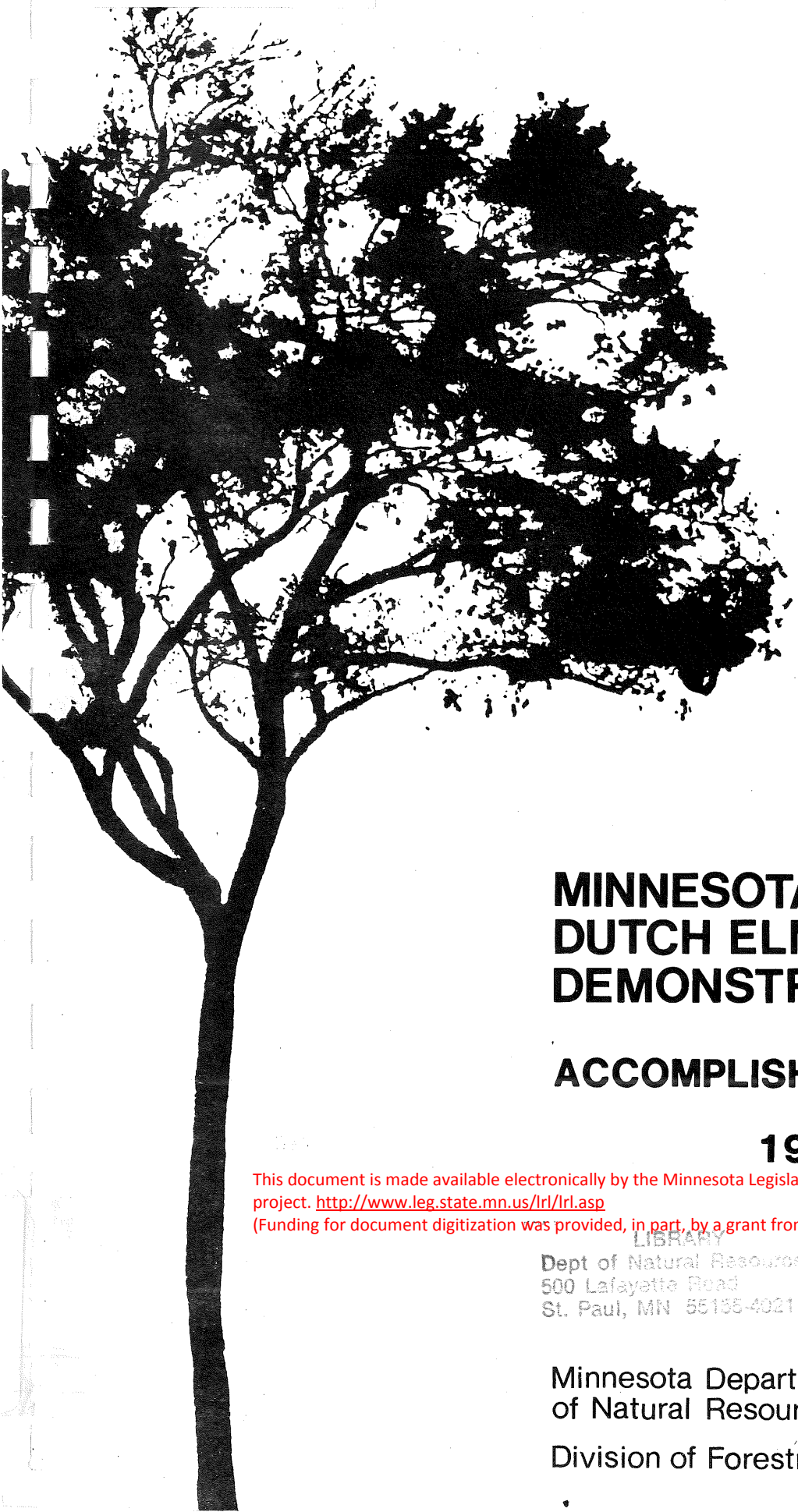

MINNESOTA'S FEDERAL DUTCH ELM DISEASE DEMONSTRATION PROJECT

ACCOMPLISHMENT REPORT

1979

Minnesota Department
of Natural Resources

Division of Forestry

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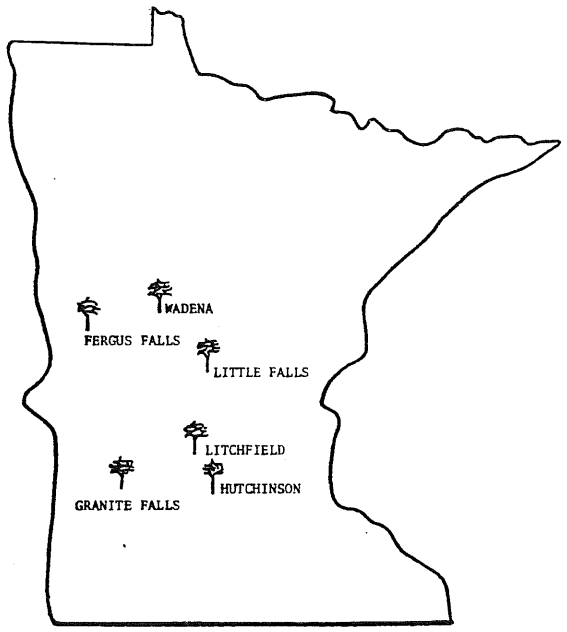

MINNESOTA'S DEMONSTRATION CITIES

Prepared by the Federal Dutch Elm Disease
Demonstration Program
Division of Forestry
Minnesota Department of
Natural Resources

PART II

INFORMATION AND EDUCATION PROGRAM

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BACKGROUND

In fiscal year 1978, Congress granted the United States Forest Service $2.5 million in General Forestry Assistance funds for Dutch elm disease special projects. This appropriation would allow State and Private Forestry to provide technical and educational assistance in establishing disease management and utilization projects. The objectives of this assistance program were 1) to make available, on a nationwide basis, information and education to communities, municipal governments, landowners, and individual homeowners on the history, incidence, severity, and management of Dutch elm disease; 2) to make available information and education on the utilization of elm trees infected and killed by Dutch elm disease; and 3) to establish and maintain, in selected areas of the United States, demonstration sites to show the application and results of effective Dutch elm disease management and utilization programs.

Minnesota was one of the states selected to participate in this Forest Service Dutch elm disease and utilization program. At the end of 1978, the State's project had completed the initial stages of establishing high performance Dutch elm disease management programs in six selected Minnesota cities--Fergus Falls, Granite Falls, Hutchinson, Litchfield, Little Falls, and Wadena--to augment the basic tree removal program already existing in each of the communities. This demonstration project is a cooperative effort among the Department of Natural Resources, the Department of Agriculture, the Extension Service of the University of Minnesota, and the participating cities. Of the $2.5 million appropriation passed by Congress in fiscal year 1978, Minnesota received $310,500 for its community demonstration project. In 1979, Congress again made

available funds for Dutch elm disease special projects. Of this $2.6 million appropriation, Minnesota received $768,000. The community demonstration project is anticipated to run for a five-year period. At the end of this time, the project will hopefully provide the evidence that Dutch elm disease can be suppressed over enough years so as to document a workable disease management system for each of the six demonstration cities.

Minnesota's program was developed around the idea that two types of demonstration sites would be used, each site to be replicated three times. The first demonstration site was to

1) cover an area of one to two square miles
2) have a population of 5-15,000 people
3) have 6-10,000 elm trees which comprised at least 60-70% of the total tree population
4) have a Dutch elm disease incidence of 1-3%, and
5) be well isolated from wild elm populations.

The second demonstration site was to

1) cover an area of one to two square miles
2) have a population of 5-15,000 people
3) have 5-15,000 elm trees which comprised at least 60-70% of the total tree population
4) have a Dutch elm disease incidence of 1-5%, and
5) have a wild elm population in, or adjacent to, the control area.

The cities selected for this demonstration project were those that best fit the aforementioned criteria. Each city also had to be actively involved in the Department of Agriculture's Shade Tree Program. This requirement was considered important since to participate in the Shade Tree Program, each city, on its own, had to have already initiated a Dutch elm disease management plan and had to have already made a financial commitment to support that plan. Since Minnesota is a state which lays claim to

having a large amount of water as a natural resource, and since many Minnesota cities are on or near this water, a few of the selected demonstration communities were located on or near a river.

The cooperative agencies agreed that the following disease management practices (listed on a priority basis) would be recommended to the demonstration cities for each year of the program--

A) Conduct a thorough late winter and early spring inspection for the detection of all downed elm wood, elm firewood piles, felled elm trees, stumps, and brush.

B) Destroy all detected, non-debarked elm material by April 1.

C) Conduct on a continuous basis throughout the year, thorough inspections for the detection of all diseased elm trees.

D) Therapeutically prune diseased branches from those trees identified by project personnel as showing early Dutch elm disease symptoms.

E) Immediately remove all diseased elm trees with a greater than 5% wilt infection. Those diseased trees having a wilt infection of less than 5% and not selected by project personnel for therapeutic pruning or systemic fungicide injection should also be immediately removed. A strong effort should be made to remove diseased trees detected before June 1, by June 1, and to remove diseased trees detected before July 15, by July 15. June 1 and July 15 coincide with the main emergence periods of elm bark beetles.

F) Remove all felled elm trees to a disposal site approved by the Department of Agriculture (regulatory agency).

G) Provide and install root graft barriers in areas where an elm tree with a greater than 5% disease infection is within forty (40) feet of other healthy elm trees.

H) Remove from healthy elm trees all dead and dying branches during the period extending from late October to late February/March.

I) Reduce the Dutch elm disease control area when project personnel feel that high level management can no longer be provided within the boundaries originally designated.

J) Inject, protectively or therapeutically, high value elm trees with systemic fungicides.

K) Destroy low-vigor, non-diseased elm trees which in the opinion of the tree inspector are a hazard to the overall effectiveness of the project. In conjunction with said destruction, debark or cause to be removed the remaining tree stumps.

L) Remove those wild elm populations located within and adjacent to the control area which are, or could be, hazardous to the overall disease management program.

Fergus Falls - Synopsis of 1978

Due primarily to the encouragement of interested citizens and the concern of public officials, Fergus Falls had the most attractive and best-maintained elm population of the six demonstration communities. Diseased tree inspection, although thorough, was slow because the city employee working on the Dutch elm disease program had other responsibilities as well. All diseased elms on public property were removed within the twenty-day time limit required by the Minnesota Department of Agriculture's Shade Tree Program. Residents were responsible for arranging the removal of any diseased elm detected on their property. Most people complied with the twenty-day time limit, but others had to be convinced that quick removal was still the most effective way to curtail the spread of Dutch elm disease before their trees came down. City officials required that elms suspected of having Dutch elm disease and located on private property be confirmed by laboratory testing. Lengthy delays in tree removal due to this requirement did not occur, however, because all culturing of the disease fungus was done at the municipal laboratory. Root graft barrier installation was initiated, but underground utility lines sometimes made placement difficult. City officials were hesitant to enforce the removal of woodpiles which largely contributed to many infections being transmitted through beetle inoculation. In this first year of the

program, Fergus Falls used its own record-keeping system, which, although complete, could not easily retrieve information for quick dissemination.

Granite Falls - Synopsis of 1978

Losses due to Dutch elm disease were high this year because of a lack of good inspection surveys in the past. Numerous trees were removed that had probably been infected in 1977 or even as early as 1976. Diseased tree removal was of primary importance and since so much of this removal work was "catch-up" from previous years, there was no time to implement other disease management practices. The city's attitude at the beginning of the project was rather poor. Hopeful about what the federal program could do for them in regards to their Dutch elm disease program, city officials were, nevertheless, worried that the promised financial aid would not materialize. Program personnel had to convince city officials to relocate the municipal disposal site as the original one was flooded by the Minnesota River every spring. Although tree removal was so important, negotiations with the private contractor were slow to be completed. The tree inspector hired by the city was young, and having no supervision, began to "slip", marking fewer and fewer diseased trees as the summer progressed and completing records haphazardly. Probably the worst set-back of the year, however, was when the removal records kept on three hundred (300) trees were stolen from the tree inspector's car. For the remainder of the summer, the stumps of those removed trees listed in the lost records were relocated and their diameters measured. An average stump size was determined, and based on this, the contractor was paid for his removal work.

Hutchinson - Synopsis of 1978

In this city too, elm losses were unexpectedly high during this first year of the demonstration project because of a lack of thorough inspection surveys having been completed in previous years. A number of trees infected in 1977 had not yet been located and elms with wilting symptoms visibly noticeable were not marked. Woodpiles containing a high percentage of elm were a common occurrence and root graft infections were becoming a serious problem. Project personnel first began by concentrating on detecting and marking all diseased trees. Prompt tree removal was then emphasized. Diseased trees were removed quickly, ninety-five percent of them being removed within the twenty-day time limit set by the Minnesota Department of Agriculture's Shade Tree Program. To reduce disease infections spread through common root grafts, barrier placement work was also begun. Fall coloration arrived early, making field diagnosis difficult. Through timber sales, approximately 14,500 board feet of elm were sold to a local sawmill operator and through log sales, 24,000 board feet of elm were sold to an outside firm.

Litchfield - Synopsis of 1978

Due solely to the influence of its tree inspector, Litchfield had established a Dutch elm disease program before many other Minnesota communities had even heard of the disease. Therefore, city officials were very willing to cooperate with project personnel, but they still did not fully comprehend that an effective Dutch elm disease management program involves more than just prompt tree removal. The city inexperienced with letting bids for tree removal work, gave in to the contractor's request of not being "tied-down" to detailed bid specifications, and, in place of a binding contract, relied only on the "word" of each tree removal firm. The assistant hired to help the tree inspector was irresponsible, unenthusiastic, and unresponsive to the requests made by his supervisors.

When he began to cause more work for the tree inspector, each tree he marked as diseased having to be rechecked, his employment was terminated. With the tree inspector helping city residents arrange to have their diseased trees taken down by private contractors, all tree removal work was quickly completed with little root grafting occurring.

Little Falls - Synopsis of 1978

In previous years, city officials recognized that Dutch elm disease was responsible for killing a number of trees, but they did not realize how severe the problem had become, nor did they have any idea of how to bring disease losses down to a more manageable level. From the first, Little Falls posed one of the more difficult challenges--disease incidence was higher than program personnel had at first anticipated, the financial commitment of the city to its Dutch elm disease program was only in the amount of $2,100, and people, technically capable of handling the disease program, were lacking at the city level. Inspection was slow through most of the active growing season due to the absence of qualified tree inspectors. For effective disease management, the control area of the federal demonstration project was re-defined to include only those residential sections containing a heavy population of elm. Tree removal fell behind as the season progressed because city attorneys would not allow the use of individual work orders but required that a new contract be re-bid each time one hundred fifty (150) diseased trees were marked for removal. All marketable logs were awarded to the tree removal contractor. However, when these logs were haphazardly piled and were not removed within the designated time limit of one week, the city required them to be burned, thus putting an end to this utilization attempt. An island in that part of the Mississippi River which runs through the middle of town was identified as a major breeding site for elm bark beetles. The island was

clear-cut of all hazardous elm, but only after a lengthy delay which resulted from having to wait for the water level to go down before men and equipment could cross to the island.

Wadena - Synopsis of 1978

In this initial year of the program, the elm population was under stress due to drought conditions carried-over from 1977. The sparse and light-colored foliage of each elm was indicative of its weakened condition. The majority of trees contained a high percentage of dead wood and infections caused by Dutch elm disease, Verticillium wilt, and black leafspot were prevalent. Inspection surveys, encompassing the entire city, were begun on a continuous basis throughout the season. By the end of September, all diseased elm trees had been detected, marked, and removed within the twenty-day time limit required by the Minnesota Department of Agriculture's Shade Tree Program. The use of root graft barriers was begun as was the use of facilities to laboratory confirm the presence of the Dutch elm disease fungus. Public resistance was strong during the developing stages of the program, so disease management practices, other than that of prompt tree removal, were not readily accepted. Field diagnosis was made difficult by not having the necessary equipment to obtain disease samples from large trees. Probably the most troublesome thing to deal with, however, was the discovery of a new pathogen which hindered disease diagnosis. This pathogen, a fungus which produces Dutch elm disease-like symptoms, has yet to be identified.

ACCOMPLISHMENTS AND PROBLEMS

Overcoming obstacles and pinpointing major objectives were the accomplishments made by the demonstration project in 1978. This year, 1979, was the first year, then, that a disease management program began to replace the tree removal program which had existed prior to this time in the six demonstration communities. Not being confined to the first year of the program only, obstacles had to be dealt with again this year. The accomplishments made in advancing the program, however, seemed to minimize the effects of the problems which occurred. With this year of 1979 nearing its end, the program had definitely come closer to its goal of providing the evidence that Dutch elm disease can be suppressed over enough years so as to document a workable management system for each of the demonstration communities.

