University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Historical Materials from University of Nebraska-Lincoln Extension

Extension

1970

EC70-1845 Dutch Elm Disease - Its Cause and Prevention in Nebraska

David Wysong

Robert E. Roselle
University of Nebraska-Lincoln, rroselle1@unl.edu

Follow this and additional works at: http://digitalcommons.unl.edu/extensionhist

Wysong, David and Roselle, Robert E., "EC70-1845 Dutch Elm Disease - Its Cause and Prevention in Nebraska" (1970). *Historical Materials from University of Nebraska-Lincoln Extension*. 4046.
http://digitalcommons.unl.edu/extensionhist/4046

This Article is brought to you for free and open access by the Extension at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Historical Materials from University of Nebraska-Lincoln Extension by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

AGRI
S
85
E1
#70-1845
c.1

E. C. 70-1845

RECEIVED
OCT 19 1972
C. Y. THOMPSON
LIBRARY

dutch elm disease-

Its cause and prevention in Nebraska....

Cooperative Extension Service, University of Nebraska
College of Agriculture and Home Economics,
and U.S. Department of Agriculture Cooperating
E. F. Frolik, Dean J. L. Adams, Director

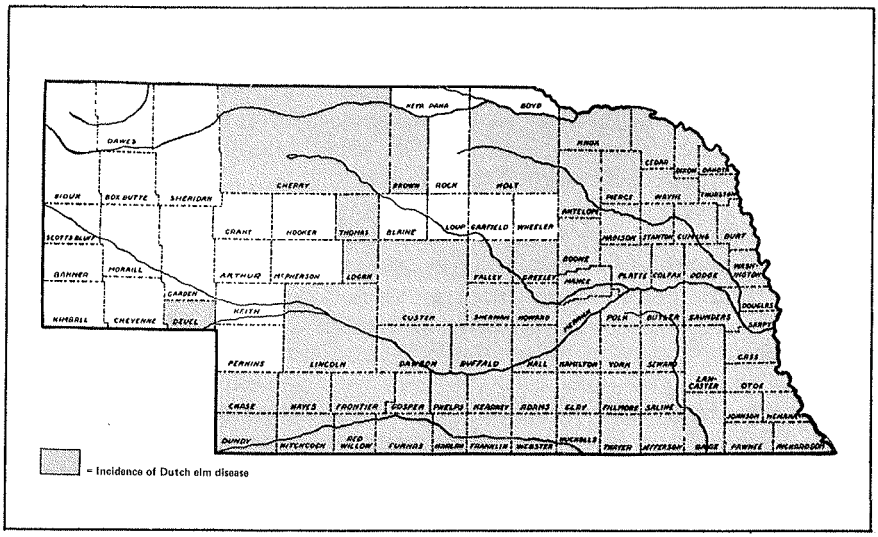

Figure 1. Dutch elm disease incidence in Nebraska.

Dutch Elm Disease

Its Cause and Prevention in Nebraska

David S. Wysong and Robert Roselle[1]

INTRODUCTION

Dutch elm disease was first described in 1921 as a serious disease of elms in Holland. Within a short time, the disease spread throughout Europe and into central Asia. Although the origin of the causal agent is not known, circumstantial evidence indicates it may have originated in eastern Asia.

The first cases of the disease in North America were identified in New Jersey in 1932, although this malady of elms was suspected as early as 1930 in Ohio.

Since then, the disease has been reported from the east coast westward into Colorado and from North Carolina and Arkansas to the Canadian provinces of Quebec, Ontario and New Brunswick.

The first known case of Dutch elm disease in Nebraska occurred in 1960 in Douglas County. By the end of 1969, 70 counties had confirmed cases of infected trees. (Fig. 1).

---

[1] Agricultural Extension Plant Pathologist and Agricultural Extension Entomologist, respectively.

CAUSE AND SYMPTOMS

Dutch elm disease is caused by a fungus[2] that grows in the water-conducting vessels of the tree causing leaves to wilt and the tree to die.

This disease is one of several vascular wilt diseases attacking elms, all of which produce symptoms that look very much alike. Wilting of leaves about June or July is usually the first symptom noticed. Leaves on one or more branches are wilted and rolled or cupped at the edge. The wilting symptom becomes more pronounced in July and August (Fig. 2). These leaves turn dull green or yellow, dry out and fall or turn brown, curl, become brittle and remain attached to twigs for some weeks.

