How to Identify and Control Dutch Elm Disease, Oak Wilt*

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The Dutch elm disease was found in Illinois for the first time when an infected tree was discovered last summer a few miles east of the City of Mattoon, about 175 miles south and slightly west of Chicago. The disease also was found last summer for the first time in Detroit, Michigan, and in the neighboring city of Windsor, Ontario, Canada.

Prior to 1950 it was known to occur in Indiana, Kentucky and Tennessee and the States eastward to the Atlantic and northward to, and including, Vermont. It also had been found in Denver, Colorado, and in Canada, east of Montreal.

For the latest authentic information on the Dutch elm disease I refer you to Special Circular No. 80, Elm Phloem Necrosis and Dutch Elm Disease, distributed by the Ohio Agricultural Experiment Station and U. S. Department of Agriculture, Wooster, Ohio. This pamphlet contains more information than I can possibly give you in the space allotted here.

Briefly, the disease was brought into the United States from Europe, presumably in a shipment of elm logs. It has been known in this country since 1930. It is caused by a fungus, **Ceratostomella ulmi, which** is spread chiefly by the smaller European elm bark beetle, **Scolytus multistriatus,** and perhaps to some extent by the native elm bark beetle, **Hylurgopinus rufipes.**

All elm species commonly planted in this country are susceptible except the Siberian elm, **Ulmus pumila,** and the Chinese elm, **Ulmus parvifolia.** External symptoms of Dutch elm disease are similar to those of elm phloem necrosis, virticillium wilt, and several other diseases, as well as those caused by mechanical injuries and unfavorable growing conditions. The leaves on one or more branches suddenly wilt, become discolored and die. Progressively, the fungus invades other branches with like results, and eventually the tree may die. Positive identification of the disease can be made only through laboratory tests. From a suspect tree select several branch specimens about ½ inch in diameter and 8 inches long, making the cuttings from limbs on which the foliage is wilting or discolored. Do not take cuttings from branches that are dead and dry. Send the branch specimens to your State Experiment Station or the Dutch Elm Disease Identification Laboratory, Bureau of Entomology and Plant Quarantine, 503 Main Street, East Orange, New Jersey.

Control Method

The control recommended by pathologists of the U. S. Department of Agriculture consists of spraying valuable elms with DDT. Three formulas are given as follows: **Formula A.** 16 pounds of technical DDT dissolved in a mixture of 2¼ gallons of benzene and 1 gallons of Velsicol AR-50. To this solution add 1 pint of Triton X-100. **Formula B.** 16 pounds of technical DDT dissolved in 4 gallons of xylene. Add 1 pint of Triton X-100. **Formula C.** 20 pounds of technical DDT dissolved in a mixture of 5 gallons of xylene and 2½ gallons of Acme white oil. Add 1½ pints of Triton X-100. In hydraulic sprayers use Formula A or B diluted with water to make 100 gallons; in mist blowers use Formula C diluted with water to make 20 gallons. One application should be made before the leaves appear in the spring, and a second application about two to three months later. All elm bark beetle breeding material, such as dead, dying or recently cut elm wood, should be destroyed. This material can be destroyed by burning or spraying thoroughly all bark surfaces with a solution of DDT in No. 2 fuel oil (8 pounds of DDT in each 100 gallons of oil.)

The oak wilt disease was first found in Wisconsin. Records and detailed descriptions indicate that it was present at least as far back as 1929. In 1942 investigators at the University of Wisconsin proved that the disease was caused by the fungus, Chalara quarcina, so-named by B. W. Henry in 1944, which invades the tree resulting in wilting of the foliage and death of the tree.

Meanwhile, the disease apparently had spread southward, for by 1949 it was known to be present not only in Wisconsin, but also in Minnesota, Iowa, Illinois, Indiana and Missouri. During the summer of 1950 it was found in four additional States, — Ohio, Pennsylvania, Nebraska and Arkansas.

Oak wilt spreads in at least two different ways. The disease may suddenly appear in an oak several hundred yards or a mile or more distant from any known infested tree. The logical assumption is that the disease is carried from infected trees, but the agency responsible is not known. Among the possible carriers suspected are insects, birds and rodents. In the second type of spread, the disease, starting from a single infected tree, moves progressively to adjacent trees and gradually invades an oak stand in a more or less concentric pattern. In well-established areas of infection in a forest it is not uncommon to find oaks that have been dead for several years standing near the center; these are surrounded by more recently killed trees, while the outer edge of the area is spotted with trees in various stages of active wilt. It has been demonstrated that this latter type of tree-to-tree local spread can occur through natural grafting of oak roots. Studies have revealed that such root grafting is very common, and that the spores of the oak wilt disease can move readily through these grafts.

Of the twenty-eight or more native species of oak-tested, none has been found to be immune to the oak wilt disease. Those of the white oak group seem to be somewhat more resistant than the red oaks; infected red oaks usually die within a few weeks after the first symptoms appear, while white oaks may live for two or three years progressively dying from the top downward. No infected tree of the red oak group has been known to recover; it has been reported that drastic pruning may check the disease in white oaks occasionally.

First Symptom of Disease

In the red oak group the first symptom of the disease is a wilting and discoloration of the foliage on one or more branches, usually near the top of the tree. In the early stages when held against the light, irregular-shaped, darkened areas are visible between the leaf surfaces. Leaves that remain attached to infected branches turn brown to bronze in color. Leaf fall may occur during any of the color stages. The disease progresses rapidly downward through the tree; complete defoliation and death of the tree usually occurs within two to four weeks after the first symptoms of wilt appear.