Program Accomplishments - 1979

1. Tree losses due to Dutch elm disease have dropped significantly in the demonstration communities of Fergus Falls, Granite Falls, Hutchinson, Litchfield, Little Falls, and Wadena.
2. Each year of the program, the cities have participated more, have required less technical assistance than the year before, and have annually increased their shade tree program budgets.
3. Probably the most important accomplishment is that four of the six cities now have permanent foresters or tree inspectors-a development which was brought about through the project's influence. Of the remaining two cities, one is budgeting for a permanent forester's position in 1980, while the other one has someone, year-round, who works with the Dutch elm disease program. This development has enabled the federal project's personnel to drop their policy-making role and assume, instead, that of an advisor/consultant.

4. Additional management practices have been implemented and/or previously used management practices have been improved. New in 1979 was the injection of selected trees with Arbotect, the pruning, therapeutically, of selected trees, and the incorporation of an annual elm tree trimming program in each of the communities. Practices which were continued in 1979 were the use of better and more numerous inspection surveys (this included diseased tree and woodpile detection surveys), an increased promptness in diseased tree removal, and the more extensive use of root graft barrier installation.

   --an excellent training session held at the University of Minnesota for the foresters and tree inspectors of the demonstration cities was largely responsible for increasing the willingness of the cities to use systemic fungicides, prune therapeutically, and install more root graft barriers

5. Two control cities were selected for each demonstration community. The Dutch elm disease situation in each selected city resembles as closely as possible the disease situation in the demonstration community to which it is being compared. Through the process of comparing, it is hoped that these "controls" will be able to confirm the level of success attained in each of the demonstration cities.

Demonstration city	Control Cities
Fergus Falls	Alexandria Elbow Lake
Granite Falls	Ortonville Redwood Falls
Hutchinson	Glencoe Olivia
Litchfield	Hector Renville
Little Falls	Princeton Cambridge
Wadena	Sauk Center Staples

--map of control cities is on next page--

CONTROL CITIES

6. The cities took more responsibility in diagnosing diseased trees. This included either creating or utilizing more extensively, facilities in which the Dutch elm disease fungus could be laboratory cultured.

7. An improved record-keeping system was initiated in each demonstration community. This system simplified the paperwork required of the tree inspector and unified the cities as to the information each collected regarding the Dutch elm disease program.

Fergus Falls - 1979 Program Accomplishments

Perhaps the most helpful contribution made to this program was the creation of the permanent position of city forester. Having one position concerned only with the municipal Dutch elm disease program, more city-wide diseased tree and woodpile inspection surveys were completed than had been in 1978.

Tree losses were fewer than those experienced in the previous year--one hundred seventeen (117) trees were removed in 1978 as compared to one hundred (100) trees removed in 1979. City personnel needed less technical assistance to implement disease management practices. Root graft barrier installation was increased, tree injection with Arbotect was begun, and a trimming program encompassing a portion of the city's elm population was initiated during the winter months. City officials required all "suspect" trees, public and private, to be confirmed by laboratory testing. As in 1978, the municipal laboratory facilities were extensively used. Fergus Falls utilized the program's standardized record-keeping system this year which helped to alleviate some of the confusion that resulted last year when the city used its own method to document program statistics. The demonstration program received good newspaper and radio coverage, mostly due to local initiative. The city forester also formed several service organizations into volunteer elm-watch groups.

Granite Falls - 1979 Program Accomplishments

Again, of most help to the demonstration project was the creation of a city forester's position. At first considered only seasonal, the position was made permanent at the end of the summer, its responsibilities to include the management of all city park land as well as that of the Dutch elm disease program. The city also felt it necessary to hire a seasonal tree inspector to assist the forester. Because Granite Falls is located on the Minnesota River, wild elm populations are prevalent in and around the city. To make the Dutch elm disease program more workable, the city was divided into priority areas. Priority I included the inner core of the city where complete disease management took place. Not only was prompt tree removal emphasized, but practices such as root graft barrier placement and

injection of systemic fungicides were also implemented. Priority II was the "buffer zone". In this area, thorough inspection surveys and timely removal of diseased trees were initiated. Priority III included the outer limits of the city where only occasional inspection surveys and limited diseased tree removal occurred. The new forester inspected thoroughly for hazardous elm wood and was very strict about seeing that it was removed and disposed of properly. This was a vast improvement over past years since little or no woodpile inspection had occurred prior to this time. Disease losses were down from last year--four hundred eight (408) trees were removed in 1979 as compared to five hundred thirty-two (532) trees removed in 1978. Selected trees were injected with Arbotect. The forester hired some young students through a local employment group to do the injection, and although they needed daily supervision, it seemed an effective way in which to get the work done. Laboratory facilities to culture the disease fungus were set-up and their use encouraged; some therapeutic pruning was done; and, a fall application of Dursban was applied--two-thirds of the city was covered in three days. The Extension Service of the University of Minnesota and program personnel gave presentations on Dutch elm disease to the biology classes at the senior high school. These presentations went over well, the students and teacher, alike, being very enthusiastic about the project.

Hutchinson - 1979 Program Accomplishments

Most important to the demonstration project and to the municipal Dutch elm disease management program was the hiring of a full-time city forester. Due to the size of the city and the importance of conducting thorough inspection surveys, three additional seasonal employees were hired to assist the city forester. One seasonal employee has since been hired on as full-time. Hutchinson also passed an ordinance restricting the use of non-debarked elm firewood and an ordinance incorporating more comprehensive disease

management practices into the city's existing program. Tree losses were significantly lower from those of the previous year--six hundred (600) trees were removed in 1979 compared to eight hundred seventy-five (875) trees removed in 1978. Woodpile inspection was again of high priority as was root graft barrier installation. Selected trees were injected with Arbotect and some therapeutic pruning was done. A trimming program to remove dead wood will be carried-out on a portion of the city's elm during the winter months. Facilities were provided by the city so that the samples could be laboratory tested if disease diagnosis proved difficult. Timber sales begun in the winter of 1978-1979 were finished-up, all sites finally being cleared of brush.

Litchfield - 1979 Program Accomplishments

Organized woodpile inspections, almost non-existent in 1978, were conducted regularly in 1979. All condemned firewood piles were disposed of by the city or debarked by the homeowners. Diseased tree inspection was continuous and much more thorough than that of the previous year. The tree inspector handled the public well, responding quickly to calls concerning diseased trees. The standard record-keeping system introduced this year helped to alleviate much of the confusion which had resulted last year when any paper work was required. The city crews removed diseased trees on public property within a week of their being marked and were very good about salvaging marketable logs. Tree losses were lower than those experienced last year--two hundred thirty-two (232) trees were removed in 1979 as compared to two hundred sixty-seven (267) trees removed in 1978. Therapeutic pruning was introduced as was the injection of selected trees with Arbotect. Facilities were set-up this year in order that problem trees could be laboratory tested. A trimming program to remove dead wood from a portion of the city's elm population is to start during the winter months.

Little Falls - 1979 Program Accomplishments

Little Falls markedly improved its 1979 Dutch elm disease management program from that of 1978. The permanent tree inspector hired this year did an excellent job of woodpile detection. All stockpiled elm was removed from the control area before the active disease season had begun. Detecting, marking, and removing diseased trees were completed faster and with fewer difficulties. The tree inspector had the strong support of the city council when enforcing the regulations pertaining to the treatment of diseased elms. The demonstration project was given its greatest support when city officials felt it important enough to increase the Dutch elm disease budget from the $2100 appropriated in 1978 to $25,000 appropriated in 1979. Disease losses were significantly lower--six hundred seventy-seven (677) trees were removed in 1978 as compared to five hundred sixteen (516) trees removed in 1979. Tree removal work was done faster and at a much reduced cost per tree due to better contracting procedures, improved contract specifications, and the employment of a reliable tree removal firm. Different from last year was the prompt disposal of all diseased elm, the acceptance of a standard record-keeping system, and the establishment of facilities where Dutch elm disease could be laboratory diagnosed. A trimming program encompassing a portion of the city's elm population was initiated, and placement of root graft barriers and injection of selected trees with Arbotect were begun. In an area where the wild elm population was becoming troublesome, the high school's Future Farmers of America (FFA) group removed the trees as a work project.

Wadena - 1979 Program Accomplishments

Heavy snows and subsequent spring rains enabled Wadena's tree population to "shake off" the drought-related stress it had been under since 1977. Throughout 1979, the elm population looked healthier and better maintained

than that of the previous year. Prompt removal of diseased trees was again considered of primary importance. All but two trees were detected, marked, and removed within the twenty-day time limit required by the Minnesota Department of Agriculture's Shade Tree Program. Removal of the two remaining trees was delayed only because root graft barriers were placed before the trees were taken down. Tree losses dropped significantly from the previous year--eighty-one (81) trees were removed in 1978 compared to sixty-four (64) trees removed in 1979. Much of the resistance initially shown to the program was lacking this year. The city council was more supportive of the program's disease management recommendations and upped its shade tree program budget from that of the previous year. With the hiring of more qualified people at the city level, program personnel were finally able to drop their policy-making role and assume, instead, that of an advisor/consultant. Detection of diseased trees was continuous throughout the season just as in 1978, but woodpile inspection was increased. The number of root graft barriers placed was also increased and injection of selected trees with Arbotect was initiated. A few elms, whose disease infections occurred only in the crown, were pruned therapeutically. The city also began a pruning program, the intent being to remove all dead wood. The municipal laboratory facilities were used extensively this year as city officials again required that the majority of trees suspected of being diseased be confirmed by laboratory testing.

Program Problems - 1979

1. The worst problem in some of the demonstration cities was the poor performance of the tree removal contractors. These contractors were often delinquent in removing diseased trees, site clean-up was poor, and streets were often blocked unnecessarily during tree removal.

2. Because the program's utilization project is still in its planning stage, little has been done with the diseased trees that were removed. Some marketable logs have been sold, but the majority were disposed of by burning.

3. Many of the diseased management practices--tree sampling, root graft barrier installation, systemic fungicide injection--were delayed and/or made difficult by the late delivery of necessary equipment.

4. Elm losses were increased by the heavy mortality of Siberian elms. Due to the hard winter of 1978-1979, dieback was quite prevalent. By spring, many of these elms had died or were in such a weakened condition that they became a hazard which had to be removed.

5. An unidentified fungus (suspected to be a species of Dothiorella) which showed Dutch elm disease-like symptoms in the field, made disease diagnosis difficult. First discovered in Wadena (1978), it has now been found in each of the other demonstration cities as well.

6. Therapeutic pruning, placement of root graft barriers, injection of systemic fungicides, and application of Dursban to reduce the native elm bark beetle population were not used as extensively as they should have been because time was often short and help was not always available.

7. Although it cannot be viewed as a problem, the drop in tree losses that occurred this year has caused much worry and speculation. Although it is felt that this is an accomplishment directly related to the demonstration program's influence, there is much concern that the project just "lucked out". The third year of the program will be very important, then, in proving that it is, indeed, the project's efforts that are responsible for this significant drop in tree losses.

Fergus Falls - 1979 Program Problems

Although the majority of diseased trees were removed within the specified time limit of twenty days, nine trees remained standing for an extended period. Tree removal was delayed because of slow laboratory confirmation, root graft barrier placement, or failure of the homeowner to meet the removal deadline. The city forester was solely responsible for initiating

all municipal Dutch elm disease program activities. However, he was not responsible for assigning city crews tree removal work, maintaining program cost records, or planning the municipal Dutch elm disease budget. This division of responsibilities within the Dutch elm disease program was a significant problem this year, since communication between the forester and the city officials responsible for the budget was not good. The city forester has brought a high degree of enthusiasm to his job, but has had a difficult time of understanding the ways in which each management practice is to be used and of how it is to be prioritized. At times root graft barrier installation was not properly done. City personnel did not seem to fully understand the procedure of successfully disrupting root grafts, some barriers being made too short in order that no grass on private property was killed. Dieback due to the hard winter was quite evident in the Siberian elm population. An unidentified fungus was found to be affecting a number of the city's elm trees. This fungus was initially discovered in Wadena (1978) and causes symptoms in the elm similar to those of Dutch elm disease, making field diagnosis difficult. Not enough quality logs were cut at one time to attract local buyers, so no method of utilization was used. Although a standardized record-keeping system helped to eliminate some of the confusion which occurred while documenting last year's program statistics, city personnel were sloppy in maintaining this year's records, making the retrieval of information difficult.

Granite Falls - 1979 Program Problems

Tree sampling and root graft barrier installation were made difficult by the late delivery of necessary equipment. The seasonal tree inspector, and to a lesser degree, the city forester, were too fast to condemn a tree as having Dutch elm disease. This situation had improved by the end of the summer as being able to differentiate Dutch elm disease symptoms from those

of other elm diseases comes with experience. Although the laboratory facilities were used, the cultures were sometimes mixed-up and unnecessary contamination was prevalent. Root grafting was a severe problem this year, but very few barriers were placed. One problem is that the bedrock, common in this area, limits the method of barrier placement to just one, vapam. Even this method is often difficult to apply because of the bedrock being so close to the soil surface. The contractor hired to do the tree removal work was irresponsible, being delinquent in getting much of his work done. The forester was strict with the tree removal firm, however, and made sure that the work was completed according to the terms of the contracts. Making field diagnosis difficult was the discovery of a fungus which showed Dutch elm disease-like symptoms.

Hutchinson - 1979 Program Problems

Woodpile inspection, almost non-existent in 1978, was still not as thorough this year as it should have been. Program personnel found a quantity of non-debarked elm which had gone undetected through the numerous inspection surveys. The tree inspectors were slow and somewhat lacking in confidence as they persisted in sampling trees showing very obvious disease symptoms. The tree removal contractor was a problem and had much to do with the tree inspectors being slow. At the expense of their other responsibilities, the tree inspectors were constantly checking on whether or not the contractor had satisfactorily completed his work assignments. This contractor was delinquent in removing numerous trees, site clean-up was poor, and streets were often blocked unnecessarily during tree removal. When public support of the program was threatened by continual complaints against the contractor, the city, under the terms of the agreement, refused him any more work and, instead, brought in a more reliable

firm to complete tree removal. Root grafting continued to be a serious problem but the placement of barriers was not recommended by the tree inspectors in many areas where it might have been beneficial. Late delivery of equipment delayed tree injection and root graft barrier placement, and also made sampling of diseased trees more difficult. More therapeutic pruning could have been accomplished if better coordination between the city crews (which were to do the work) and the tree inspectors had been established. When preparing laboratory cultures, tree inspectors were not careful enough and contamination resulted.

Litchfield - 1979 Program Problems

Inspection, root graft barrier installation, and systemic fungicide injection were delayed or made difficult by the late delivery of necessary equipment. The full-time tree inspector retired this year so much of the inspecting and marking of diseased trees were done on his own time. With no one working full-time on the Dutch elm disease program, no root graft barriers were placed and little injection and therapeutic pruning were accomplished. Although the city crews removed trees quickly on public property, diseased trees were often left standing up-to-a-month on private property. The tree removal firm responsible for trees on private property was unreliable, being delinquent in removing most of the trees it was assigned and further angering city officials by not showing-up for scheduled meetings during which work orders were to be discussed. In 1978, diseased trees on private as well as public property were removed quickly, often within the same week as their being marked. The delay this year in private tree removal was detrimental to the program as upset homeowners began to complain. Much of the tree inspector's time was used to check-back on the contractor's work, or lack of work as was often the case. Root grafting will be more prevalent next year because of this delay in tree removal. The contractor was also negligent in salvaging any marketable logs.

The Siberian elm population experienced severe dieback thought to be caused by the cold, lenghty winter. This being the first year of the city's doing its own laboratory testing, good culturing techniques were lacking. An unidentified fungus showing Dutch elm disease-like symptoms and early fall coloring made field diagnosis difficult.

Little Falls - 1979 Program Problems

Both the sampling of diseased trees and the placing of root graft barriers were delayed in this city, too, because needed equipment was delivered late in the season. The federal Dutch elm disease program re-defined its control area to include only those residential sections containing a heavy population of elm. Little Falls, however, designated its control zone as anything within the city limits. These separate control areas (although they often overlapped) were hard to differentiate on paper, making record-keeping difficult. Very little effort was made to market saleable logs. No other form of utilization was attempted, so all elm material was burned within the time limit established by the Department of Agriculture's Shade Tree Program. An unidentified fungus was found to be affecting a number of the city's elm trees. It is of importance to program personnel because its Dutch elm disease-like symptoms make field diagnosis difficult if not impossible. Dieback, resulting from the hard winter, was common in the city's Siberian elm population. An attempt to establish a city elm watch group received no response from the public.