From mid-summer onward, symptoms consist mainly of the development of yellowish leaves in one part of the crown or on occasional twigs. This has been termed "flagging." Following these symptoms, the affected branches die and the condition extends to other branches until the entire tree dies.

---

[2] *Ceratocystis ulmi* (Buism.) C. Moreau.

Figure 2. Characteristic symptoms of foliage on diseased elm.

Infected trees may die in a season, a year or two, or may persist for several years, depending upon: (1) time of infection, (2) amount of inoculum (spores), (3) length of water-conducting vessels into which the fungus was introduced, (4) soil moisture, (5) soil and air temperature and (6) elm species.

Internally, a vascular staining appears in the annual rings (commonly in the present season's wood, occasionally in the previous season's wood). This brownish discoloration appears as discontinuous streaks when the bark is peeled away from the wood, or as small, shiny, black to brown dots (or a partial to complete ring) when the branch is viewed in cross section (Fig. 3).

When an elm tree shows a combination of symptoms, Dutch elm disease should be suspected. A laboratory diagnosis must be made for positive identification. A positive diagnosis of DED takes into consideration the gross visual symptoms expressed by the host, the colony characteristics of the fungus in culture, and the identification of the fungus itself based on certain stages of development. Diagnosis must be made by plant pathologists, or technicians especially trained to identify the fungus.

For laboratory diagnosis, take samples from branches having wilted leaves and discoloration in the outer sapwood. Three to five branch samples from ½ to 1 inch in diameter and from 4 to 6 inches long should be taken. Decayed bark or badly rotted wood is of no value for DED diagnosis. Keep twig collections from different trees separate, tie them securely, wrap in wax paper and enclose in a package for mailing. A letter giving information as to tree location, city, county, date of collection, and collector should accompany each sample.

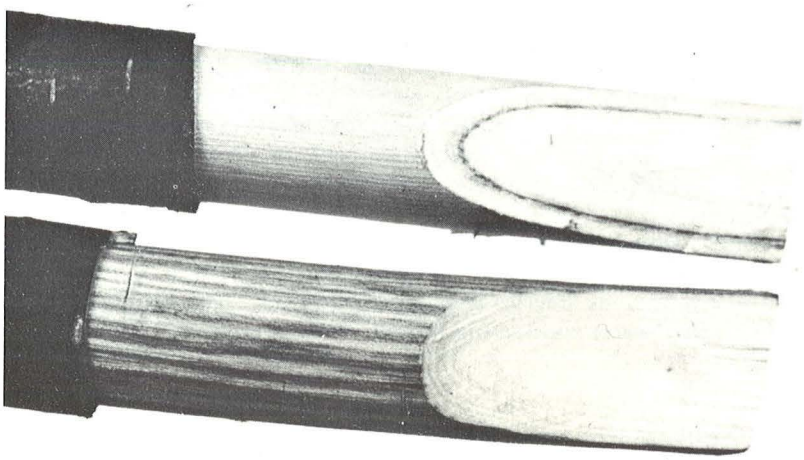

Figure 3. Internal vascular discoloration in sapwood of branch from infected elm.

Samples may be submitted to the Dept. of Plant Pathology, University of Nebraska, through the county Agricultural Extension Agent from counties which have (1) not yet experienced Dutch elm disease, or (2) experienced Dutch elm disease for one year or less.

HOSTS

All American species of elm are susceptible to Dutch elm disease. This includes, in Nebraska, the American elm (*Ulmus americana*), slippery elm (*U. rubra*), and rock elm (*U. thomasii*). European elms are susceptible, although a selection from one European species (*U. carpinifolia*) is somewhat resistant. This selection, called the Christine Buisman elm, is now being grown in this country.

A recent release of a resistant "hybrid" elm, developed in The Netherlands, is called the Groenveld (Green Field) elm. Siberian elm (*U. pumila*) and Chinese elm (*U. parvifolia*) are less susceptible than American or European species of elms.

CARRIERS OF FUNGUS

In Nebraska the principal carrier of DED is the smaller European elm bark beetle.[3] The native elm bark beetle[4] can also carry the fungus, but it is much less important. The European elm bark beetle, like the fungus, was introduced into the United States from Europe.

European elm bark beetles may be recognized by the general appearance of adults and by the pattern of brood galleries on inner bark. The adult is about 1/8 inch long, dark reddish brown, shiny and has a short spine under the rear end of the body.

Egg galleries of the European species are cut along a single line parallel to the grain of the wood. Eggs are deposited along the sides of the gallery. When eggs hatch, the larvae tunnel in smaller galleries constructed at right angles to the egg laying gallery (Fig. 4).

