

THE BEHAVIOR OF OAK WILT IN SINNISSIPPI FOREST*

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The oak wilt disease, caused by the fungus *Chalara quericina* Henry, has been found in at least 18 states. The study of the mysterious dying of oaks was begun in Wisconsin in 1934. In Illinois the dying of oaks in the late 1930's was generally thought to be the delayed result of injuries suffered in the severe drouth years of 1934 and 1936. It now appears that the real cause may have been the oak wilt disease which was then unknown. The fact that dying trees were in patches and that trees in the red-oak group were particularly conspicuous supports this supposition.

The disease is now most prevalent in northern Illinois, although it has been found in isolated locations throughout the state. There is no reason to believe that it will be less damaging in central and southern Illinois.

Although work on the disease has been under way for a long time in Wisconsin and Iowa, it is only within the last two years that a large number of research workers have turned their attention to it. All phases of the nature and effects of the disease are now being studied. Pathologists and physiologists are studying the life history and behavior of the fungus and its hosts and the methods of dissemination of the pathogen. The transmission of the disease from one

tree to another through root grafts has been established. It is thought to be the principal means by which an ever-widening circle of dead trees develops around the first infected tree in a specific location.

There is as yet no conclusive proof as to how the disease becomes established in trees which are not close enough to an infected tree to have established a root graft with it. The carrier may be wind, water, birds, insects, rodents, or some agent which has not been suspected. No one has as yet demonstrated that it is any of these agents. In attempts to control the disease, attention has been focused thus far on breaking the organic connection between the roots of the diseased tree and those of adjacent healthy trees. This may be done by trenching in the soil or by poisoning a ring of trees around an infection center. It has been reported that experiments in chemotherapy have yielded encouraging results.

In Illinois we are concerned about oak wilt disease because 5,832,000-000 board feet of our merchantable timber, or 56.4 percent of the total forest stand, is oak. Oaks are not only the most abundant species but, except for black walnut or tulip poplar, they are usually the most valuable. The oak volume in Illinois is divided almost equally between those which are most susceptible to the disease (the red-oak group) and those in which the disease develops more slowly (the white-oak group).

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Sinnissippi Forest near Oregon, in the Rock River Valley, is typical of the upland oak forests of northern Illinois. It contains 1,600 acres of native timberland bearing a stand of 7 million board feet of timber, of which 90 percent is oak. Its management is directed by research foresters of the Illinois Agricultural Experiment Station. Because the Forest has been mapped in detail and every significant difference in site quality or stand composition has been segregated, this area affords a unique opportunity to study the behavior of oak wilt disease and to experiment with methods of control. Observation of the spread of oak wilt in this area has been under way for two years.

In the summer of 1950 the location of every tree showing symptoms of the disease, and of every dead tree which appeared to have died of the disease, was plotted on large scale maps. This was done by covering the area completely with strip transects. Each affected tree, whether dead or alive, was recorded by species, diameter, crown class, and probable date of death, if not living. The same procedure was followed twice in the summer of 1951, adding new locations or enlarging the affected area on the map wherever new diseased trees were found.

An analysis of the data leads to several interesting observations:

More than 100,000 board feet of merchantable timber have been killed. In the summer of 1951 trees containing more than 50 M board feet of timber showed the disease for the first time. Fifty-two percent of the oaks in Sinnissippi Forest are in the red-oak group and 48 percent are

in the white-oak group (either *Quercus alba* or *Quercus macrocarpa*). Of the trees which have been attacked by oak wilt, more than 80 percent are in the red-oak group and less than 20 percent are white or bur oak. Since the forest is made up of almost equal numbers of trees in the red-oak and white-oak groups and the incidence of oak wilt disease is in ratio of more than four to one, these observations bear out the general belief that the red-oak group is more susceptible to wilt than the white-oak group. Within the red-oak group the red oak species (*Quercus rubra* L.) is more susceptible than black oak (*Quercus velutina* Lam.). Only 9.5 percent of the oaks in Sinnissippi Forest are red, but 23.5 percent of the trees affected by oak wilt are of this species; 42.8 percent of all the oaks are black and 56.9 percent of the trees affected by wilt are of this species.

Not only does the higher proportion of trees in the red oak group become infected, but also the disease progresses more rapidly in red oaks than in white oaks. In the first observations in July of 1951, symptoms were observed in many trees which did not show evidence of disease in 1950. At the time of the second examination, in August and September, 1951, red oaks that showed only symptoms at the first examination were dead, whereas the disease had progressed more slowly in the white oaks.

In forest areas, large trees are more likely than small ones to become infected. In other words, the ratio of infected trees to total trees, when compared by diameter classes, increases with increase in diameter.

This is apparent in a comparison of all oaks by diameter classes or in a comparison of individual species.

The data do not show any differences in the incidence of oak wilt with respect to site quality or environment which cannot be explained by the effect of the site quality or environment on the size of the trees and the composition of the stand. Any material change in site quality, whether it be due to a difference in soil, slope, aspect, or a combination of these, results in a change in stand composition. Frequently these changes are sufficiently great to justify classifying the stand as a different forest type. The red-oak type contains a predominance of the most susceptible species (red oak); 1.4 percent of all the trees in this type have been attacked by oak wilt. The black-oak type contains a predominance of black oak; 0.92 percent of the trees in this type have

been affected. In the white-oak type only 0.35 percent of the oaks have been affected. In the mixed-oak type, which contains substantial proportions of red, black, and white oak, 0.95 percent of the trees have been attacked.

Observation of the spread of oak wilt in Sinnissippi Forest will be continued in the summer of 1952 in the same way that it was conducted in 1951. In selected compartments various experimental control measures will be undertaken. The Forest is intensively managed for timber production. Most of the 100,000 board feet of timber killed by the wilt has been harvested and used. Since many of the trees were cut soon after they died, this harvest may have affected the spread of the disease. Experiments will be designed to determine the nature of this effect.