Wadena - 1979 Program Problems

Although local mills were interested in available elm logs, there were never enough trees removed at one time to qualify as a full truckload. Since the Department of Agriculture does not allow a city to stockpile non-debarked elm logs for more than five (5) days, this method of utilization was not used. Wadena's Siberian elm population did not do well in the

1978-1979 winter season. Many of these trees did not sufficiently recover from the dieback they experienced as a result of the hard winter. The unidentified fungus which was first discovered in 1978, now appears to be wide-spread throughout Wadena's elm population. Affected trees show symptoms similar to those of Dutch elm disease, thus making field diagnosis difficult. Laboratory culturing of "suspect" trees has become necessary in order to correctly diagnose the disease problem. Inspection, sampling, and root graft barrier installation were made difficult by the delayed shipment of the equipment necessary to complete these disease management practices. Two areas with wild elm, north of the municipal disease control zone, are a steady source of native elm bark beetles. If nothing is done to alleviate this problem, the presence of these wild elms could have a detrimental effect on any disease management effort used in this area for the next several years.

DISEASE STATISTICS - 1979

FERGUS FALLS

.Total number of elm trees--16,500

.Elms lost in 1977--40 trees

.1978 Projected elm loss--initially, 90 trees - revised, 100 trees

.1978 Actual elm loss--117 trees

.1979 Projected elm loss--215 trees

.1979 Actual elm loss--100 trees

Trees removed due to Dutch elm disease--49
public property-28 trees removed; 21 beetle infections, 7 root graft infections
private property-21 trees removed; 8 beetle infections, 13 root graft infections

Weakened/dead elms removed--49 trees
public property-20 trees removed
private property-29 trees removed

Elms removed due to other causes--2 trees (both were on public property)

American elms removed--62 trees
public property--37 trees removed
private property--25 trees removed

Siberian elms removed--37 trees
public property--13 trees removed
private property--24 trees removed

Red elms removed--1 tree (on private property)

Total cost of tree removal work--$10,021.00
Average cost per tree--$100.00

.1980 Projected elm loss--150 trees

.All trees are to be removed within the twenty (20) day time limit required by the Minnesota Department of Agriculture's Shade Tree Program. The remaining stumps must be removed or debarked.

.All trees removed due to Dutch elm disease were laboratory tested. A total of 140 samples were cultured; 49 were positive.

.The native elm bark beetle is the insect vector present in Fergus Falls.

.Other disease management practices implemented--

14 root graft barriers installed (vapam used)
10 trees injected with Arbotect
1,965 elms were trimmed
168 woodpiles were detected (6 containing elm remained in the spring and had to be removed)

Disease Statistics - 1979
Fergus Falls continued

.1978 Federal grant ---------- $18,870.75
Supplemental federal grant --- 8,500.00

$27,370.75 in total

.1978 Municipal budget for Dutch elm disease

City's contribution ---------- $18,340.00
Minnesota Shade Tree Program contribution --- 14,410.00

$32,750.00 in total

.1979 Federal grant -- $55,260.40

1979 Municipal shade tree program budget -- $26,050.00

.1980 Requested federal grant -- $38,657.50

DISEASE STATISTICS - 1979

GRANITE FALLS

.Total number of elm trees--6,920

.Elms lost in 1977--77 trees

.1978 Projected elm loss--initially, 300 trees - revised, 500-600 trees

.1978 Actual elm loss--532 trees

.1979 Projected elm loss--525 trees

.1979 Actual elm loss--408 trees

public property-213 trees removed
private property-195 trees removed

Trees removed due to Dutch elm disease--206

96 beetle infections
110 root graft infections

Weakened/dead elms removed--193 trees
Elms removed due to other causes--9 trees

American elms removed--303 trees
Siberian elms removed--75 trees
Red elms removed--28 trees
Rock elms removed--2 trees

Total cost of tree removal work--$27,909.91
Average cost per tree--$68.41

.1980 Projected elm loss--375 trees

.All trees are to be removed within the twenty (20) day time limit required by the Minnesota Department of Agriculture's Shade Tree Program. Of the remaining stumps, 262 were ground-out and 146 were debarked.

.Questionable trees were laboratory tested for Dutch elm disease. A total of 47 samples were cultured; 14 were positive.

.Both the native elm bark beetle and the smaller European bark beetle are present in Granite Falls.

.Other disease management practices implemented--

2 root graft barriers installed (vapam used)
13 trees injected with Arbotect
4 trees therapeutically pruned
78 woodpiles containing elm were detected-all hazardous wood was eliminated
4,600 trees were sprayed with Dursban

Disease Statistics - 1979
Granite Falls continued

.1978 Federal grant ---------- $30,680.00
Supplemental federal grant --- 12,500.00

$43,180.00 in total

.1978 Municipal budget for Dutch elm disease
City's contribution ---------- $15,573.60
Minnesota Shade Tree Program's contribution --- 12,236.40

$27,810.00 in total

.1979 Federal grant -- $74,747.00

1979 Municipal shade tree program budget -- $30,000.00

.1980 Requested federal grant -- $51,315.00

DISEASE STATISTICS - 1979

HUTCHINSON

.Total number of elm trees--16,000

.Elms lost in 1977--141 trees

.1978 Projected elm loss--initially, 600 trees-revised, 850-900 trees

.1978 Actual elm loss--875 trees

.1979 Projected elm loss--1,750 trees

.1979 Actual elm loss--600 trees

public property-201 trees removed
private property-399 trees removed

Trees removed due to Dutch elm disease--436
219 beetle infections
217 root graft infections

Weakened/dead elms removed--156 trees

Elms removed due to other causes--8 trees

American elms removed--458 trees

Siberian elms removed--117 trees

Red elms removed--25 trees

Tree removal costs have not been totalled. The city had difficulties with its original contractor and had to replace him late in the season. Because of this problem, tree removal work was just completed, so total cost figures are not yet available.

.1980 Projected elm loss--600 trees

.All trees are to be removed within the twenty (20) day time limit required by the Minnesota Department of Agriculture's Shade Tree Program. The remaining stumps must be removed or debarked.

.Questionable trees were laboratory tested for Dutch elm disease. A total of 20 samples were cultured; 9 were positive.

.Both the native elm bark beetle and the smaller European bark beetle are present in Hutchinson.

.Other disease management practices implemented--

9 root graft barriers installed (vibratory plow and mechanical trencher used)
9 trees injected with Arbotect
10 trees therapeutically pruned
43 woodpiles containing elm were detected-all hazardous wood was eliminated

Disease Statistics - 1979
Hutchinson continued

.1978 Federal grant ---------- $11,388.00
Supplemental federal grant --- 10,000.00

$21,388.00 in total

.1978 Municipal budget for Dutch elm disease

City's contribution ---------- $41,126.96
Minnesota Shade Tree Program's contribution --- 32,314.04

$73,441.00 in total

.1979 Federal grant -- $174,159.00

1979 Municipal shade tree program budget -- $98,000.00

.1980 Requested federal grant -- $72,940.00

DISEASE STATISTICS - 1979

LITCHFIELD

.Total number of elm trees--7,798

.Elms lost in 1977--91 trees

.1978 Projected elm loss--250 trees

.1978 Actual elm loss--267 trees

.1979 Projected elm loss--385 trees

.1979 Actual elm loss--232 trees

public property-85 trees removed
private property-147 trees removed

Trees removed due to Dutch elm disease-173
122 beetle infections
51 root graft infections

Weakened/dead elms removed--56 trees

Elms removed due to other causes--3 trees

American elms removed--186 trees

Siberian elms removed--44 trees

Red elms removed--2 trees

Total cost of tree removal work--$20,165.00 (this amount was spent on the removal of 202 trees-the remaining 30 trees were removed by homeowners at their own expense)

Average cost per tree--$99.83

.1980 Projected elm loss--230 trees

.All trees are to be removed within the twenty (20) day time limit required by the Minnesota Department of Agriculture's Shade Tree Program. Of the remaining stumps, 186 were ground-out and 46 were debarked.

.Five questionable trees were laboratory tested for Dutch elm disease; all five were positive.

.Both the native elm bark beetle and the smaller European bark beetle are present in Litchfield.

.Other disease management practices implemented--

4 trees injected with Arbotect
1 tree therapeutically pruned
46 woodpiles containing elm were detected-all hazardous wood was eliminated

Disease Statistics - 1979
Litchfield continued

.1978 Federal grant -- $28,756.60

.1978 Municipal budget for Dutch elm disease

City's contribution ----------	$ 6,944.00
Minnesota Shade Tree Program's contribution ---	5,456.00
	$12,400.00 in total

.1979 Federal grant -- $64,188.00

1979 Municipal shade tree program budget -- $25,500.00

.1980 Requested federal grant -- $51,500.00

DISEASE STATISTICS - 1979

LITTLE FALLS

.Total number of elm trees--7,174

.Elms lost in 1977--350 trees

.1978 Projected elm loss--initially, 500 trees - revised, 640-690 trees

.1978 Actual elm loss--677 trees

.1979 Projected elm loss--715 trees

.1979 Actual elm loss--516 trees

public property-156 trees removed
private property-360 trees removed

Trees removed due to Dutch elm disease--340
Federal control area-194 trees removed; 87 beetle infections, 107 root graft infections

City control area-119 trees removed; 52 beetle infections, 67 root graft infections

Wild areas (trees removed by FFA* group)-27 trees removed; 7 beetle infections, 20 root graft infections

Weakened/dead elms removed--175 trees

Federal control area-102 trees removed
City control area-51 trees removed
Wild areas (trees removed by FFA* group)-22 trees removed

Elms removed due to other causes-1 tree removed (located in the city control area)

American elms removed--399 trees
Federal control area-203 trees removed
City control area-147 trees removed
Wild areas (trees removed by FFA* group)-49 trees removed

Siberian elms removed-112 trees
Federal control area-88 trees removed
City control area-24 trees removed

Red elms removed-5 trees (removed from the federal control area)

Total cost of tree removal work--$19,519.65
Average cost per tree--$37.83

.1980 Projected elm loss--500 trees

.All trees are to be removed within the twenty (20) day time limit required by the Minnesota Department of Agriculture's Shade Tree Program. Of the remaining stumps, 345 were ground-out and 171 were debarked.

*FFA is Future Farmers of America

Disease Statistics - 1979
Little Falls continued

.Only questionable trees were laboratory tested for Dutch elm disease. A total of 50 samples were cultured; 15 were positive.

.The native elm bark beetle is the insect vector most prevalent in Little Falls. The smaller European bark beetle has not been found in significant numbers.

.Other disease management practices implemented--

10 root graft barriers installed (vapam used)
17 trees injected with Arbotect
103 elms were trimmed
76 woodpiles containing elm were detected -all hazardous wood was eliminated

.1978 Federal grant ---------- $60,817.00
Supplemental federal grant --- 2,500.00

$63,317.00 in total

.1978 Municipal budget for Dutch elm disease

City's contribution ---------- $1,176.00
Minnesota Shade Tree Program's contribution --- 924.00

$2,100.00 in total

.1979 Federal grant -- $91,498.85

1979 Municipal shade tree program budget -- $25,000.00

.1980 Requested federal grant -- $61,207.00

DISEASE STATISTICS - 1979

WADENA

.Total number of elm trees--4,800

.Elms lost in 1977--4 trees

.1978 Projected elm loss--100 trees

.1978 Actual elm loss--81 trees

.1979 Projected elm loss--140 trees

.1979 Actual elm loss--64 trees

Trees removed due to Dutch elm disease--38
public property-24 trees removed; 9 beetle infections, 15 root graft infections
private property-14 trees removed; 10 beetle infections, 4 root graft infections

Weakened/dead elms removed--26 trees
public property-19 trees removed
private property-7 trees removed

American elms removed--57 trees
public property-42 trees removed
private property-15 trees removed

Siberian elms removed--7 trees
public property-1 tree removed
private property-6 trees removed

Total cost of city's tree removal work--$7,333.99
Average cost per tree--$114.59 (includes stump removal)

.1980 Projected elm loss--75 trees

.All trees are to be removed within the twenty (20) day time limit required by the Minnesota Department of Agriculture's Shade Tree Program. The remaining stumps of all trees must be removed or debarked.

.Laboratory facilities were used to culture 48 samples; 20 were positive.

.The native elm bark beetle is the insect vector present in Wadena.

.Other disease management practices implemented--

12 root graft barriers installed (6 using a vibratory plow; 6 using vapam)
9 trees injected with Arbotect
2 trees therapeutically pruned
155 elms were trimmed
125 woodpiles were detected (the 28 containing elm were disposed of by April, 1979)

.1978 Federal grant---$11,592.00

.1978 Municipal budget for Dutch elm disease

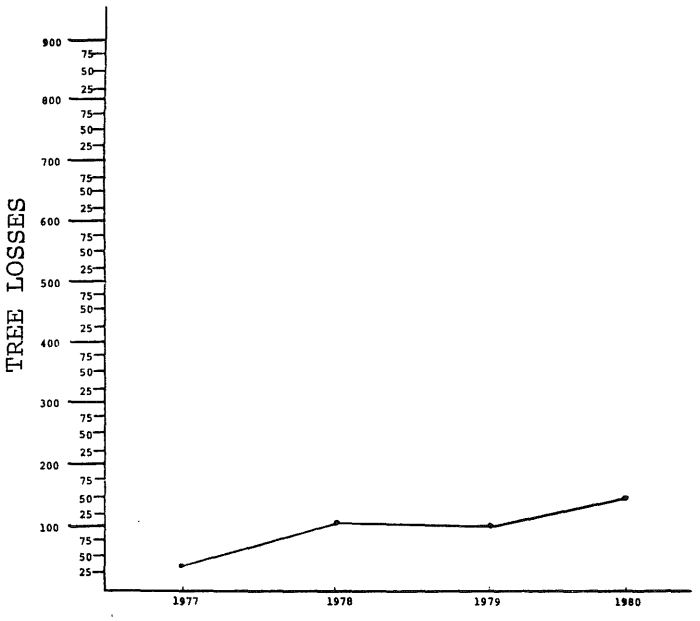
City's contribution ----------	$11,200.00
Minnesota Shade Tree Program's contribution ---	8,800.00
	$20,000.00