In the white oak group the leaves of an infected branch become tan in color, and may remain attached for a considerable period of time. In some cases only a single branch may die during the first season after wilt symptoms appear; often numerous branches with wilting, dying leaves are scattered throughout the crown. Occasionally an infected tree in the white oak group dies in the first year after symptoms appear. Usually, however, a tree dies progressively from the top downward over a period of several years.

Causes Extensive Damage

Oak wilt has caused extensive damage in several forest areas. In a stand of 250 acres north of Byron, Illinois, in which the disease was first reported in 1947, it is estimated that about 30 percent of the merchantable oak timber has been killed. In an 1800 acre tract near Oregon, Illinois, in which the diesase is believed to have been present about eight years, 50,000 board feet of lumber have been salvaged from oak wilt killed trees, with another 50,000 board feet remaining to be cut. Up to this year it is estimated that the tree loss is equivalent to about 20 acres of timber, or slightly more than 1 percent of the timber stand. In Pilot Knob State Park in Iowa, a 380 acre tract, the disease is believed to have been present 15 or more years, and an estimated 10,000 dead trees were removed prior to 1940. In 1943 only a few scattered diseased trees were reported. By 1950 it was estimated that 30 percent of the oaks were infected, with about 20,000 dead trees standing, 6" and up in diameter.

Need for Prompt Action

Although the disease is serious and every effort should be made to bring it under control, the panic that has induced forest land owners to sell their oak stands through fear that the trees would be destroyed, which reportedly has happened, is not justified. Comparison of oak wilt with the Chestnut blight, elm phloem necrosis, or any other tree disease, is useless except as such examples serve to illustrate the need for prompt action when destructive diseases occur. Oak wilt is known to be a disease serious enough to warrant research work directed toward establishing controls.

No method of preventing the disease from "jumping" great distances is known; it is unlikely that satisfactory control methods will be devised until the means by which it is carried has been discovered. Elimination of the source of infection, that is, removal of diseased trees, is the only measure of control suggested to date. Experimental work indicates that it may be possible to prevent spread of the disease in localized areas by isolating infected trees through the use of chemicals or by trenching deeply and severing all roots. Since the roots apparently serve as channels through which the disease may flow, passing from an infected tree to a healthy tree by means of root grafts, severing these roots should arrest progress of the disease. In trenching done to date, practically no roots have been found deeper than 30 inches below the ground

surface. In the Chicago area we have trenched to a depth of 36 inches to allow some margin of safety.

Wilting leaves and other external symptoms cannot be accepted as positive proof of oak wilt since confusingly similar symptoms result from other less serious diseases; the only sure method of determining the presence of oak wilt is through laboratory culture. Branch samples, of the same type as suggested in discussion of the Dutch elm disease, should be collected from suspect trees. These should then be sent to your State Agriculture Experiment Station, or to the U.S.D.A. Division of Forest Pathology, University of Missouri, Columbia, Missouri.

Time Accounting Shows Many "Outside" Jobs

Closely detailed records of work charged against golf course maintenance usually show considerable work that is done by course maintenance staff although it is not a course maintenance account. In many cases club officials don't know these "outside" charges, hence get an inaccurate view of what is actually spent on the course.

At the Country Club of Scranton, Clark's Summit, Pa., records are kept simply but accurately by the maintenance staff under the management of Ted C. Weisser. Record of total hours and cost per job for 1949 show that next to greens maintenance the largest division of maintenance force's time was devoted to general work around the club.

The details of the jobs and the time:

GREENS	HOURS
Poling	854½
Cutting	1,154
Seeding—Top Dressing	776½
Spraying Brown Patch	301
Watering	656
Changing Cups	562
Spiking	120
Rolling	20
Plugging	13
Weeding	128
	4,585

TEES	
Cutting	213
Rolling	20
Watering	116½
Ball Washers	153
Renovation	556½
Top Dressing	71
	1,130

FAIRWAYS	
Spraying DDT	30½
Cutting Fairways	595½
Cutting Rough	483
Fertilizing	110
Rolling	2
Out Bound Stakes	2
Renovating	60
	1,282

BUNKERS	
Raking	2,256
Hauling Lumber	9
	2,265

REPAIRS	
Replacing Tile	402
Watering System	104
Machinery	912
Painting Fire House	2
Painting Barn	237
Painting Tee Benches	78
Painting Parking Signs	13
	1,748

MISCELLANEOUS	
Mowing - Trimming	700
Roadways - Paths	58
Flowers	500
Hauling—Club House	833½
Caddies—Hollenback Trip	7
Repairing Tables—C. H.	29
Plowing Snow	69
Scranton for Parts	50
Scranton Tennis Club	1½
Clarks Summit for Parts	16
Cottages 1-2-2	350
Repairing Golf Shop Steps	6
Hauling Cinders	53
Painting Golf Shop	47
Repairing Tank	9
Fireworks	111½
Television	51
Painting Shelter	73
Covers for Water System	25
Painting Machinery	29
Painting Rakes	14
Screening Soil	650
Painting Tee Benches	35
Snow Fences	34
Kitchen Tables	13
Painting Chairs C. H.	4½
Raking Hay	58½
No. 8 Bridge	40
Hauling Benches	13
Water Tank Roof	5
Cutting Wood C. H.	46
Planting Trees	286
Cleaning Barn	11
	4,226
TOTAL	15,236