Adult beetles tunnel through the bark to the surface. A shotgun pattern of small holes in the bark indicates the emergence of the beetles.

Beetles that have developed in a tree killed by DED carry fungus spores on their bodies when they emerge. The fungus is transmitted to healthy trees by beetles feeding in twig crotches, generally in the spring when water-conducting vessels of new growth are long.

[3] *Scolytus multistriatus* (Marsh).
[4] *Hylurgopinus rufipes* (Eichh).

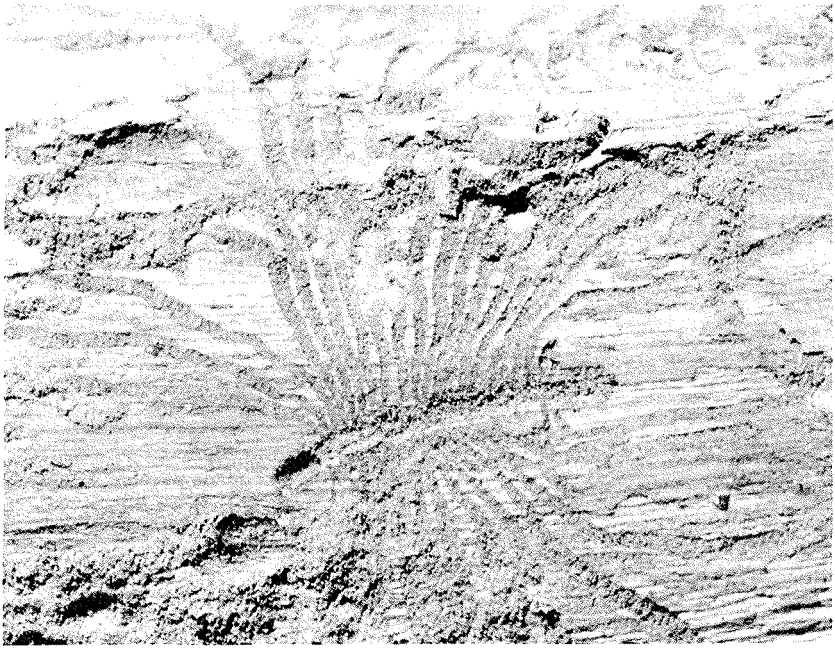

Figure 4. Main egg-laying galleries and smaller larval tunnels of European elm bark beetles in wood beneath bark of elm.

METHODS OF PREVENTION

Sanitation

Since beetles carry the fungus from infected to healthy trees, the first step in preventing Dutch elm disease from spreading is to destroy the breeding places of the beetles. Remove all old and dying branches from otherwise healthy trees. Then burn or bury them. In addition, promptly remove low-vigor elm trees or elms that have been killed due to insect attack, soil fills, ice injury, lightning, disease or other causes.

Elm wood that has been cut and stacked should be treated in one of two ways: (1) burn and destroy it, or (2) remove and burn the bark from all pieces.

Any elm wood capable of harboring bark beetles can serve as a reservoir for Dutch elm disease fungus.

Spraying

Healthy trees can be protected with a single annual application of methoxychlor between February 1 and leaf emergence. Thoroughly

Table 1. Ratio of material-to-water mixtures for methoxychlor.

Material	Ratio
Hydraulic equipment (for preparation of a 2% emulsion):	
Methoxychlor (25%), emulsifiable concentrate	8 gal of conc. to 92 gal of water
Mist blower equipment (for the preparation of a 12.5% emulsion):	
Methoxychlor (25%), emulsifiable concentrate	25 gal of conc. to 25 gal of water

cover the tree with spray. Particular attention should be given to 1, 2 and 3-year-old twigs. Spraying should be done on days that have little or no wind, no rain, and temperatures of 40 degrees or above. Methoxychlor may be applied as a 2% emulsion with hydraulic spray equipment or as a 12.5% emulsion with a mist blower. Table 1 shows the ratio of material-to-water mixtures for methoxychlor to obtain recommended strengths.

Commercial formulations of insecticide concentrates include materials other than active ingredients. Solvents are usually xylene or aromatic petroleum. Xylene formulations are preferred for tree spraying. A horticultural white oil in the concentrations will tend to decrease the rate of evaporation, and facilitate removal of spray deposits from automobiles.

If hydraulic spray equipment is used, enough spray should be applied to thoroughly wet all bark surfaces. This usually requires 20 to 30 gallons for an average 50-foot elm tree. For mist blowers, between 2 to 3 gallons of spray is adequate to treat the same sized elm.

