

Studies of the Control of Oak Wilt Disease in Southern Indiana

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Oak wilt disease, incited by *Ceratocystis fagacearum* (Bretz) Hunt, was first reported in Indiana by Cummins in 1949 (1). Surveys conducted by Stearns and Crowder (6) from 1952 to 1956 established the distribution of this disease in the state. It was shown that oak wilt is more widespread and most destructive in the northcentral and northwestern counties but is also present in several southern counties of the state. Schreiber and Green (4) conducted intensive studies on the actual and potential rates of spread of oak wilt disease in northern and southern Indiana in 1957 and 1958 and made additional surveys of disease incidence, especially in the southern part of the state. These investigations showed that, though the incidence of oak wilt in the southern counties is low, the potential destructiveness of this disease is equally as great in this area as in the northern counties.

Quercus spp. are the most important and numerous tree species utilized by the lumbering and wood-using industries in Indiana. Total harvest of native lumber in 1949 was 183 million board feet with oak comprising 45% of the total. This important industry is located almost exclusively in the southern counties.

Since 1959, emphasis in oak wilt investigations in the Department of Botany and Plant Pathology, Purdue University, has been the development of a suitable control program in the southern areas of the state. This has included aerial survey as a means of detection of oak wilt and the application of eradication practices to contain and eventually eliminate oak wilt as a disease of economic importance from the timberlands of southern Indiana.

Aerial Survey

Aerial surveying has proven to be more efficient than ground survey as a means of detecting oak wilt disease when the terrain is rough and inaccessible. In 1959, several areas, 300 to 400 sq. miles in area, were selected for intensive aerial survey. These were located in parts of Morgan, Monroe, Bartholomew, Jackson, Brown, Scott, Gibson, Franklin, Dearborn, and Ripley counties. The flight pattern for survey was intervals of $\frac{1}{2}$ to 1 mile at altitudes of 300 to 1,000 feet and air speeds of 100 to 115 m.p.h. Air crews¹ consisted of the pilot and 1 or 2 observers. All suspected infection centers were accurately marked on either 7.5 or 15 minute topographic maps. The aerial survey group met with ground

1. The writers wish to acknowledge the assistance of personnel from the Division of Entomology, Indiana State Department of Conservation.

PLATE 1. A. Aerial view of oak wilt infection center. B. Oak wilt infection center after poisoning and felling of all oaks. C. Basal boring of buttress roots for application of silvicide. D. Application of silvicide, note saw girdle to reduce upward movement. E. Resprouting of stump after poisoning and felling. F. Irregular upward translocation of sodium arsenite.

