UT Extension
W126

How Do Acorns Develop?

David Mercker, Extension Specialist
Jennifer Franklin, Assistant Professor
Larry Tankersley, Extension Specialist
Forestry, Wildlife and Fisheries

Each year during the spring months as the days get longer and warmer, the forest comes alive with new plant growth. Conditions needed for growth (warmer temperatures, moisture, extended day length, etc.) scarce over the winter months, reappear and stimulate new life. Each species responds at its own pace to these changes as flowers are born. For oak trees, as leaves begin to unfurl, flower buds also expand and bloom. Ultimately, a new crop of acorns will mature from these flowers and disperse into new habitats (Figure 1).

Oaks and many other trees are *monoecious*. This means that both the male (staminate) and female (pistillate) flowers are on the same tree. Potentially, every tree of reproductive age is capable of producing acorns, and the majority of female flowers are pollinated by the male flowers of other oak trees within the same area. In contrast, other trees, such as persimmon and white ash, are *dioecious*. In dioecious trees, the male and female flowers are produced on separate plants, and only those trees with female flowers produce seed.

Flowering in most oaks is triggered by rising temperatures in the spring. Red oaks tend to flower about two weeks earlier than white oaks. The male flowers of oak trees are quite noticeable. Normally by April, oaks have produced long, worm-like

Figure 1. Acorn crop produced by swamp chestnut oak (*Quercus michauxii*).

structures that droop downward off the base of newly forming branches. These male flowers, called *catkins,* have a number of small flowers arranged like beads on a string along a central stem (Figure 2). These male flowers produce pollen that affects many allergy sufferers by mid-April. Pollen is shed one to two weeks after the catkins first appear, over a period of three or four days. Pollen shedding is often

Figure 2. Male flowers of southern red oak (*Quercus falcata Michx*).

delayed by rain and high humidity. Pollen shedding will be greatly reduced if a prolonged period of damp weather occurs while catkins are on the trees, resulting in a poor acorn crop.

The female flowers are much less noticeable, requiring a magnifying glass for identification. They are also located on newly forming twigs at the base of emerging leaves, and are easily overlooked because they closely resemble leaf buds. Female flowers are mainly found in the upper portion of the crown, so they are rarely seen by the casual observer. These flowers appear approximately one week later than male flowers, just as pollen begins to be shed. The female flowers have three very small, reddish *stigmas* that resemble small pedestals and rise up from the *ovules* located at the base of the female flower. These stigmas receive pollen grains from the male flowers. There are six ovules at the base of each female flower containing *ova* or eggs, of which only one *ovum* will become fertilized and mature into an acorn.

Year-to-year acorn production is very unpredictable, due mainly to external factors, and also genetic make-up of that particular oak family. Freezing temperatures during the flowering period kill the flowers, often resulting in small acorn crops. Acorn production can also be limited by high wind and excessive rainfall (affecting pollen distribution and damage to male flowers), insects (such as weevils that feast on the contents of acorns), nutrition, humidity and soil moisture. Oak trees often abort acorns during periods of stress, thereby conserving resources such as water and nutrients. This benefits the tree by redirecting resources away from seed production and into more critical life-sustaining processes.

Most species of oaks begin producing acorns at about 20 years old. Peak production occurs from about 50 to 80 years, and then acorn production tapers off after 80 years. Certain trees typically produce more acorns than others – a phenomenon that deer hunters are keen on following. Healthy trees with dominant crowns (crowns decidedly higher and larger than those of surrounding trees) often will produce more acorns than unhealthy, suppressed trees. The genetics of the tree also play a large role in the quantity of acorns produced. Trees with highly productive parents are also likely to produce good acorn crops. A year of heavy acorn production may use up much of a tree's stored nitrogen, and few acorns may be produced the following year while the tree's nutrient stores are replenished.

Twenty species of oak trees are native to Tennessee. Eight oak species are in the white oak group and 12 are in the red oak group. As a general rule, acorns from species in the white oak group tend to taste sweeter than the bitter acorns from the red oak group (containing tannic acid). Another difference between the groups is that acorns from the white oak group mature in one year, while acorns from the red oak group mature two years after the flowers are pollinated. As a result, red oak acorn production can be affected by conditions that occurred over two years of weather events.

Very few acorns survive to sprout and produce a new oak tree; most serve as a source of food for wildlife, insects and fungi (Figure 3). Acorns are an important food and source of protein for blue jays, wild turkeys, ruffed grouse, squirrels, chipmunks and other rodents, deer and black bear. Oak trees have a high aesthetic value and produce valuable forest products too. Perpetuation and sustainability of the oaks is important and begins with flowering and germination of acorns.

Figure 3. Germinating water oak acorn *(Quercus nigra L.)*

Procedure for Surveying Acorns

When conducted annually, acorn surveys can help landowners and wildlife managers note trends and make thoughtful predictions about the condition of certain wildlife species. Acorn production is important for conditioning, breeding capacity and weight gain for many species of forest wildlife. An acorn survey can be used to assess the coming fall/winter food availability and indicate the need for supplemental food sources such as food plots.

To survey acorns, you must understand differences between a branch, a limb and a twig. Branches are the largest stems that result from the first divisions from the main tree trunk. Limbs represent roughly the 3-foot section at the end of a branch. Twigs are the smallest (final) divisions at the end of each limb.

The following are simple guidelines for surveying a forest for hard mast:

1. Conduct your annual survey between the third week of August through the second week of September. If conducted earlier, not all the acorns will have developed. If conducted later, acorns will have already dropped or been consumed by wildlife.

2. Select individual trees and mark or otherwise note their location so that you can visit them every year. Record the species of oak.

3. Using binoculars, randomly select five limbs evenly distributed around the tree's crown. Avoid biasing the survey by selecting only limbs abundant with acorns. Laying on your back under the tree canopy works best.

4. Count the total number of twigs with and without acorns on each limb. Note that red oak acorns mature in two years; therefore, the acorns will be on the older growth away from the end of the twig. Record this for five branches and calculate the average per branch. This calculation will give you the percentage of twigs with acorns.

5. Record the total number of acorns on each limb.

6. Repeat the process for each tree selected.

Depending on the size of your forest and your general level of interest, you can sample individual trees or entire stands of trees. Information gathered will give a general rating of the acorns available to the wildlife. Conducting the survey annually, using the same trees and or stands of trees, will allow you to quickly and inexpensively evaluate the acorn production. Small differences in production may be difficult to detect, but detecting moderate to large differences over time will be interesting and useful for wildlife management.

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