Disease Statistics - 1979
Wadena continued

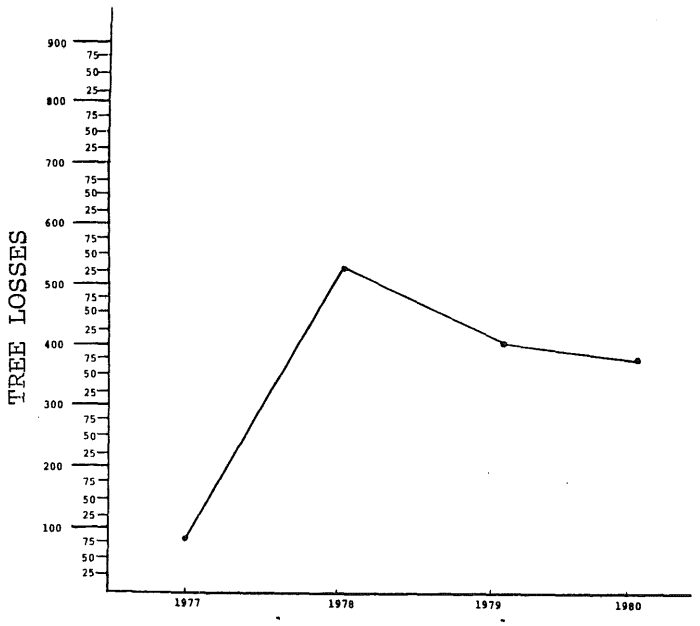
.1979 Federal grant -- $27,466.75

1979 Municipal shade tree program budget -- $21,500.00

.1980 Requested federal grant -- $29,840.00

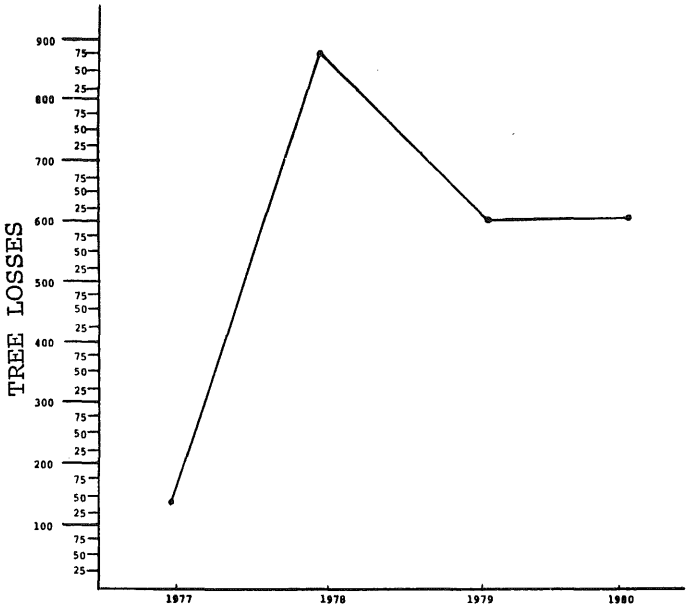


Fergus Falls - Dutch Elm Disease Loss Trend

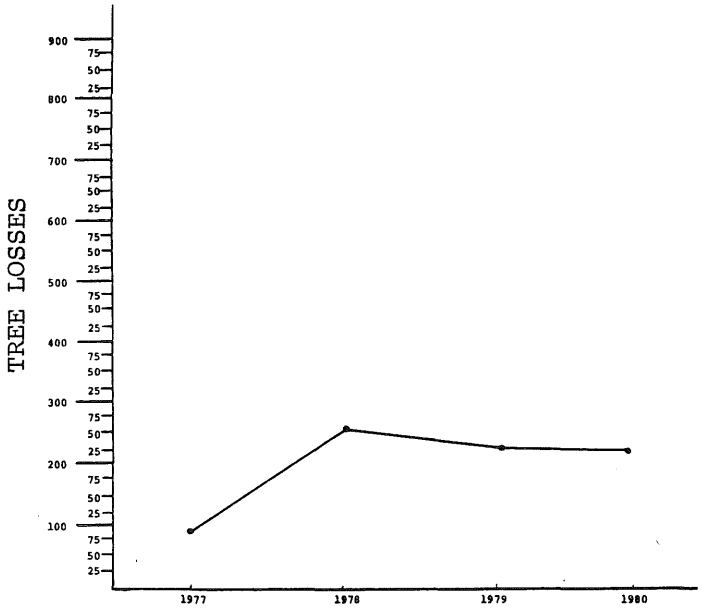


Granite Falls - Dutch Elm Disease Loss Trend

All 1980 figures are projected tree losses

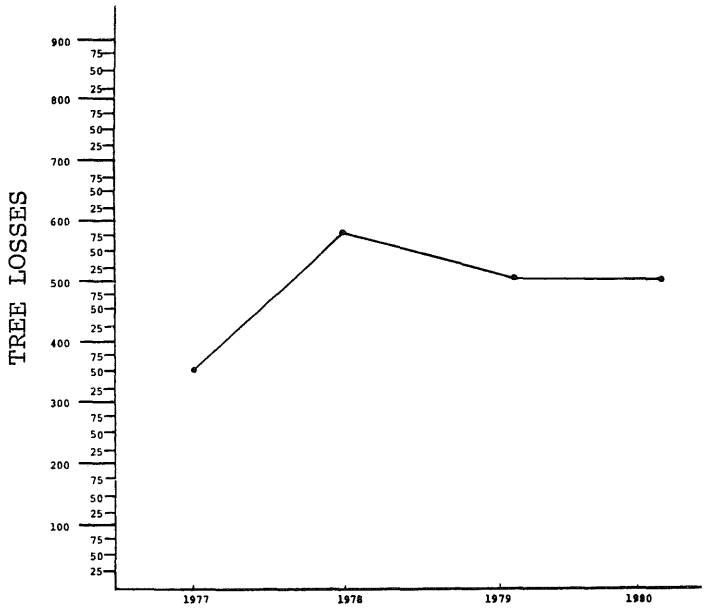


Hutchinson - Dutch Elm Disease Loss Trend

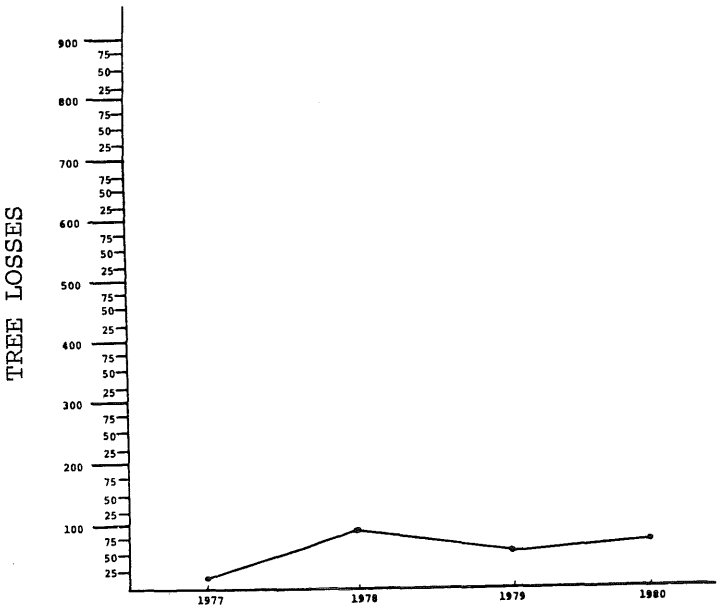


Litchfield - Dutch Elm Disease Loss Trend

All 1980 figures are projected tree losses

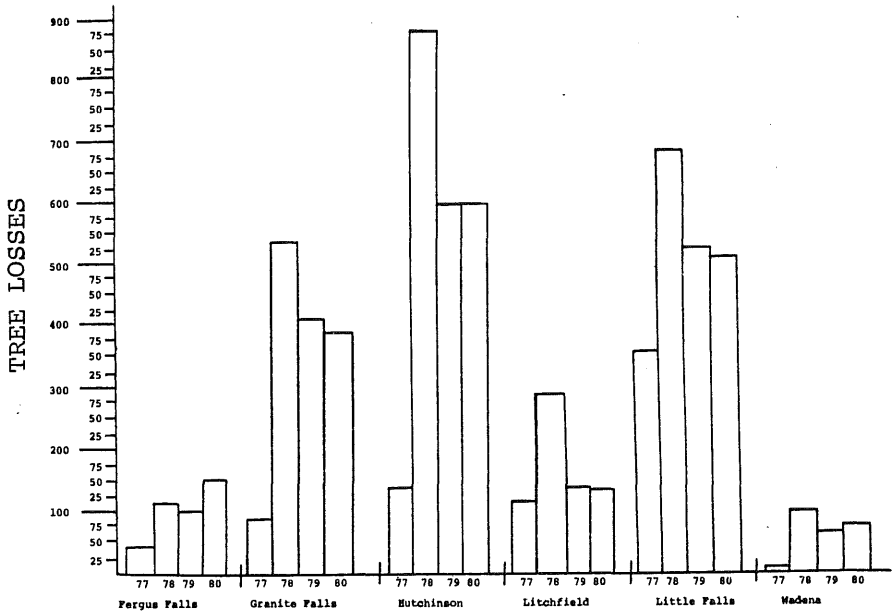


Little Falls - Dutch Elm Disease Loss Trend



Wadena - Dutch Elm Disease Loss Trend

All 1980 figures are projected tree losses



Bar Graph of Tree Losses in the Demonstration Cities

All 1980 figures are projected tree losses

Fergus Falls

Elm population in 1977--16,500

Losses in 1977 - 40
1978 - 117
1979 - 100

257 trees

Elm population in 1979--16,243

There has been a 1.6% tree loss

Granite Falls

Elm population in 1977--6,920

Losses in 1977 - 77
1978 - 532
1979 - 408

1,017 trees

Elm population in 1979--5,903

There has been a 14.7% tree loss

Hutchinson

Elm population in 1977--16,000

Losses in 1977 - 141
1978 - 875
1979 - 600

1,616 trees

Elm population in 1979--14,384

There has been a 10.1% tree loss

Litchfield

Elm population in 1977--7,798

Losses in 1977 - 91
1978 - 267
1979 - 232

590 trees

Elm population in 1979--7,208

There has been a 7.6% tree loss

Little Falls

Elm population in 1977--7,174

Losses in 1977 - 350
1978 - 677
1979 - 516

1,543 trees

Elm population in 1979--5,631

There has been a 21.5% tree loss

Wadena

Elm population in 1977--4,800

Losses in 1977 - 4
1978 - 81
1979 - 64

149 trees

Elm population in 1979--4,651

There has been a 3.1% tree loss

PROPOSED BUDGET - 1980

FERGUS FALLS

Personal Services	$15,970.00
--one full-time forester = $9,300.00 (one-half of requested salary - city must contribute remaining one-half)	
--one seasonal, full-time tree inspector $5.60/hour, 40 hours/week for fourteen weeks = $3,136.00	
--fringe benefits for above positions = $3,534.00	
Equipment Rental	$ 5,037.50
--one, half-ton pick-up for city forester $175/month for six months = $1,050.00 (city is responsible for funding the vehicle for the other six months)	
--one, half-ton pick-up for seasonal tree inspector $175/month for three and one-half months = $612.50	
--one aerial bucket truck for tree sampling 75 hours at $45/hour = $3,375.00	
Disease Management Practices	$17,200.00
--to assist in the removal of trees and stumps, $5,200.00	
--trimming of dead wood from elm trees = $9,000.00	
--installation of root graft barriers 50 barriers at $15.00 each = $750.00	
--use of systemic fungicides 25 trees at $90.00 each = $2,250.00	
Miscellaneous Small Equipment and Supplies	$ 300.00
Office Expenses	$ 150.00
Total Federal Contribution Requested	$38,657.50

PROPOSED BUDGET - 1980

GRANITE FALLS

Personal Services	$ 5,840.00
--one seasonal, full-time tree inspector, assistant $5.00/hour, 40 hours/week for sixteen weeks = $3,200.00	
--fringe benefits for above position = $640.00	
--two seasonal laborers (to assist with root graft barrier placement, tree injection, etc.) $4.00/hour, 250 hours/season x 2 = $2,000.00	
Disease Management Practices	$44,975.00
--to assist in the removal of trees and stumps, $23,125.00	
--trimming of dead wood from elm trees = $10,000.00	
--therapeutic pruning of an estimated 35 trees = $2,500.00	
--installation of root graft barriers = $1,500.00	
--use of systemic fungicides 50 trees at $125.00 each = $6,250.00	
--removal of firewood piles = $600.00	
--use of Dursban to control native elm bark beetle populations = $1,000.00	
Miscellaneous Small Equipment and Supplies	$ 300.00
Office Expenses	$ 200.00
Total Federal Contribution Requested	$51,315.00

PROPOSED BUDGET - 1980

HUTCHINSON

Personal Services	$12,840.00

--one full-time tree inspector, assistant = $7,500.00
includes fringe benefits
(one-half of requested salary - city must contribute remaining one-half)

--one seasonal, full-time tree inspector
$5.00/hour, 40 hours/week for sixteen weeks = $3,200.00

--fringe benefits for above position = $640.00

--one seasonal laborer (to assist with root graft barrier placement, tree injection, etc.)
$6.00/hour, 250 hours/season = $1,500.00

Disease Management Practices	$59,300.00

--to assist in the removal of trees and stumps, $16,000.00

--trimming of dead wood from elm trees = $21,000.00

--therapeutic pruning of an estimated 60 trees = $4,200.00

--installation of root graft barriers = $5,500.00

--use of systemic fungicides
72 trees at $125.00 each = $9,000.00

--removal of firewood piles = $600.00

--use of Dursban to control native elm bark beetle populations = $3,000.00

Miscellaneous Small Equipment and Supplies	$ 400.00
Office Expenses	$ 400.00
Total Federal Contribution Requested	$72,940.00

PROPOSED BUDGET - 1980

LITCHFIELD

Personal Services	$ 5,500.00
--one tree inspector, assistant = $3,500.00 includes fringe benefits	
--two seasonal laborers (to assist with root graft barrier placement, tree injection, etc.) $4.00/hour, 250 hours/season x 2 = $2,000.00	
Disease Management Practices	$45,300.00
--to assist in the removal of trees and stumps, $13,650.00	
--trimming of dead wood from elm trees = $15,750.00	
--therapeutic pruning of an estimated 40 trees = $2,800.00	
--installation of root graft barriers = $2,500.00	
--use of systemic fungicides = $7,500.00	
--removal of firewood piles = $600.00	
--use of Dursban to control native elm bark beetle populations = $2,500.00	
Miscellaneous Small Equipment and Supplies	$ 400.00
Office Expenses	$ 300.00
Total Federal Contribution Requested	$51,500.00

PROPOSED BUDGET - 1980

LITTLE FALLS

Personal Services	$10,095.00
--one full-time tree inspector $5.50/hour, 40 hours/week for seventeen weeks = $3,740.00 (one-half of requested salary - city must contribute remaining one-half)	
--one seasonal, full-time tree inspector $5.00/hour, 40 hours/week for fourteen weeks = $2,800.00	
--fringe benefits for above positions = $1,635.00	
--two seasonal laborers (to assist with root graft barrier placement, tree injection, etc.) $4.00/hour, 240 hours/season x 2 = $1,920.00	
Equipment Rental	$ 1,062.00
--mileage for seasonal tree inspector's vehicle $.25/mile - 75 miles/week for fourteen weeks = $262.50	
--one aerial bucket truck for tree sampling 20 hours at $40/hour = $800.00	
Disease Management Practices	$49,450.00
--to assist in the removal of trees and stumps, $31,500.00	
--trimming of dead wood from elm trees = $9,000.00	
--therapeutic pruning of an estimated 20 trees = $1,000.00	
--installation of root graft barriers 100 barriers at $15.00 each = $1,500.00	
--use of systemic fungicides 25 trees at $90.00 each = $2,250.00	
--use of Dursban to control native elm bark beetle populations = $4,200.00	
Miscellaneous Small Equipment and Supplies	$ 500.00
Office Expenses	$ 100.00
Total Federal Contribution Requested	$61,207.00

PROPOSED BUDGET - 1980

WADENA

Personal Services	$ 6,780.00

--one full-time tree inspector
$5.50/hour, 40 hours/week for twenty weeks = $4,400.00

--one temporary, full-time tree inspector
$6.40/hour, 40 hours/week for four weeks = $1,024.00
(this person will be "borrowed" from Wadena's city parks crew for the month)

--fringe benefits for above positions = $1,356.00

Equipment Rental	$ 3,440.00

--one half-ton pick-up for tree inspector
$60/week for twenty-four weeks = $1,440.00

--one aerial bucket truck for tree sampling
50 hours at $40/hour = $2,000.00

Disease Management Practices	$19,220.00

--to assist in the removal of trees and stumps; to therapeutically prune those elm trees specifically designated by program personnel; $6,250.00
(the city will be responsible for assuming one-half of the total of all tree removal costs incurred with the city's Dutch elm disease management program)

--trimming of dead wood from elm trees = $8,500.00

--installation of root graft barriers
30 barriers at $20.00 each = $600.00

--use of systemic fungicides
15 trees at $90.00 each = $1,350.00

--use of Dursban to control native elm bark beetle populations = $2,520.00

Miscellaneous Small Equipment and Supplies	$ 300.00
Office Expenses	$ 100.00
Total Federal Contribution Requested	$29,840.00

THE PROGRAM - 1980

The year 1978 was one of organization, the demonstration program being structured and its future years being planned. The year 1979 was one of implementation, disease management programs beginning to replace existing tree removal programs. The year 1980 will be one of evaluation and further implementation. If elm losses continue to drop in 1980, it will have to be evaluated as to what degree the disease management practices recommended by the demonstration project are responsible. Also, if elm losses continue to drop, more time and funds will be expended on implementing other disease management practices--for example, root graft barrier installation, systemic fungicide injection, therapeutic pruning--so they become as major a part of the Dutch elm disease program as prompt tree removal. The utilization project to be finally implemented in 1980, will have to be evaluated as to its worth--can the funds expended on this project be justified by the amount of firewood which is processed; will problems that cannot be handled occur while moving the equipment from city to city; and, will public support become stronger through this attempt at utilizing the available wood resource. Finally, the computerization of all tree loss data in 1980 will enable the project to determine or evaluate how far it has come in providing the evidence that the disease management system in each participating demonstration city is workable.

Program Additions and Continuations - 1980

1. The utilization project to process the diseased elm into firewood will be brought from its 1979 planning stage into full operation. Some high value logs may be sold first, however, and not included in the utilization process.
2. Because accurate elm inventories were not available, tree loss data has been difficult to evaluate in the past years. Using program personnel and additional help when necessary, a tree-by-tree inventory of the elm population in each demonstration community will be obtained. When this

inventory is completed, the disease history of each elm treated in some way (tree removed due to Dutch elm disease, tree injected with a systemic fungicide, tree pruned therapeutically, etc.) during the years of the demonstration program will also be computerized. This computerized tree loss data and disease information will be easily retrievable so that corrections and additions can be made as they occur.

3. The installation of root graft barriers will be increased; the use of therapeutic pruning will be increased; and, the use of a systemic fungicide in selected trees will be continued.

4. The spraying of Dursban to help control native elm bark beetle populations will be initiated in some of the demonstration communities. The effectiveness of this management practice on a community-wide basis must be evaluated as well as its usefulness in relation to native elm bark beetle populations in a given control area.

5. An unidentified fungus (suspected to be a species of Dothiorella) which showed Dutch elm disease-like symptoms in the field, made disease diagnosis difficult throughout this past season. Plant pathologists from the University of Minnesota hope to inoculate some elm trees with isolates of this fungus so that its full potential can be established.

6. Monitoring of the control cities will be continued. More time will be spent on comparing the Dutch elm disease programs of the "controls" with those of the demonstration communities. The differences between the program of each control city and its comparable demonstration community will help to evaluate the level of success achieved in disease management in each of the demonstration cities.

7. Hopefully, a training session for the foresters and tree inspectors of the demonstration cities will be held again this year. The training session sponsored by the University of Minnesota last year demonstrated the best method to apply systemic fungicides, how to prune therapeutically, and how to best install root graft barriers. Last year's training session was probably the one individual effort most responsible for convincing city personnel that disease management practices, other than that of prompt tree removal, are necessary and effective. Inspecting procedures and laboratory culturing of Ceratocystis ulmi were also covered at this time.

