two groups, but this article concentrates on differences regarding acorn production. One of the most distinctive differences between red and white oaks is the length of time required to produce acorns. Red oak acorns take 15 months (two growing seasons) and white oak acorns take three months (one growing season) to mature. Additionally, red oak acorns have higher tannic acid content, resulting in a bitter taste compared to white oaks, which have lower levels of tannins. If you look closely at the twigs of red oak species, you will notice small, immature acorns on the current year's growth and mature acorns on last year's growth. The mature acorns were formed last year, and the smaller, immature acorns will be next year's crop. For this reason, sometimes red oak species have good

Table 1. Native oak species in Mississippi.

Common name	Scientific name
White oak group	
White oak	*Quercus alba*
Bluff oak	*Quercus austrina*
Durand oak	*Quercus durandii*
Overcup oak	*Quercus lyrata*
Bur oak	*Quercus macrocarpa*
Sand post oak	*Quercus margaretta*
Swamp chestnut oak	*Quercus michauxii*
Chinkapin oak	*Quercus muehlenbergii*
Oglethorpe oak	*Quercus oglethorpensis*
Dwarf chinkapin oak	*Quercus prinoides*
Swamp post oak	*Quercus similis*
Post oak	*Quercus stellata*
Live oak	*Quercus virginiana*
Red oak group	
Arkansas oak	*Quercus arkansana*
Scarlett oak	*Quercus coccinea*
Southern red oak	*Quercus falcata*
Sand live oak	*Quercus germinata*
Laurel oak	*Quercus hemisphaerica*
Bluejack oak	*Quercus incana*
Turkey oak	*Quercus laevis*
Swamp laurel oak	*Quercus laurifolia*
Blackjack oak	*Quercus marilandica*
Dwarf live oak	*Quercus minima*
Chestnut oak	*Quercus montana*
Myrtle oak	*Quercus myrtifolia*
Water oak	*Quercus nigra*
Cherrybark oak	*Quercus pagoda*
Pin oak	*Quercus palustris*
Willow oak	*Quercus phellos*
Runner oak	*Quercus pumila*
Northern red oak	*Quercus rubra*
Shumard oak	*Quercus shumardii*
Nuttall oak	*Quercus texana*
Black oak	*Quercus velutina*

Summarized from Mississippi Trees.

acorn crops when white oak acorns are nonexistent due to a late freeze earlier in the year.

Acorn production can vary substantially by year. Typically, most oak species only produce a "good" mast crop of acorns every 3–4 years. Some species are more productive than others (e.g., white oak and willow oak). Within any given species, some individual trees will tend to produce more acorns than others. Additionally, genetic influences may result in a great deal of variability in the timing of acorn drop among individuals of the same species.

Research has shown that, when an individual tree in the white oak group produces well, other white oaks in the same population will tend to produce similarly. Conversely, acorn production in trees of the red oak group is not as closely synced, and acorn production by individual trees within a stand will often vary drastically. Also, only a small percentage of trees in a stand of either oak group is capable of heavy acorn production in any given year. Studies have found that, even in years of high acorn production, this proportion comprises only about 30 percent of large, healthy trees in the white oak group. If management efforts are centered on enhanced acorn production, these trees should be selected for further management.

Figure 8. Silhouetted acorns on a Shumard oak branch. Photo by Brady Self.

Management for Increased Acorn Production

The only way to know which trees are the best acorn producers is to evaluate mast production of individual trees. You can evaluate individual trees using binoculars to observe acorn production during late summer to early fall months and determine which trees to favor in future management efforts. Acorn counts made during this time of year will provide you with the best production estimate possible. Later counts may be inaccurate because of acorn loss from insect infestation, consumption by wildlife, and acorn fall. Due to the variability of year-to-year acorn production, these evaluations should take place over the course of 5 or more years. If the amount of time you can spend making evaluations is limited, individual trees may be observed during a "bumper" mast year to make a rough estimate regarding production potential. Keep in mind that many good producers in the red oak group may be overlooked during a single year's observations. Table 2 shows criteria for evaluating which trees are prime acorn producers.