Helicopters have been used for application of dormant sprays to control elm bark beetles. The efficacy of helicopter applications has not been fully determined. When research and experience indicate that low volume helicopter sprays are effective, appropriate recommendations will be issued.

Methoxychlor, like most other insecticides, is a poison and should be handled as such. Be sure to read instructions on the manufacturer's label. Care should be taken to prevent pools of the spray from collecting on the ground, in the streets or on equipment where birds or animals may drink the material.

It is essential that methoxychlor not drift to fish ponds or lakes. It is toxic to fish and severe kills can be expected if fish-bearing waters become contaminated.

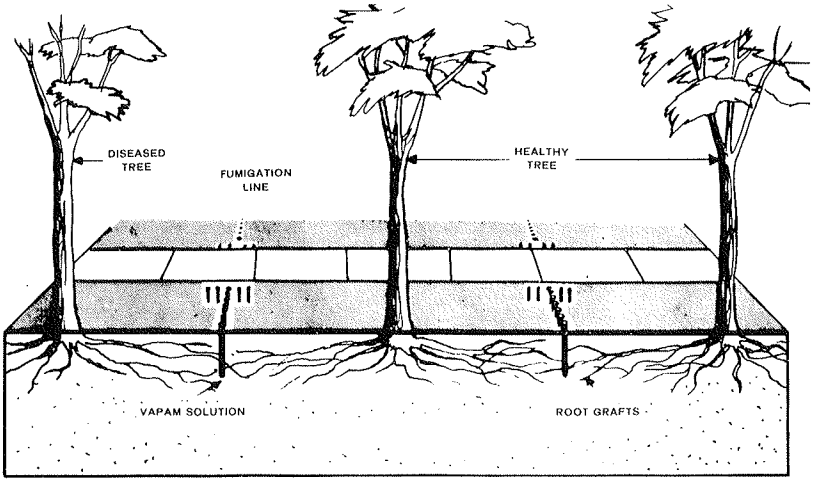

Figure 5. Method of fumigant placement between diseased and healthy trees.

Root Graft Transmission

In addition to being carried by bark beetles, the fungus is known to spread from elm to elm through natural root grafts. This is evident in the progressive death of trees adjacent to an infected tree in close-spaced city parkway plantings.

The only way to prevent this type of transmission is to create a barrier between diseased and healthy trees by severing or killing the root unions. This may be accomplished by trenching to a depth of 24 inches or by injecting a soil fumigant (SMDC[5]) into 1-inch holes drilled 18 inches deep and 6 inches apart betweeen trees to be treated. Only one application is necessary, although the treatment should be made when the first symptoms of Dutch elm disease are recognized (Fig. 5).

SMDC will kill the turf in a strip along the fumigation zone. The strips can be re-seeded or sodded after about 2 weeks. Or, if left undisturbed, they will fill in from the side within 6-8 weeks.

[5] Sodium n-methyldithiocarbamate dihydrate is sold under the trade names of Vapam (Stauffer Chemical Co.) and VPM (E. I. DuPont de Nemours and Co.).

SUGGESTED TREES FOR REPLANTING PURPOSES

Communities will lose a certain percentage of elm trees regardless of control measures employed. It may be desirable to plan a planting program to replace elms lost due to Dutch elm disease and other causes. When planning replacement programs, use several species of shade and flowering trees adapted to Nebraska. Avoid solid plantings to one species. A list of shade and flowering trees (EC 65-1210) for use in Nebraska may be obtained through your county agent.

ADDITIONAL PUBLICATIONS ON DUTCH ELM DISEASE IN NEBRASKA

For more detailed information on Dutch elm disease in Nebraska, consult the following publications available through your County Agricultural Extension Agent.

1. EC 65-1210. 1965. Shade and flowering trees.

2. Agr. Notebook #20 (R). 1965. Sending in specimens for identification of Dutch elm disease.

3. Agr. Notebook #60 (R)5. 1970. Questions and answers concerning Dutch elm disease.

4. Agr. Notebook #64. 1967. Root graft transmission of the fungus causing Dutch elm disease.

5. Wysong, D. S. 1967. Dutch elm disease—Proper controls can halt tree killer. Nebraska Farm and Ranch Quarterly 14: 11-13.

6. Wysong, D. S., and W. G.Willis. 1968. Recorded distribution of Dutch elm disease west of the Mississippi River as of 1967. Plant Disease Rptr. 52: 652–653.