8. The demonstration cities will be encouraged to apply for TREE CITY, USA recognition. This is an award which is given to those cities that have a legally constituted tree body, a community tree ordinance, an active community forestry program supported by public funds, and an arbor day proclamation and planting. This type of recognition is important because it shows how the demonstration project has helped to encourage the cities to not only establish a Dutch elm disease program, but to work with other aspects of urban forestry as well. Fergus Falls was the one demonstration community that applied for, and received, TREE CITY, USA recognition in 1979.

Fergus Falls - The Program in 1980

Because a large portion of the city was covered last year, only a small amount of trimming (removal of dead wood from the elms) will be done during the winter months. Woodpile inspection will again be of high priority, more and better root graft barriers will be placed, injection of selected trees with Arbotect will continue, and therapeutic pruning will be implemented. If the native elm bark beetle population poses a serious threat, Dursban will be used as a control effort. It will be necessary to closely supervise the way in which this year's records are kept. Fergus Falls may also be included in the program's utilization project.

Granite Falls - The Program in 1980

The hiring of a competent tree removal firm will be of highest priority. Hazardous wood inspections as well as thorough diseased tree detection surveys will again be emphasized. More systemic fungicide injection and therapeutic pruning will be done to selected trees. Since root grafting has been a problem in previous years, city personnel will concentrate on placing more barriers. The wild elm populations in and around the city continue to be a problem. It is hoped that this year an effective method of eradicating these wild elms can be found. Since the laboratory facilities will again be used, culturing techniques will have to be improved. Pruning to remove dead wood

from a portion of the city's elm population will begin during the winter months. If native elm bark beetle populations remain high, a fall application of Dursban will again be applied. Granite Falls is to participate in the demonstration program's utilization project which will process all unmarketable elm logs into non-hazardous firewood.

Hutchinson - The Program in 1980

For the continued reduction of disease losses, inspection surveys must be more thorough. Woodpile inspection will be of primary concern and hopefully, very little non-debarked elm wood will be overlooked. Root grafting will continue to be a problem so the city forester will have to concentrate on placing barriers at all locations where the spread of this type of disease infection can be slowed down. Injection of selected trees with Arbotect will continue and therapeutic pruning will be used wherever possible. A more reliable contractor will be hired so that diseased trees will be removed promptly. Trimming to remove dead wood from a portion of the city's elm trees will begin during the winter months. Dursban will be used if the number of native elm bark beetles is large enough to warrant this control effort. Besides selling marketable logs, the city will also participate in the program's utilization project.

Litchfield - The Program in 1980

The city has included in its budget the position of city forester. Having someone work full-time on the Dutch elm disease program will encourage the use of other management practices besides that of prompt tree removal. Woodpile and diseased tree inspections will remain high in priority. Placement of root graft barriers will begin and injection of selected trees with Arbotect will be continued. With the city getting a new bucket truck this year, diseased tree sampling and therapeutic pruning will be done faster and more easily. The city crews will probably continue tree removal on public property. All

marketable logs will again be salvaged for possible sale and Litchfield will participate in the demonstration program's utilization project which will process much of the unmarketable elm material into non-hazardous firewood. Dursban, to control the native elm bark beetle population, will be applied in the spring and/or fall. Trimming of dead wood from a portion of the city's elm trees will be done during the winter months.

Little Falls - The Program in 1980

Since the city will be required to assume more of the financial burden incurred with diseased tree removal, separating the federal and municipal control zones will no longer be necessary. As part of the federal program's utilization project, elm logs will be rendered "pest-risk free" and split for firewood. Root graft barriers will continue to be utilized in as many situations as possible. During the summer, additional laborers will be hired to install root graft barriers. This will enable the tree inspectors to devote most of their time to completing diseased tree surveys and supervising the work of the tree removal contractor. Woodpile inspection will again be given top priority and another portion of the elm population will be trimmed in the winter. Therapeutic pruning of selected trees will be new to 1980's program as will be the spraying of Dursban to control the native elm bark beetle population.

Wadena - The Program in 1980

During the winter months, another section of Wadena's elm population will be trimmed (all dead wood removed). In the spring, woodpile inspection will again be given first priority. Root graft barrier installation will be stressed, injection of selected trees with Arbotect will continue, and therapeutic pruning will be initiated in more situations. Spring and/or fall spraying of Dursban to control the native elm bark beetle population may also

be used. It is anticipated that the city will assume more of the financial responsibilities incurred with its Dutch elm disease management program. Limited utilization, primarily that of producing non-hazardous firewood, is also planned for the upcoming year.

UTILIZATION PROJECT
WORK GUIDELINE

Purpose of project. The one aspect of Dutch elm disease management that the federal project has not extensively dealt with to date, is wood utilization. Diseased trees are now being burned or buried. Granite Falls, Hutchinson, Litchfield, and Little Falls have experienced tree losses high enough to justify the implementation of utilization methods. Most of the removed elm could be used as firewood but for the fact that when not debarked, it becomes a serious hazard to stopping the spread of Dutch elm disease. Therefore, it has been proposed that in the aforementioned demonstration communities (although Fergus Falls and Wadena may yet be included) a portable debarker and log splitter will be put to use rendering elm "safe" for distribution. It is hoped that this project will not only promote the use of non-hazardous elm wood but will also provide an example to other small cities of how they can join together in purchasing or renting equipment to be used in utilizing diseased elm trees.

Project plan. Since each demonstration community is participating in the Department of Agriculture's ShadeTree Program, this project is working against a regulation imposed by this agency which states that non-debarked elm wood, stockpiled for utilization purposes, must be processed within five (5) days. Debarking in each city, therefore will be completed before the log splitting operation is even begun. This means that two project employees will first move from city to city (the travel route having been previously planned) debarking the wood. This part of the operation will start at the beginning of June and will probably be terminated at the end of September (if tree removal work has not been completed, debarking will be continued until all elm has been processed). When debarking in each city is completed, the remaining employee--one position is terminated at the end of September--will begin travelling from one community

to another, splitting the previously debarked wood. During this part of the operation, the help of city workers will definitely be needed. The project will continue until all the wood is processed and ready for sale. The end of December should mark the termination of this project until the following May, if and when funding again becomes available. Some high value logs may be sold first, however, and not included in the utilization process. Any elm material too small to utilize will be disposed of by burning.

Calendar of events.

October 1979 - April 1980

.complete equipment purchases
.complete equipment leasing agreements
.hire personnel
.get each involved city to pass a resolution stating that

1. help will be supplied when needed
2. wood will be sold at a fair marketable price, and
3. all money raised through the sale of the firewood will be put back into the shade tree program

May 1980

.start first employee
.begin to assemble equipment
.finalize the project's travel agenda
.inform city officials as to when the equipment will be in their communities and what help will be needed

June 1980

.start second employee
.begin the debarking operation in the city first on the travel agenda

July-September 1980

.continue the debarking operation according to the travel agenda
.terminate, at the end of September, the employee started in June

October-December 1980

.terminate debarking operation if all wood has been processed (if elms are clear-cut from wild areas during the winter months, however, the debarker will again be used)
.begin splitting the previously debarked wood
.begin to sell firewood (each city's responsibility)
.terminate, at the end of December, the employee started in May
.close-down the project until the following May if all debarking and splitting has been completed

Equipment to be purchased

.Model 636 Morbark portable debarker-rebuilt
purchase price - $49,500 + 15% inflationary price increase = $56,925
contact person/company - Jay Benson
Road Machinery and Supplies

.SS500 LaFont log splitter
purchase price - $3,996 + 15% inflationary price increase = $4,596

accessories--single wedge - $195 + 15% inflationary price increase = $225
4-way wedge - $325 + 15% inflationary price increase = $375

contact person/company - Paul Stegmeir
The Energy Shed, Inc.

.Chain Saws
one-111S purchase price - $475 + 15% inflationary price increase = $548
two-910E purchase price - $870 ($435 each) + 15% inflationary price increase = $1,000

contact company - Chanhassen Lawn and Sports

Equipment to be leased

.Bobcat-900 Series, front-end loader
rental price - $2,200/month + 15% inflationary price increase = $2,530/month
(this includes bucket, grapple, and coupler)

contact person/company - Terry Rice
Tri State Machinery

.Miller RC 530 trailer
rental price - $360/month + 15% inflationary price increase = $414/month

contact person/company - Bob Freeberg
Road Machinery and Supplies

.Stake-bed truck--the bed being twelve or more feet in length
-must be able to pull a trailer and its load (the bobcat) weighing a total of approximately 20,000 lbs
-must be fitted with a storage box in the bed of the truck for small equipment such as chain saws
-must have room for at least three fuel tanks

one-250 gallon tank (to carry diesel fuel for the debarker)
one-50 gallon tank (to carry gasoline for the log splitter)
one-30 gallon tank (to carry gasoline for the chain saws)

∴ the log splitter will be carried in the bed of the truck-the bobcat will be able to load and unload the log splitter

contact person/company - Ike Holden at the Department of Natural Resources' Northern Service Center has been contacted and will probably be able to get a truck "outfitted" for the project

.Truck to haul the portable debarker
-the project intends to contract (short-term) with an independent trucking firm which will be responsible for transporting the debarker from one location to another

contact company - Anderson Trucking
St. Cloud, Minnesota

Personnel. Two heavy equipment operators will be needed to oversee this utilization project. Each demonstration city will have the responsibility of supplying additional manpower whenever it is needed (each city will be asked to pass a resolution which confirms this). These new positions will be regarded as intermittent, seasonal employment. One position will be filled at the beginning of May and continued through December. The remaining position will be filled at the beginning of June and continued through September. The procedure for filling these positions is as follows--

1. as part of a federal program, the positions must be cleared by the LAC (Legislative Advisory Committee)
2. position descriptions must be written and then approved by the State Department of Personnel, and,
3. applicants must be interviewed.

All companies selling (or leasing) machinery to the project will provide training in the operation of that equipment. One of the demonstration communities will be assigned as the home station for these employees.

BUDGET

Personal Services	$ 22,000.00
--two heavy equipment operators (one eight month appointment, one four month appointment) salaries, fringe benefits, and travel expenses	
Equipment Purchases	$ 68,669.00
--portable debarker, rebuilt Morbark Model 636 - $56,925.00	

--log splitter, SS500 LaFont - $4,596.00
accessories - single wedge - $225.00
4-way wedge - $375.00

--chain saws - one 111S - $548.00
two 910E - $1,000.00

--miscellaneous equipment - to include shovels, extra chains, oil, grease, fuel tanks - $5,000.00

Equipment Rental $ 31,052.00

--front-end loader, Bobcat 900 series
includes bucket, grapple, and coupler
$2,530.00/month x 8 months = $20,240.00

--trailer, Miller RC 530
$414.00/month x 8 months = $3,312.00

--stake-bed truck fitted with a storage box and able to pull a trailer that when loaded weighs approximately 20,000 lbs
750 miles/month x 75¢/mile = $562.50/month x 8 months = $4,500.00

--truck to haul debarker from one site to another, short term contracts with an independent trucking firm = $3,000.00

Miscellaneous Expenditures $ 10,000.00

--to include fuel and machinery repair costs

Emergency Contingency Fund $ 13,500.00

Total Budget $145,221.00

Total Anticipated Budget	$145,221.00
Total Federal Contribution from 1979	126,837.00
Funds Requested for the Utilization Project in 1980	$ 18,384.00

Items left to complete

1. Organize a travelling agenda for the project-determine how long the equipment will be in each location before it moves on to another.

2. Determine whether or not the DNR (Northern Service Center) will be able to supply the project with a stake-bed truck capable of pulling a loaded trailer.

3. Line-up short-term contracts with an independent trucking firm that will move the debarker from place to place. Anderson Trucking of St. Cloud hauls "by the job".

4. Get demonstration cities to pass a resolution which states that
   --when necessary, city help will be supplied so that debarking and splitting will not be held-up due to a lack of manpower
   --the city will sell the processed firewood at fair market value, and
   --all money raised through the sale of the firewood will be put back into the city's shade tree program.

5. Determine how much of a fuel supply can be carried to each site.

6. Secure a variance from the Department of Agriculture-Shade Tree Program if and/or when the wood stockpiled at an utilization site cannot be processed within five (5) days as specified by the rules and regulations.

7. Determine if the equipment will be stored or rented-out during the period between the termination of the project in the winter and its start-up in the spring.

8. Determine how and when the debarker is to be transported if it is wider than the legal limit permits for unrestricted movement on the roadways (legal limit-eight feet wide; debarker is nine feet wide).

9. Get the positions approved for the heavy equipment operators by the LAC (Legislative Advisory Committee) and the State Department of Personnel.

UTILIZATION EQUIPMENT DEPRECIATION SCHEDULE

Description of Equipment	Time When Purchase of Equipment will be completed	Purchase Cost	Estimated Trade-In Value	Balance for Depreciation	Estimated Years of Service	Depreciation for Each Year
Debarker rebuilt Morbark Model 636 Portable	Winter 1979-1980	$57,000	$33,000	$24,000	3	$8,000
Log Splitter SS50C LaFont Portable	Winter 1979-1980	$5,000	$2,750 (if well maintained)	$2,250	3	$750

— SAMPLE —

RESOLUTION NO. _____

UTILIZATION PROJECT PARTICIPATION

WHEREAS, the City of _____, Minnesota, has been selected by the Department of Natural Resources to participate in the Dutch elm disease demonstration project to be funded by the United States Forest Service; and

WHEREAS, The City of _____ previously resolved to contract with the Department of Natural Resources for said funds on five-year basis; and

WHEREAS, the City of _____ has now been asked to participate in the Dutch elm disease demonstration program's utilization project of processing all unmarketable elm into non-hazardous firewood,

NOW THEREFORE, BE IT RESOLVED by the City Council of the City of _____, Minnesota, that the City of _____ desires to participate in the aforementioned utilization project and agrees to

1. supply city help whenever the utilization equipment is in the community
2. sell all processed firewood at a fair marketable price (as determined by the Division of Forestry, Department of Natural Resources), and
3. put all money raised through the sale of the firewood into the municipal shade tree program.

Adopted by the City Council of _____ this _____ day of _____ (month), 19____.

ATTEST: APPROVE:

_____ _____

signature/title signature/title

INVENTORY AND TREE LOSS DATA SYSTEM

PROPOSED BUDGET

Data Collection	$15,154.96
--consultant services $150/day x 5 days plus expenses = $1,100.00	
--program personnel - living expenses, only $2.07/hour x 1,164 hours = $2,409.48	
--three temporary employees wages - $5.00/hour x 1,164 hours = $5,820.00 living expenses - $2.07/hour x 1,164 hours = $2,409.48	
--allowance for delays caused by bad weather = $1,596.00	
--survey forms (printing) = $1,020.00	
--miscellaneous equipment and supplies = $800.00	
Data Processing	$16,505.00
--softwear development = $5,000.00	
--keypunch services $5.50/hour x 1,120 hours = $6,160.00	
--computer operator $80/day x 5 days = $400.00	
--computer time $150/hour x 10 hours = $1,500.00	
--computer tapes 15 tapes at $15.00 each = $225.00	
--computer output (lists, graphs, etc.) = $3,220.00	
Contingency Fund	$ 3,166.00
Total Budget Requested	$34,825.96

-This budget is based on compiling disease information on approximately 51,000 elm trees-

FEDERAL DUTCH ELM DISEASE DEMONSTRATION PROJECT

TOTAL PROPOSED BUDGET - 1980

Department of Natural Resources	$ 95,500.00
--Communications = $12,000.00	
--Travel expenses = $7,000.00	
--Local purchases = $2,000.00	
--Salaries (including fringe benefits) = $65,000.00	
--Contingency fund = $9,500.00	
Department of Agriculture	$ 19,500.00
--Salary (including fringe benefits) = $17,000.00	
--Travel expenses = $2,500.00	
Community Demonstration Program	$305,459.50
see itemized budgets on pages 39-44	
Utilization Program	$ 18,384.00
see itemized budget on pages 54-55	
Inventory and Tree Loss Data System	$ 34,825.00
see itemized budget on page 58	
Total 1980 Federal Contribution Requested	$473,668.50

CONCLUSION

The intent of Minnesota's federally funded Dutch elm disease project is to demonstrate the effectiveness of known disease management practices. It is hoped that with additional federal assistance--both financial and technical--the increase in elm losses due to Dutch elm disease can be stopped and eventually reduced to a level which can be handled economically by each city with its own finances.

The following are the disease management practices whose effectiveness will be demonstrated by the federal Dutch elm disease project. Each one is discussed as to what it involves and to how important it is to the overall program.

1. WOODPILE AND DISEASED TREE INSPECTION

   What it involves. The surveying of each demonstration city to find and mark for removal all hazardous elm wood and all trees with Dutch elm disease. When one survey of each city is completed, another will follow so that inspections are continuous.