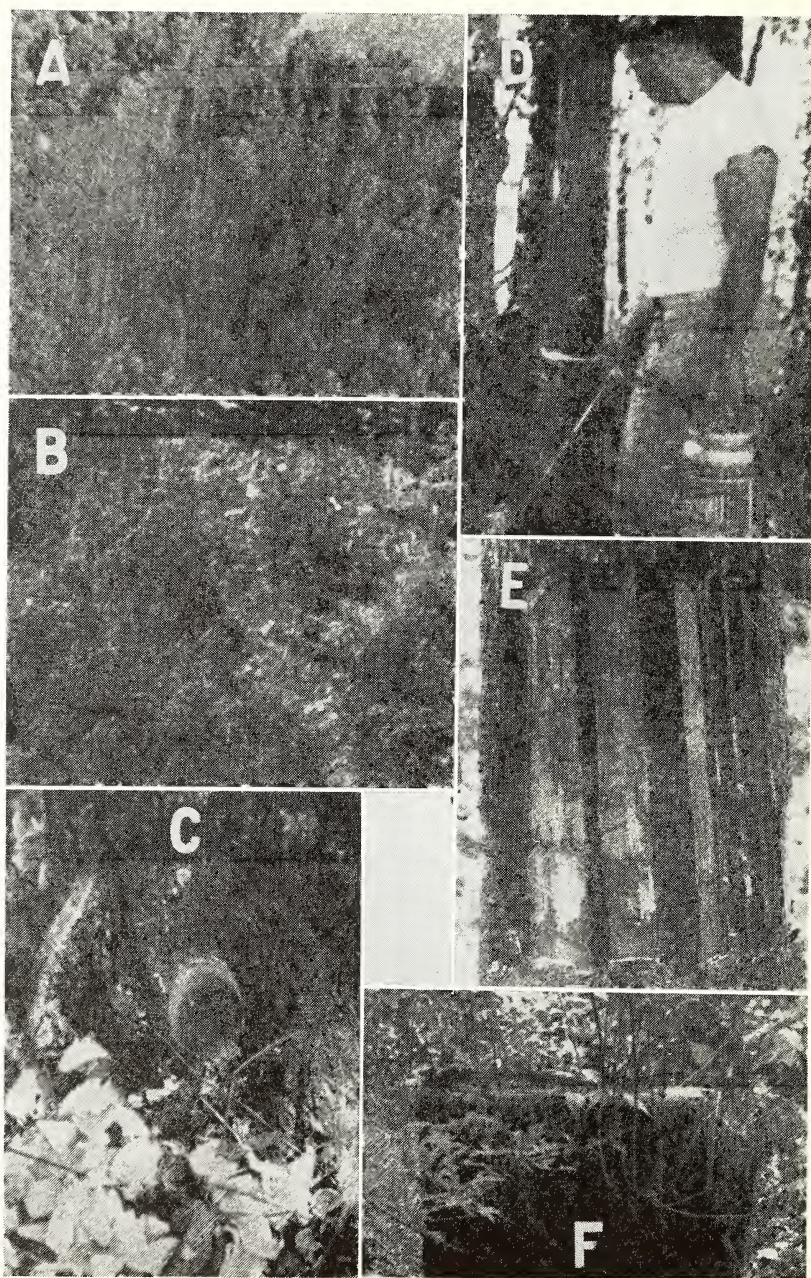


Plate 1

crews and, using the topographic maps marked during aerial survey, the suspect areas were located and specimen samples taken for laboratory isolation attempts of the oak wilt pathogen.

Aerial observers could quickly learn to distinguish oak wilt infection centers by the typical foliage symptoms and the characteristic circular spread of the disease in infected stands. However, single tree infections were more difficult to distinguish and mortality from lightning strike and other causes frequently was confusing. It was also found that ground crews were able to locate suspect areas much more readily if they were marked from the air as well as indicated on topographic maps. Many different techniques were tried and it was found that rolls of toilet tissue dropped from the plane provided the best means of marking suspect areas for ground crews.

The results of the aerial survey for oak wilt incidence, to date, have confirmed the general distribution of oak wilt disease in southern Indiana. These surveys have also shown that the greatest incidence of new infection occurs in the area of existing infection centers. Since the incidence of oak wilt is low in the southern part of the state there appears to be an excellent opportunity to markedly reduce or eliminate this potentially destructive disease from this area by direct control practices.

Eradication Studies 1959-60

In 1959, a number of oak wilt infection centers, located on both public² and private lands, were included in studies to determine the effectiveness of eradication practices to prevent further spread of this disease. It has been established (3) that the pathogen may spread from tree to tree via natural root grafts and that such grafts may be found at distances from 30 to 50 feet. Thus, it is necessary to form a barrier of 30 to 50 feet around the infection center to assure against any bridging root grafts between infected and healthy trees.

Each infection center placed under the eradication program was handled as follows: All oaks within the infection center and within a 30 to 50 feet radius of the center were poisoned by drilling holes to a depth of 3 inches in the buttress roots and applying either an aqueous solution sodium arsenite or 2,4,5T (2,4,5 trichlorophenoxyacetic acid) in kerosene. The roots were drilled with a 1½ inch auger bit attachment for a chain saw. After poisoning, the trees were felled and either piled for disposal or, in some cases, salvaged for pulp or other uses. In either case, extreme care was taken in the handling and disposal of the felled trees to prevent mechanical injury to the other trees of the stand.

In some cases, sprouting was observed from the cut stumps the following season. These sprouts were promptly sprayed with 2,4,5T solution. It was noted that trees poisoned with sodium arsenite frequently sprouted because of the uneven distribution of the poison in the vascular tissues. In some instances, the poisoned trees were girdled with a circumferential saw cut in an effort to get more complete lateral and downward translocation of the silvicide. The girdling was done, also, to hasten drying

2. The writers wish to acknowledge the assistance of the Director and staff of the Division of Forestry, Indiana State Department of Conservation.

of the poisoned tree and thus reduce formation of the ascigerous stage of the pathogen. This spore stage is assumed to be the principal source of inoculum for "long distance" spread of the pathogen (2) (5).

To date, 10 infection centers have been included in the oak wilt eradication studies. These include 3 centers in Pike County State Forest and the remainder on private land in Dearborn, Brown, Clark, Washington and Dubois counties. Additional areas will be placed under eradication as they become available. It is presumed that a period of 3 to 5 years will be required before final conclusions can be drawn concerning the effectiveness of this method of control. If these control practices are effective in the areas selected for study, oak wilt can be controlled in southern Indiana by routine aerial survey and regulatory practices.

Literature Cited

1. CUMMINS, G. B. 1949. Oak wilt in Indiana. Plant Dis. Repr. 33(8).
2. DORSEY, C. K., F. F. JEWELL, J. G. LEACH and R. P. TRUE. 1953. Experimental transmission of oak wilt by four species of Nitidulidae. Plant Dis. Repr. 37(8) : 419-420.
3. KUNTZ, J. E. and A. J. RIKER. 1956. Oak Wilt. Wisconsin Conservation Dept. and U. S. D. A. Bul. 519 :1-12.
4. SCHREIBER, L. R. and R. J. GREEN, JR. 1959. The occurrence and prevalence of oak wilt in Indiana. Master of Science Thesis, Purdue University.
5. STAMBAUGH, W. J., C. L. FERGUS, F. C. CRAIGHEAD and H. E. THOMPSON. 1955. Viable spores of *Endoconidiophora fagacearum* from bark and wood-boring beetles. Plant Dis. Repr. 39(11) :867-871.
6. STEARNS, F. and H. CROWDER. 1957. Oak wilt in southern Indiana. Proc. Ind. Acad. of Sci. 66 :63.