Table 2. A ranking of acorn production for individual trees by red and white oak group.

Ranking	Average number of acorns per branch[1]	
	White oaks	Red oaks
Excellent	18+	24+
Good	12–17	16–23
Fair	6–11	8–15
Poor	5 or less	7 or less

Adapted from Johnson (1994).
[1]Based on the last 24 inches of healthy branches in the upper one-third of the crown.

Figure 9. Oak trees retained after timber stand improvement to encourage increased growth and acorn production. Photo by Brady Self.

After your best-producing trees have been identified, timber stand improvement (TSI) or thinning operations should be performed in their immediate vicinity. These operations should focus on exposing crowns of remaining trees to full sunlight (Figure 9). The focus in these practices should be to fully expose the crowns of selected trees to sunlight on all sides and facilitate crown expansion, which ultimately leads to increased acorn production. Dominant and codominant trees will typically be the most prolific acorn producers, but under certain site conditions, some codominant trees should be removed so that dominant trees have more space for crown expansion.

It is not necessary to thin the entire forest to increase acorn production substantially. It is likely that only a few good acorn-producing oak trees will be found on any given acre. When thinning, make sure that a mixture of both red and white oaks are retained to account for yearly fluctuations in the acorn crop. Your overall goal should be a 50–60 percent oak component in the residual stand. Residual oaks should be evenly divided between the red and white oak groups. Maintaining an even split between the two oak groups provides a safeguard against a total acorn crop failure in any given year while maximizing acorn production across the forest.

The diameter of individual trees should be considered when selecting which trees are potentially the best producers. While most oak species do not exhibit a clear correlation between diameter and acorn production, larger diameter trees typically produce more acorns than smaller diameter trees. However, in some species, production gradually declines as the tree grows larger. Typically, production in red oaks peaks at slightly smaller diameters than in white oaks. However, most species in both groups exhibit maximum production somewhere near 20 inches diameter at breast height (DBH) or greater, after which production gradually declines.

It is important to note that it will take several years for individual oak stems to respond to thinnings with an observable increase in acorn production. Often, people expect—and are disappointed with the lack of—first-year mast increases after carrying out some of the above-mentioned work. It often takes 4–5 years for residual tree crowns to expand enough to show an observable post-thinning response in the form of increased acorn production.

Conclusion

Many Mississippi forests contain a substantial variety of hard and soft mast-producing trees important in the provision of food and habitat for a wide variety of wildlife species. Acorns are an important source of food for many species. Additionally, many landowners focus on management of oak species for the high-quality wood they produce. Forest management practices that favor oaks can provide a satisfactory approach to achieving both stand improvement for wildlife and increased quality and growth of trees for silvicultural production.

Additional Reading

Burns, R. M., & Honkala, B. H. (1990). *Silvics of North America: Volume 2. Hardwoods* (Agriculture Handbook No. 654). U.S. Department of Agriculture, Forest Service.

Harrar, E. S., Leopold, D. J., & White, F. M. (2000). *Harlow and Harrar's textbook of dendrology* (9th ed.). McGraw-Hill.

Hodges, J. D., Evans, D. L., & Garnett, L. W. (2012). *Mississippi trees* (2nd ed.). Mississippi Forestry Commission.

Johnson, P. S. (1994). *How to manage oak forests for acorn production* (Technical Brief TB-NC-1). North Central Forest Experiment Station, U.S. Department of Agriculture, Forest Service.

McShea, W. J., & Healy, W. M. (2002). *Oak forest ecosystems: Ecology and management for wildlife*. Johns Hopkins University Press.

Miller, H. A., & Lamb, S. H. (1985). *Oaks of North America*. Naturegraph Publishers.

Pierce, R. A., Dwyer, J., Stelzer, H. E., & Coggeshall, M. (2013). *Managing oaks for acorn production to benefit wildlife in Missouri* (University of Missouri Extension Publication G9414).

Stein, J., Binion, D., & Acciavatti, R. (2003). *Field guide to native oak species of eastern North America* (Forest Health Technology Enterprise Team Publication 2003-01). U.S. Department of Agriculture, U.S. Forest Service.

Notes

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