   Its importance to the program. Since bark beetles breed in non-debarked elm wood, the removal and subsequent destruction of this "brood" material can help to reduce beetle populations. The beginning of any good Dutch elm disease program is the inspecting for, and the marking of, all diseased elm trees.

2. THERAPEUTIC PRUNING

   What it involves. Pruning the diseased branches from those trees showing early Dutch elm disease symptoms. For most effective results, no more than 5% of the tree's crown should show early disease symptoms, and pruning must be completed immediately after detection. Infected branches should be pruned back to the main trunk.

   Its importance to the program. Therapeutic pruning is a management practice that is often ignored and discredited. It can become an important approach to managing Dutch elm disease, however, if removing infected branches can prevent the sacrifice of the entire tree.

3. DISEASED TREE REMOVAL

What it involves. The removing and disposing of those trees infected with Dutch elm disease. In conjunction with this, the removing or debarking of the remaining tree stumps.

Its importance to the program. Prompt tree removal is the basis of any good Dutch elm disease management program. Removing diseased trees quickly prevents other healthy elms from getting infections through root grafting. Since bark beetles tend to breed in dead and dying elms, prompt removal also eliminates possible beetle "brood" material. Debarking or removing tree stumps will eliminate, too, this additional source of "brood" material.

4. ROOT GRAFT BARRIER PLACEMENT

What it involves. The severing of roots which are shared between two or more elm trees. Root graft barriers should be placed in those areas where an elm tree with a greater than 5% disease infection is within forty (40) feet of other healthy elm trees. Mechanical methods (vibratory plow, trencher) and chemical methods (vapam) are available for disrupting these common root grafts.

Its importance to the program. Until this management practice is extensively used, the disease fungus is simply going to walk up and down the streets of each demonstration city, reducing the effectiveness of all other control efforts.

5. RE-DEFINING CONTROL AREAS

What it involves. Reducing the boundaries of a city's disease control area to include only those residential sections containing a heavy population of elm.

Its importance to the program. Since managing a disease program is costly in both time and dollars, it is necessary to apply control practices only in those areas where they will be most effective. Places where management of the disease will be, at best, minimal, should be designated as a lower priority or excluded entirely from the municipal control area.

6. INJECTION

What it involves. The injecting of high value elm trees with a systemic fungicide (Arbotect), protectively or therapeutically. Therapeutic

injections should not be applied on any elm tree if more than 5% of the upper crown is wilting. Since injection does not fully guarantee that elm trees will be immune to, or cured of, Dutch elm disease, it is not to be used in place of other disease management practices (tree removal, for instance) but rather, is to be used as an additional management effort (for instance, injection combined with therapeutic pruning).

Its importance to the program. It is hoped that injecting high value elm trees with a systemic fungicide will provide them with some protection against the disease fungus. This method of treatment could also have some beneficial effect as far as preventing the movement of the fungus into adjacent healthy elm trees.

7. TRIMMING/REMOVAL OF WEAKENED OR DEAD ELMS

What it involves. The removing of dead wood from healthy elm trees. Also, the taking down of those elms which are dead or in a weakened condition.

Its importance to the program. Any dead branch in an otherwise healthy elm tree is a potential breeding site for bark beetles. Trees can still be sending nutrients and water (at a reduced rate, however) to nearly dead branches. Removing these dead or dying branches, therefore, enables the nutrients and water to be redirected to healthy parts of the tree. Weakened elms are more susceptible to disease infections, the primary one being, of course, Dutch elm disease. Dead elms which remain standing are yet another source of beetle "brood" material.

8. ELIMINATION OF WILD ELMS

What it involves. Removing or in some way killing those elms which are growing wild. Often these wild areas are not easily accessible to men and equipment, so tree removal is not practical. Killing the trees quickly, perhaps by using chemicals, may be the only possible way in which to eliminate these trees.

Its importance to the program. Wild areas containing a good number of elms border some of the demonstration cities. Disease management is impractical in these areas due to poor cost effectiveness and men and equipment not being able to find easy access to the trees. Dutch elm disease is usually running rampant in these areas and has threatened to spread to the urban elm populations. These trees must be removed or in some way rendered harmless in order that the urban elms are protected.

9. ESTABLISHMENT OF CONTROL CITIES

What it involves. The selection and monitoring of cities whose disease management programs can be compared to those of the demonstration cities.

Its importance to the program. Two control cities were selected for each demonstration community. Through monitoring the disease programs of these control cities, the success of those management practices implemented by the federal demonstration program in each of its participating cities can be effectively evaluated.

10. COMPUTERIZATION OF TREE LOSS DATA

What it involves. Getting an inventory of the elm population in each demonstration city, cataloging each elm tree as to its disease history, and finally, computerizing the aforementioned information.

Its importance to the program. The two years of each demonstration city's disease history is contained in hand-written records. There is always the possibility of these records being lost or damaged in some way as well as the information recorded in this manner being very difficult and time-consuming to retrieve. New elm inventories are necessary since the existing ones were quickly done and not as thorough as they should have been. Computerizing the tree inventories as well as the disease history of each tree will enable program personnel to locate any elm and know instantly what has been done to it in the way of disease treatment (has the tree been removed, has it been injected, has a root graft barrier been placed, etc.). Also, corrections and additions to the tree loss data can be made quickly and easily.

11. IMPLEMENTATION OF UTILIZATION PROJECT

What it involves. The processing of unmarketable elm material into non-hazardous firewood.

Its importance to the program. The majority of diseased trees removed in the demonstration cities are disposed of by burning. Everyone concedes that it is a great waste not to utilize this resource in some way, especially now with firewood in demand because of the energy "crunch". Each city's disease management program will be made complete if the unmarketable elm material can be processed into non-hazardous firewood.

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MASTER LOG - DUTCH ELM DISEASE

Date _____

Tree Number	Address	Owner	Area	H R	dbh	Sp	Scp	Date Rem Comp.	Rem. By	Logs	Del.	Date Marked	Rep. By	Date of Notif.	Type	% Inf	Cause Rem.	Det. Fact.	Past Tr.	Cost of Removal	Remarks

— Actual size of field sheet is 8½ by 14" —

Tree No. -
one number per tree (and letter)

Address -
Street address or description using known reference points

Owner -
City property - C
Private property - P
(owner's name if required)

Area -
appropriate number

High Risk -
high risk tree - X
not high risk - 0

Dib -
diameter at 4½ feet
(measure in inches and tenths of inches)

Species -
American elm - A
Red elm - R
Rock elm - RK
Siberian elm - S
Chinese elm - C
Red Oak - RO
Pin Oak - PO
White Oak - WO
Bur Oak - BO

Stump -
grind out - G
debark - D

Logs -
Estimated number of feet of merchantable logs that can be cut from the tree 8, 12, 16, etc.

Date marked -
month/day

Reported by -
private individual - P
city tree inspector - C

% Infection -
up to 10% - 1
10 to 20% - 2
20 to 30% - 3
30 to 40% - 4
40 to 50% - 5
50 to 60% - 6
60 to 70% - 7
70 to 80% - 8
80 to 90% - 9
90 to 100% - 0

Cause for Removal -
beetle infection - B
root graft infection - R
die back - D
dead tree - M
storm damage - S
insect damage - I
other (specify in remarks) - 0
(note in remarks if this is only a guess)

Determining factors -
lab isolation - L
stain - S
wilt - W
discoloration - D
dead branches - B

Past treatment -
-injected (date, chemical and dosage in remarks) - I
-root graft barrier (date and type in remarks) - R
-Therapeutic pruning (date in remarks) - T
-other pruning (year performed in remarks) - P
-other treatments (specify type and date) - O
-None - N

RGB Recommended -
X - yes
0 - no

Date of Notification -
(or date work order is issued)
month/day

Type of Notice -
(private property only)
personal - P
mailed - M

Date "Turned Over" -
month/day tree turned over to contractor

Amount -
amount turned over, (whole tree, just stump, etc.)

Delinquent -
X - yes
0 - no

Check back dates -
month/day

Results -
described work completed

Date removal completed
(tree and stump)
month/day

Removed by -
City crews - C
City tree contractor - T
Private individual or contractor - P

Remarks -
include additional details and any non-coded observations.

Cost of Removal -
$ Amount spent

Subsidy Amount -
Subsidy due $

Symbols and Abbreviations

- healthy elm
- suspect elm/sample taken
- DED/marked tree
- dead-standing elm
- elm stump/non-debarked
- elm stump/debarked
- old stump location/ground out
- tree/non elm
- elm to be therapeutically pruned
- elm therapeutically pruned
- injected, diseased
- injected, healthy
- woodpile, logs/and/or branches
- SW sidewalk
- fence
- house w/street#
- alley
- D driveway
- SE street w/name
- G garage
- U utility bldg/other structure
- property lines
- utility lines
- yard veg
- N,S,E,W directions

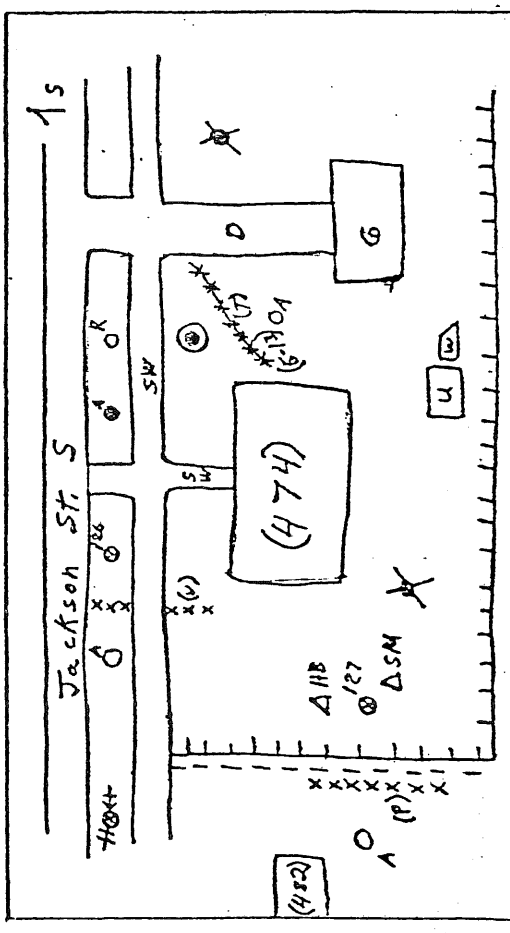
TR	tree removed
NR	tree of HW not removed
WR	HW removed
SG	stump ground
SD	stump debarked
SNG	stump not ground or debarked
ST	Standing tree
S	Stump
HW	Hazardous Wood
FT	Fallen Tree

P - plow
T - trencher
V - vapam
} RGB types

xxxxxxx recommend RGB
~~xxxxxxx~~ installed RGB
(10-11) date completed RGB

HB	hackberry
GA	green ash
BA	black ash
W	willow
BX	boxelder
RM	red maple
SM	sugar maple
SL	silver maple
B	basswood
RP	red pine
WP	white pine
SP	spruce
P	popple
I	ironwood
CW	cottonwood
Br	birch

Map



5-USE LOG

☐ HAZARDOUS WOOD ☐ RGB ☐ THERAPEUTIC TRIM ☐ INJECTION ☐ SAMPLE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
- 99 -														

Hazardous Wood Log

1. Hazardous wood number
2. Address (include area number in upper right hand corner)
3. Owner
4. Date of notice
5. Date hazard eliminated
6.
7.
8. Type of notice
   P-Personal
   M-Mail
9. Species
10. Form of wood
    F-Firewood
    L-Logs
    S-Stumps
11. Evidence of bark beetles
    N-Native
    E-European
    B-Both
    A-Absent
12. Solution
    D-debarked by property owner
    R-disposed of by property owner
    C-disposed of by city
    U-unknown
13.
14.
15. Remarks

Root Graft Barrier Log

1. Barrier number
2. Address (include area number in upper right hand corner)
3.
4. Date recommended
5. Date installed
6. Date infected tree(s) removed
7. Field sheet number for map
8. Type of barrier
   P-Plow
   T-Trencher
   V-Vapam
9. Feet of barrier
10. Man hours used (nearest ¼ hour)
11. Number of personnel
12. Barrier failed
13.
14.
15. Remarks

Therapeutic Pruning Log

1. Treated tree number
2. Address (include area number in upper right hand corner)
3. Location on property
4. Date recommended
5. Date performed
6. DBH
7. Species
8. % infection
9. Confirmed DED
10. Wound dressing applied (N-None, Code for type)
11. Man hours used
12. Number of personnel
13. Pruning failed - tree condemned
14. Additional Treatment
    I-Injection
    R-Root Graft Barrier
    N-None
15. Remarks (include other treatments, tree #, etc.)

Injection Log

1. Treated tree number
2. Address (include area number in upper right hand corner)
3. Location on property
4. Date of injection
5. DBH
6. Species
7. Type of barrier
   P-Preventative
   T-Therapeutic
8. Number of injection sites
9. Injection sites per inch
10. Gallons of solution
11. Fluid ounces of Arbotect 20-S
12. Man hours used
13. Number of personnel
14. Failure - tree infected
15. Remarks (include tree & weather conditions and other practices)

Sample Log

1. Address (include area number in upper right hand corner)
2. Location on property
3. Date sampled
4. Date of results
5.
6. DBH
7. Species
8. Results
9.
10.
11.
12.
13.
14.
15. Remarks

SECTION 1020 - DUTCH ELM DISEASE

Section 1020:00. Declaration of Policy. The Council of Hutchinson has determined that the health of the elm trees within the municipal limits is threatened by a fatal disease known as Dutch elm disease. It has further determined that the loss of elm trees growing upon public and private property would substantially depreciate the value of property within the City and impair the safety, good order, general welfare and convenience of the public. It is declared to be the intention of the Council to control and prevent the spread of this disease and this ordinance is enacted for that purpose.

Section 1020:05. Forester.

Subd. 1. Position Created. The powers and duties of the Forester as set forth herein are conferred upon the City Forester.

Subd. 2. Duties of Forester. It is the duty of the Forester to coordinate, under the direction and control of the Council, all activities of the municipality relating to the control and prevention of Dutch elm disease. He shall recommend to the Council the details of a program for the control of Dutch elm disease, and perform the duties incident to such a program adopted by the Council.

Section 1020:10. Dutch Elm Disease Program.

Subd. 1. It is the intention of the Council of Hutchinson to conduct a program of plant pest control pursuant to the authority granted by Minnesota Statutes 1961, Section 18.022 and Minnesota Statutes 1974, Section 18.023. This program is directed specifically at the control and elimination of Dutch elm disease fungus and elm bark beetles and is undertaken at the recommendation of the Commissioner of Agriculture. The Forester shall act as coordinator between the Commissioner of Agriculture and the Council in the conduct of this program.

The Council hereby adopts, by reference, Minnesota Statutes 1961, Section 18.022 and 1974, Section 18.023 and all their amendments.

Section 1020:15. Nuisances Declared.

Subd. 1. The following things as set forth in the subdivisions which follow are public nuisances whenever they may be found within this municipality.

Subd. 2. Any living or standing elm tree, or part thereof, infected to any degree with the Dutch elm disease fungus Ceratocystis Ulmi (Buisman) Moreau.

Subd. 3. Any elm tree or part thereof, suffering from dieback, or any other disease or harmful condition, which, in the operation of the City Forester, or his agents renders that tree or any parts thereof possible breeding or harboring sites of the elm bark beetles Scolytus Multistriatus (Eichh.) or Hylurgopinus Rufipes (Marsh).

Subd. 4. Elm trees or parts thereof as described in Subd. 2 and 3 hereby shall be termed Hazardous Trees and Portions.

Subd. 5. Any dead elm tree or part thereof, including logs, branches, stumps, firewood or other elm material from which the bark has not been removed. Termed Hazardous Wood. See Section 1020:00.

Section 1020:20. Abatement. It is unlawful for any person to cause or permit any public nuisance as defined in Section 1020:15 to remain on any premises owned or controlled by him within the corporate limits of this municipality. Such nuisances may be abated in the matter herein set forth.

Section 1020:25. Inspection and Investigation.

Subd. 1. Annual Inspection. The Forester shall inspect all premises and places within the corporate limits of this municipality as often as practicable to determine whether any condition described in Section 1020:15 of this ordinance exist thereon. He shall investigate all reported incidents of infestation of Dutch elm fungus or elm bark beetles.

Subd. 2. Entry on Private Premises. The Forester or duly authorized agents may enter upon private premises at any reasonable time for the purpose of carrying out any of the duties assigned under this ordinance.

Subd. 3. Diagnosis. The Forester shall, upon finding conditions indicating Dutch elm infestation, immediately send appropriate specimens or samples to the Commissioner of Agriculture for analysis, or take such other steps for diagnosis as may be recommended by the Commissioner.

Section 1020:30. Abatement of Dutch Elm Disease Nuisances.

Subd. 1. The abatement of the public nuisance of Hazardous Wood (as described in Sections 1020:15, Subd. 5 and Section 1021:00) is described in Section 1021:05, Subd. 1.

Subd. 2. In abating Dutch elm disease nuisances, the Forester shall cause the infected tree or wood to be sprayed, removed, burned, or otherwise effectively treated so as to destroy and prevent as fully as possible the spread of Dutch elm disease fungus and elm bark beetles. Such abatement procedures shall be carried out in accordance with current technical and expert opinions and plans as may be designated by the Commission of Agriculture.

Whenever the Forester finds with reasonable certainty that the Dutch elm disease infestation exists in any tree or wood in any public or private place in this municipality, the procedure shall be as set forth in the subdivisions which follow.

Subd. 3. If any elm tree, or any parts thereof, determined to be a nuisance (as described in Section 1020:15, Subd. 2 and 3) is discovered on public or private property within the municipal limits of the City, the Hazardous Trees and Portions shall be condemned, removed and disposed of or rendered incapable of breeding or harboring elm bark beetles in accordance with the Commission of Agricultures' rules, regulations and specifications. This shall hereby be termed proper disposal.

Subd. 4. For Hazardous Trees and Portions found on private property, the property owner shall be given no more than 7 days for Proper Disposal from the date of notification. Notification shall be given in the form of a written notice to be presented personally or by mail by the City Forester.

Subd. 5. Failure to abate the nuisance (or properly dispose of the Hazardous Trees and Portions) by the property owner within the time limit stated shall authorize the City Forester to have the nuisance abated. The City Forester may then charge all costs of the abatement to the property owner and bill him directly or have the monies due assessed to his taxes.

Subd. 6. The Forester shall keep a record of the costs of abatements done under this section and shall report monthly to the Clerk all work done for which billings and assessments are to be made stating and certifying the description of the land, lots, parcels involved and the amount chargeable to each.

Subd. 7. On or before September 1 of each year the Clerk shall list the total unpaid charges for each abatement against each separate lot of parcel to which they are attributable under this ordinance. The Council may then spread the charges or any portion thereof against the property involved as special assessment under Minnesota Statutes Sec. 429.101 and other pertinent statutes for certification to the county auditor and collection the following year along with current taxes.

Section 1020:40 Root Graft Barrier Placement.

Subd. 1. The City recognizing the problem of the spread of Dutch elm disease from infected trees to adjacent, healthy trees through root systems and common natural connections, intends to the best of its ability, to control and prevent this means of spread of the disease.

Subd. 2. To prevent the spread of the disease the City Forester shall place, or have placed, root graft barriers in the prescribed manners as currently recommended by the Commissioner of Agriculture and the University of Minnesota.

Subd. 3. Since root systems and root grafts of public trees do not restrict themselves to public property, and proper establishment of root graft barriers may require entrance and establishment on adjacent property, the City authorizes the City Forester to establish proper root graft barriers on adjacent private property when the following conditions are followed:

1. The root graft barrier is established to protect public trees.

2. The property owners permission (in writing) is required.

3. If any damage or distortion to the property is caused the City shall be responsible for the reasonable restoration of the property to the condition that existed before the placement of the barrier.

4. The barrier will be placed at no expense to the property owner.

Subd. 4. Placement of root graft barriers on private property may be done to protect private trees when requested by the homeowner, however, payment will be received to cover costs.

Section 1020:50. Therapeutic Pruning. The City, recognizing the potential of therapeutic pruning (the "amputation" of infected branches) as a possible tool in the control of Dutch elm disease authorized the City Forester to enter upon private property and carry out this procedure on private trees for the protection of public trees.

The same four conditions as stated in Section 1020:40, Subd. 3 as they apply to therapeutic pruning, shall apply.

Section 1020:60. Chemical Treatment. The City, recognizing the value of chemically treating trees either with approved fungicides or insecticides as a possible tool in the management of Dutch elm disease, and recognizing that the treatment of a private tree may help to protect other private and public trees, authorizes the City Forester to enter upon private property and chemically treat the private tree.

The same four conditions as stated in Section 1020:40, Subd. 3 as they apply to chemical treatment shall apply.

Section 1020:70. Payment of Monies Owed.

Subd. 1. The payment of monies owed to the City for the abatement of nuisances (as described in Section 1020:15) from private property shall be handled in the following manner.

Subd. 2. All expenses shall be kept by the City Forester or the City Accountant. All monies will be presented in the form of individual bills to the individual property owner stating the work done and the amount owed.

Payment shall be due on the entire amount owed within 30 calendar days from the date of the bill. If the property owner fails to pay any portion of the amount owed, the City may charge interest on the remainder due in the form 10% per annum.

Subd. 10. After the passage of the original 30 days the City may assess the remaining amount due (including all interests and penalties) to the owners property or may present claims in Small Claims Court for payment against the individual property owners.

Section 1020:75. Transporting Elm Wood Prohibited. It is unlawful for any person to transport within the corporate limits of this municipality any bark-bearing elm wood without haveing obtained a permit from the Forester. The Forester shall grant such permits only when the purposes of this ordinance will be served thereby.

Section 1020:80. Interference Prohibited. It is unlawful for any person to prevent, delay or interfere with the Forester or his agents while they are engaged in the performance of duties imposed by this ordinance.

WORK SHEET FOR EVALUATING THE SHADE TREE PROGRAM ACTIVITIES OF THE SELECTED CONTROL CITIES

1. Disease Control Area (include map)

2. Inspection Procedures

   a. Public Property

   b. Private Property

      -Notification

      -Method of Verifying Removal

   c. Inspections Completed By (specific dates)

      _____ _____ _____ _____

   d. Firewood Inspections (specific dates)

      _____ _____ _____

   e. Attach copies of the City Ordinances dealing with hazardous wood, tree removal notification, etc.

3. Tree Removal Procedures

   a. Time limit for removing High Risk Trees on Public Property

   b. Time limit for removing High Risk Trees on Private Property

   c. Tree Removal Done By

      City Crews _____%

      Contractors _____%

      Private _____%

4. Subsidy Policy

   a. Does the City reimburse homeowners for tree removal on private property? If so, what level of reimbursement is provided?

   b. Does the City special assess tree removal costs incurred on private property? If so, what is the percentage of the amount assessed?

5. Root Graft Disruption

   a. Mechanical

   b. Chemical

6. Stump Treatment

   a. Grind-out

   b. Debark

   c. Other

7. List the Chemicals used as a disease management practice (for example, systemic fungicides). Are these chemicals being used in an effective manner?

8. Disposal Policy

   Burning _____

   Burying _____

   Chipping _____

   Other _____

9. Reforestation Activities

   a. List the species of trees planted.

   b. Where is the planting stock obtained or purchased?

   c. Who does the actual planting of the trees?

10. Information to be determined by person monitoring control cities

   a. Number of diseased elm trees _____.

   b. Number of diseased elm trees detected by the City _____.

   c. Number of diseased trees removed _____.

   d. Number of delinquent trees (trees not removed within the time limit established by City policy) _____.

11. Miscellaneous comments (What is the evaluator's opinion of the City's disease management program?)

12. Is the Agricultural Extension Service involved with the City's disease management program? (For instance, has the County Extension Agent held public meetings, produced radio and/or newspaper releases, etc., concerning shade tree diseases?)

PART II

ACCOMPLISHMENT REPORT - 1979

FEDERAL DUTCH ELM DISEASE DEMONSTRATION AND UTILIZATION PROJECT

INFORMATION AND EDUCATION PROGRAM

ACCOMPLISHMENT REPORT - 1979

Dr. Ward C. Stienstra
Program Coordinator

Department of Plant Pathology
University of Minnesota, St. Paul

Minnesota Agricultural Extension Shade Tree Personnel List:

Department of Entomology, Fisheries, and Wildlife

Dr. Mark Ascerno, Jr., Assistant Professor & Extension Specialist
Dr. William J. Phillipsen, Assistant Extension Specialist

Department of Forest Products

Harlan Petersen, Extension Specialist
Dr. Lewis Hendriks, Professor & Extension Specialist

Department of Forest Resources

Pat Weicherding, Assistant Extension Forester
Dr. Marvin Smith, Professor & Extension Specialist

Department of Horticulture and Landscape Science

Richard Rideout, Assistant Extension Specialist
Jane McKinnon, Associate Professor & Extension Specialist

Department of Information and Agricultural Journalism

Linda Camp, Extension Information Specialist & Instructor

Department of Plant Pathology

Dr. Asimina Gkinis, Assistant Extension Specialist
Dr. Ward C. Stienstra, Associate Professor & Extension Specialist

Department of Rural Sociology

Dr. Randolph L. Cantrell, Assistant Professor

Synopsis

This report presents a review of the Minnesota Dutch Elm Disease Control Demonstration and Utilization Program which is federally funded. The methods used and informational packages developed for public release and use were important in creating and maintaining public awareness and public involvement in Dutch Elm Disease Management. The importance of trained technical people in each local community cannot be underestimated and few can be expected to operate a successful shade tree management program without community understanding, involvement and financial support. The results of a life time of effort of one individual are naturally slow to develop in other towns. The level of concern for trees in a town surrounded by native trees is quite different from towns which have no native tree population. The value of trees or paying the cost of tree maintenance is really a new concept for most people and is not an easy one to sell.

This federally funded project has surfaced many "operational weaknesses" in community control programs. Important as they are, the discovery of how the native elm bark beetle may by-pass traditional control procedures and how a community can prevent this overwintering may result in even more aggressive community programs with lower elm losses. Further testing and development is required but the future is promising. Also the interest in wood utilization may be a positive factor in Dutch elm disease management, if control measures can be formulated for community wood utilization programs. This would eleviate the firewood problem common to all Dutch elm disease control areas.

I. Introduction

The mission of the Agricultural Extension Service in the Federal Dutch Elm Disease Demonstration and Utilization Project is to educate the citizens and municipal staff of the participating communities and to develop local leadership in shade tree management. Specifically, Agricultural Extension specialists plan to inform local community leaders and citizens about Dutch Elm Disease and Shade Tree Management programs with the goal that local resources and established organizations in the six demonstration communities effectively manage the shade trees. This goal is not easy to achieve in a short period and may only be accomplished in part over several years. Yet some of the benefits of Dutch Elm Disease/Shade Tree Management are being seen in all six demonstration communities.

Extension staff have a responsibility to provide shade tree information to the entire state in addition to the demonstration communities. For maximum effectiveness, news releases, T.V. and radio spots were distributed to media throughout the state for the purposes of general public information and awareness of shade trees. Media in the demonstration communities also received these materials.

The goals of the Minnesota Agricultural Extension Shade Tree Program are:

1. To consult with communities in a team effort on disease identification, management, sanitation, orderly removal and tree planting and general shade tree management.
2. To work with public agencies in training tree inspectors.
3. To provide educational services for individuals and firms relating to disease and shade tree management.
4. To disseminate technical information.
5. To assist the general public concerned with shade tree management.

II. Methods

In view of the goal of "helping the communities to help themselves" limited time was spent on developing specific news stories for media in the demonstration communities. Instead, whenever possible, staff participated in local radio shows and provided questions and information so that the local papers and radio programs could develop their own stories.

1. Media coverage during 1979

A. Extension Newsline

This is a toll-free telephone system available to radio broadcasters throughout the state who call in directly to record stories for news reports. Stations in or near demonstration communities had access to this service. (An average of 20-25 stations use the stories each day)

March 23 - Treating Diseased Elm Wood
May 14 - Dutch Elm Disease
May 15 - Fungicides for Dutch Elm Disease
June 1 - Oak Wilt Disease
June 13 - Injecting Trees to Prevent Dutch Elm Disease
June 21 - Preventing Root Graft Spread of Dutch Elm Disease
June 28 - Pruning Elm Trees
July 11 - Replacing Elm Trees
September 10 - Dursban Label Approval

B. Radio Series

A five part radio series. Each segment is 3-5 minutes in length and is produced in a mini-documentary format (75 stations throughout the state receive this service, including those in or near demonstration communities).

April 23 - Dutch Elm Disease in Minnesota
July 2 - Shade Tree Management in Minnesota
July 16 - Shade Trees
September 3 - Fall Tree Care
October 12 - The Importance of the Native Elm Bark Beetle as a Carrier of Dutch Elm Disease in Minnesota

C. TV Public Service Announcements

Three PSAs were distributed to 10 television stations in or adjacent to Minnesota in March. Demonstration communities had access to these PSAs via stations in Alexandria; Fargo, North Dakota; Mankato, and stations in the Twin Cities

Debarking Elm Firewood
Dutch Elm Disease Symptoms
General Shade Tree/Dutch Elm Disease Awareness

D. Radio Public Service Announcements

Three PSAs related to Dutch elm disease control were developed and distributed to 75 radio stations throughout the state in July. Stations in or near demonstration communities received copies.

E. TV Newsclips

A television newsclip was developed on the importance of firewood disposal and debarking elm firewood. It was used on WCCO-TV on March 28. Four of the demonstration communities had access to this clip.

F. Shade Tree News Releases - 1979

March

"Get Rid of Elm Firewood by April 1"

April

"What to Plant in Minnesota this Year"
"Ten Tips for Planting Landscape Trees"
"Taming the Wild Shade Tree"
"Shopping Around"
"Dutch Elm Disease Photo Essay"
"Keeping Ahead of Shade Tree Diseases and Insect Pests this Season"

May

"Hold Off Injecting Elms"
"Watch for Early Signs of Dutch Elm Disease"

June

"Dutch Elm Disease Symptoms"
"Detect Oak Wilt Now"
"Don't Rush into Tree Injections"
"Common Questions About Dutch Elm Disease" (Part I)
"Watch for Root Graft Infections"
"Common Questions...." (Part II)
"Don't Prune Elms this Summer"
"Common Questions..." (Part III)

July

"Common Questions..." (Part IV)

September

"New Control Method for Dutch Elm Disease Management Developed"

October

"Save Energy with Trees"

2. In line with the more targeted or focused approach, considerable effort was spent talking with specific local groups and individuals. Different approaches were experimented with in northern and southern towns.

Northern

Efforts centered around identifying and talking with a range of groups and individuals in the three communities who might have an interest in trees. It was felt that such contacts would be useful in both gaining information about the community and for the purpose of mobilizing public support. A partial list of those individuals or organizations include:

A. Fergus Falls

Terry Grumann & Henry Anderson of the Otter Tail Power Company
Leroy Benson, Park and Recreation Department, Senior Citizens Club
Kiwanis Club

B. Little Falls

Warren Woodsworth, Senior Citizens Club
Les Kleinschmidt, private business man
John Hohncke, County Planning Commission, Legion Auxiliary, Garden Club, Kiwanis Jaycees, 4H

C. Wadena

Don Baustian, 4H, 20th Century Club, Garden Club
Dick Carmen, high school biology teacher
Sherman Mandta, business man

A "public participation" effort was launched in Wadena. A tree tour was organized by Bill Phillipsen in cooperation with the local county extension office, the tree inspector and the DNR staff. Signs from the Extension Art Service identified 18 trees in Wadena from June 22 - July 15, which could be used to replace dying elms. This tour proved to be very effective and can be easily repeated in other communities. Elm watch programs were initiated in Fergus Falls and Little Falls. About 150 senior citizens and Kiwanis Club members under the leadership of the community tree inspector (Bernie Pretts) are watching for early Dutch elm disease symptoms in Fergus Falls. The elm watch proved to be ineffective in Little Falls, as no strong leader was identified. This concept may be attempted again during year three.

Southern

In the southern communities, work with local schools was initiated in an effort to educate "the next generation" about the importance of trees and Dutch elm disease. This project also yielded some solid contacts with teachers who may be in a position to undertake additional tree related activities in their communities. Asimina Gkinis visited the schools as follows: April 9, Litchfield; April 24-25, Granite Falls; May 9, Hutchinson. Extension Staff also provided training to community tree inspectors on culturing elmwood samples for the purpose of disease identification. Prepared culture plates were provided to all towns and all culture results were verified by Extension.

3. Utilization - Demonstration Cities

A major deterrent to greater utilization of disease killed elm is a requirement that roundwood be debarked for long term storage. A wide range of equipment has been investigated in the search for a practical solution to this problem. A hand held chain saw attachment for debarking was located and purchased as part of this project. The unit was demonstrated on several locations in Hutchinson and Little Falls and later used on a limited basis in Hutchinson. Elm bark can be removed with this unit but its high cost and unavailability in this country makes widespread use unlikely. The proposal to add firewood production at the demonstration cities was approved and much time has been spent in consulting on equipment purchases and operational procedures. The interest in elmwood utilization is high and specialists have served as resource people and have regularly provided information about markets, industry practices and manufacturing processes to cooperators in the demonstration projects.

4. Utilization - Fuel Pellet Project

Several newspaper articles were prepared and the ground work was laid for a more extensive public information campaign following start up of the Stillwater Prison Fuel Pellet Project. These plans include a slide/tape of the production process and several video-tapes. Information about the pellet plant and wood fuel pellets was presented to several groups. The extension staff were contacted on numerous occasions by individuals and firms interested in pellet production. A fuel-feed pellet facility is currently nearing completion in Marcell, Minnesota and a plant is also under construction in northern Wisconsin. The public information effort will be activated when the Stillwater plant performance is satisfactory.

5. Tree Inspector Training

The extension shade tree specialists have supported the state wide community disease management programs by training tree inspectors. Each community receiving state funds for Dutch elm disease control must have a certified tree inspector. In March of 1979, the shade tree specialists participated in the tree inspector certification workshops at six locations around the state and a make-up session at St. Paul.

In the second year of the federal project, extension have provided in-depth technical training to tree inspectors in the six communities. This is a priority because such technical personnel are the major existing mechanism communities have for dealing with their trees. Without a solid base of local technical expertise, communities have a limited capacity to implement effective management programs. Another reason this was given high priority is that many of the tree inspectors in communities are new. Technical training was provided both formally and informally. Specialists consulted by phone and made trips to the communities as necessary. In addition a special 2-day workshop for tree inspectors from the

Demonstration Communities was held on the St. Paul Campus. This was intended to supplement the informal consulting and formal training program that they had attended in the spring of 1979, jointly sponsored by Extension and the Department of Agriculture-Shade Tree Program. The first day was an in-depth analysis of the biology of Dutch elm disease and the insects in the disease complex. Old and new management strategies were discussed extensively. Staff from the Department of Plant Pathology presented research data on tree injection. Laboratory periods followed where participants had the opportunity to observe Ceratocystis ulmi, and elm bark beetles. The 2nd day was a "hands on" session on tree injection and root graft barrier installation. All participants expressed satisfaction with the 2-day workshop and suggested it be a yearly function.

6. Advisory Board

One mechanism communities in other parts of the country have used to manage shade trees is a Shade Tree Advisory Board. During this 2nd project year extension staff began exploring the possibility of establishing such boards in the demonstration communities. Discussions were started with the county extension staff and local officials to evaluate the need for such boards and identified potential participants. Thus far extension staff have been able to proceed with this idea in only one community - Wadena. The need to develop a board of this kind is perhaps greatest in Wadena because there is no existing park and recreation department. A tentative mission and function statement has been sent to Vince Brown, City Planning Director with a proposed list of potential board members. A municipal shade tree ordinance will have to be passed by the city council before such a shade tree board can be established. Potential shade tree board participants in Wadena:

Ambrose Winkels (Real Estate)
Margaret Sherman (Retired County Nurse & Garden Club Member)
Mary Shuran (Housewife)
Jean Pettit (Garden Club
Louise Hulting (Garden Club)
Mary Phillips (Housewife)
Leonard Hoffman (Tree Nursery Company)
Ernie Jaranson (Retired Banker)
Brenda Davis (Housewife)
Sarah Yetter (Housewife)

III. Results and Discussion

An evaluation of methods used is impossible, however, a few comments about the entire program in 1979. The extension staff have been pleased with the more focused communication approach adopted for the demonstration communities. Though much remains to be done in the way of establishing advisory groups and shifting resource responsibility to a local base, staff feel they are much further ahead than they were a year ago. Steps taken this year can be built upon in the future and a solid base of experiences is evolving that will be useful in other locations in Minnesota and nationally. There are no regrets for having decided to abandon the public meeting - educational approach. In addition to the difficulty of scheduling and advertising public meetings, the turn-out is always disappointing. The time spent on development of educational materials, one-on-one consulting, tree inspector training and presentations to high school and junior high school groups is a very satisfying experience for the Agricultural Extension Staff. An indirect measure of success of this program approach maybe the fact that several groups have invited individuals to return next year with an up-date. Immediate personal feed-back has been very positive on the one-on-one consulting and the in-depth two-day tree inspector training program.

The following items are evidence of public use of extension materials and staff resources:

Exhibit 1

Letter from Sam Swan, Extension Electric Media regarding radio talk show.

Exhibit 2

Letter from Vincent C. Brown, Planning Director, City of Wadena regarding educational materials prepared, consulting in the City of Wadena, and tree inspector training and workshop.

Exhibit 3

Tree Watch, "Get Rid of Elm Firewood by April 1" and Tree Line "Identifying Elm Firewood" reproduced by the Wadena Pioneer Journal

Exhibit 4

Tree Watch, "Dutch Elm Symptoms" reprinted in Wadena Pioneer Journal. and Fergus Falls Daily Journal.

Exhibit 5

Tree Watch, "Don't Prune Elms this Summer", reprinted in Wadena Pioneer Journal.

Exhibit 6

Tree Watch, "Common Questions about Dutch Elm Disease -- Part II", reprinted in Little Falls Transcript and Wadena Pioneer Journal.

Exhibit 7

Tree Watch, "Common Questions about Dutch Elm Disease -- Part IV", reprinted in Fergus Falls Daily Journal.

Exhibit 8

Minnesota Tree Line, "Shade Trees for West Central Minnesota", reprinted in Fergus Falls Daily.

Exhibit 1

UNIVERSITY OF MINNESOTA
TWIN CITIES

Department of Information and
Agricultural Journalism
433 Coffey Hall
1420 Eckles Avenue
St. Paul, Minnesota 55108

June 21, 1979

Bill Phillipsen
Asst. Ext. Entomologist
204 Hodson Hall
St. Paul Campus

Dear Bill,

Thank you for participating on "TALK OF MANY THINGS" radio program. Your expertise on the subject of dutch elm disease and contributions to the conversation made for a well-rounded, informative program. I think some very good questions stemmed from the panel's discussion and your answers should be very helpful.

If you had any feedback or comments about the show as a result of your interview, please let me know.

Thanks again, Bill, you were great.

Sincerely,

Sam Swan
Ext. Electronic Media Leader

NRS:mtw

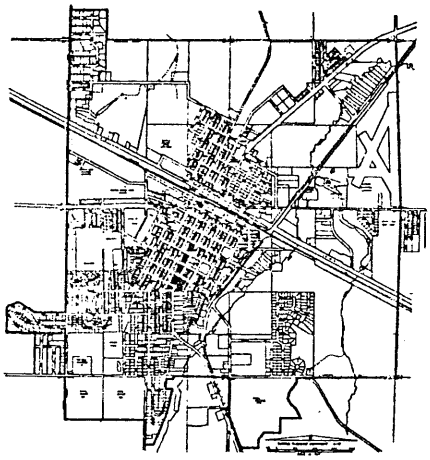


Exhibit 2

PLANNING DEPARTMENT

CITY OF WADENA

8 Bryant Avenue Southeast

P. O. Box 30 — Wadena, Minnesota 56482

Telephone 218 631-2884

October 22, 1979

Mr. William Phillipsen
Cooperative Extension Service
Department of Entomology
University of Minnesota
St. Paul, Minnesota

Dear Mr. Phillipsen:

I wish to take this time to convey my thanks to you and your associates for the wonderful work that the University has done for the City of Wadena Dutch Elm Control Program.

Because of your participation in our program by providing special education programs and literature, your interest in our special problem (unidentified fungus) and the various aspects of the research plots which contained elm trunk spray, log traps, the flight spray and the sticky trap applications has helped to acquaint people within the community with the problems connected with Dutch Elm Disease by becoming more involved regarding disease management.

Your contribution along with the Federal Program (DNR) and the Shade Tree Program has demonstrated that it is important to establish good management practices in order to have an effective Dutch Elm Control Program.

The two day workshop that was held in June, that you and Mina conducted on campus was the best Dutch Elm program that I have attended in the past four years. We were given the opportunity for field work in tree injection, root barrier, use of Vapam and most of all to work in your lab. I believe this type of workshop should be available to all Tree Inspectors.

Thank you again for your assistance in help making our program a success. I hope the future holds other opportunities for cooperation.

Sincerely,

Vincent C. Brown
Planning Director
Tree Inspector.

AGRICULTURAL EXTENSION SERVICE UNIVERSITY OF MINNESOTA • (612) 373-1785

TREE WATCH

March 26, 1979

FOR IMMEDIATE RELEASE

Get Rid of Elm Firewood By April 1

The season for enjoying fireplaces is nearly at an end, but not the season for worrying about firewood. Elm logs with the bark still on can help increase Dutch elm disease in a community. Extension specialists at the University of Minnesota urge homeowners to dispose of or debark their elm firewood immediately.

By law, homeowners may not keep elm firewood with bark intact between April 1 and September 15. And, in some communities, ordinances allow local officials to confiscate any elm wood they find between these dates.

According to extension entomologist, William Phillipsen, elm firewood is a hazard because it is a good breeding place for the elm bark beetles that carry the Dutch elm disease fungus. "Last fall, these beetles laid their eggs beneath the bark of any dead or dying elm wood they could find," he says. "Much of that dead elm wood had Dutch elm disease, so the new beetles became contaminated. Now, as the weather gets warmer, the beetles will come out of the wood to fly around and feed on healthy elms. Because the fungus is on their bodies, the beetles can infect healthy trees as they feed."

The biggest problem Phillipsen sees is firewood from diseased elms that were taken down last summer. This wood was generally too green to burn this past winter, so people may be saving it for use later on in the year. However, it is an excellent place for the beetles to lay their eggs. "The best thing to do with any elm wood you may have in your firewood pile is to completely debark it or get rid of it," Phillipsen advises. "This will ac-

complish two things," he says. "It will destroy any beetles that are still in the logs, and it will reduce the number of places the new beetles will have to lay their eggs this summer. In general, it will mean fewer beetles available to infect healthy elm trees."

Elm wood can be recognized by the alternating light and dark layers of bark, usually visible on the ends of logs (see photo). If homeowners have trouble determining whether they have elm firewood, they should contact their local tree inspector (through the local government) or county extension office.

Elm bark beetles fly around and feed generally between April 1 and September 15, so it is important to properly dispose of or debark all dead or dying elm wood during that time.

ljc

CA

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CUTLINE FOR ACCOMPANYING PHOTO:

Elm firewood can be easily recognized by the alternating light and dark layers of bark, usually visible on the ends of logs.

MINNESOTA TREE LINE

Agricultural Extension Service
University of Minnesota

Identifying Elm Firewood

No. 25—1979

William Phillipsen, Extension Entomologist
Harlan Petersen, Extension Forest Products Specialist

For communities interested in managing Dutch elm disease, one of the most important steps is removing and disposing of all dead or dying elm wood. Though many people correctly take care of diseased trees as they cut them down, they frequently overlook elm wood in firewood piles throughout their towns.

Elm firewood is an especially good breeding place for the bark beetles that carry Dutch elm disease. As many as 1800 new adult beetles have been found in a single fireplace log 3½ inches in diameter and 22 inches long. So, even a few logs in a town can pose a big threat to control efforts. As a homeowner you can help to control Dutch elm disease in your community by learning about the role of elm firewood in spreading the disease and by checking your woodpile for elm wood.

THE IMPORTANCE OF FIREWOOD PILES

Dutch elm disease is caused by a fungus that lives and grows inside elm trees. Two species of elm bark beetles (native and European) spread the disease to elms in much the same way that mosquitos spread malaria to people.

Adult bark beetles look for dead or dying elm wood and lay their eggs under the bark. One adult generally produces between 50 to 80 eggs. If that elm tree has died from Dutch elm disease, the fungus will be inside the wood and it will stick to the new beetles. When these new adults come out and go to feed on healthy elms, they carry the fungus on their bodies. In feeding, the beetles chew through the bark of a healthy elm, leaving openings where the fungus can enter the tree's vessels.

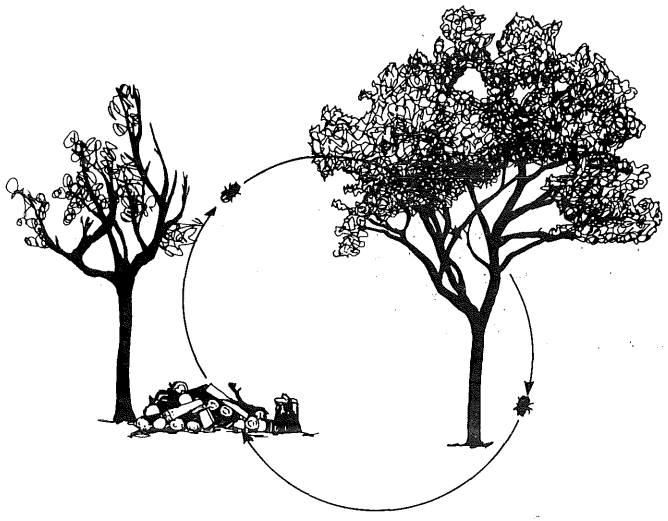

Figure 1. Elm bark beetle life cycle.

Later these adults will seek out dead or dying elm wood. They will then breed and produce still another generation of beetles to potentially spread Dutch elm disease (figure 1).

Both types of beetles require elm wood to survive and that elm wood must have its bark on for the beetles to breed successfully. If you destroy the breeding sites (logs) before the new beetles come out, then there will be fewer beetles to pass on the disease. This is the reason why removing all elm wood is so important. The beetles fly around and feed from about April 1 to September 15, so it is especially important to get rid of all elm firewood during that period or completely debark it. Since burning elm firewood kills the beetle grubs, eliminates beetle breeding sites, it is the most desirable method of disposal.

IDENTIFYING ELM FIREWOOD

One of the reasons people don't dispose of their elm firewood properly is because they are not sure how to tell it from other wood they may have on hand. It is not as easy to recognize elm as some other kinds of wood, such as white birch. However, elm does have a few special characteristics you can look for when you check your woodpile.

Three kinds of elm are native to Minnesota, American, rock, and slippery elm. American elm, also known as white, soft, or water elm is the most common tree, but in some areas slippery (red) and rock (hard) elm may be present in significant numbers. All of these kinds of trees are susceptible to Dutch elm disease, so all kinds of elm firewood must be disposed of or debarked.

Since most firewood has some bark on it, it seems logical that looking at the bark would be the easiest way to spot elm logs. This is not entirely true, though. The form, size, color, and character of bark varies considerably, depending on the age of the tree and growing conditions. Thus, looking at the *outer* bark may not be the best way to check.

Looking at the *inner* bark coloring, however, is very helpful. Both American and rock elm bark is composed of alternating light and dark layers. You can usually see these layers easily by looking at the ends of logs, as shown in figure 2. Ash (figure 3) and other common hardwoods do not show these sharply contrasting layers. If you are unsure whether a certain log is elm, it may be helpful to make a fresh cut in the bark with a knife or axe. Remember that the white and brown layering is present only in American and rock elm and cannot be used to identify slippery elm.

Another way to tell if you have elm in your woodpile is to look closely at the wood structure. Elm, regardless of species, has a distinctive pore arrangement that you can usually see quite easily. Figure 4 shows the wavy concentric line pattern as it appears at approximately 3x magnification. You can see the difference between the elm and oak, shown in figure 5 at

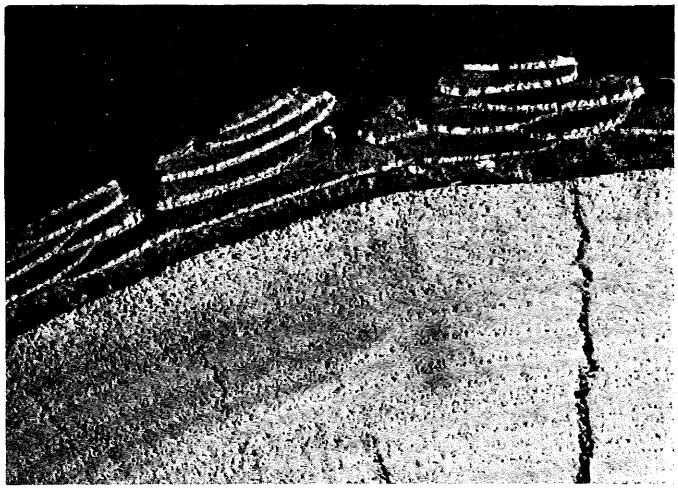

Figure 2. Characteristic layering of elm bark.

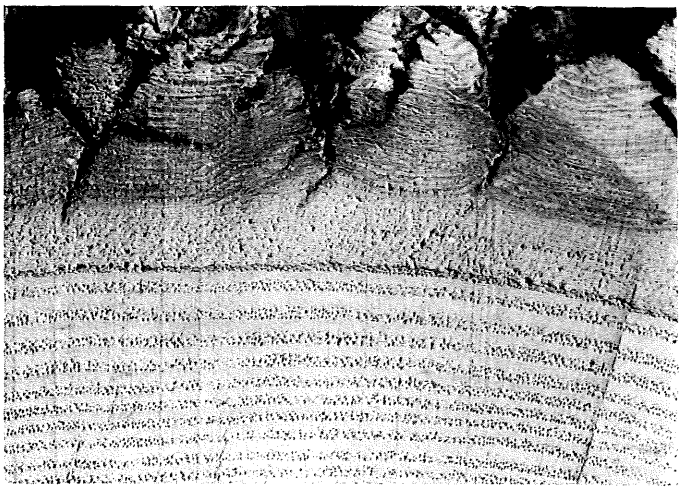

Figure 3. Cross section of ash bark.

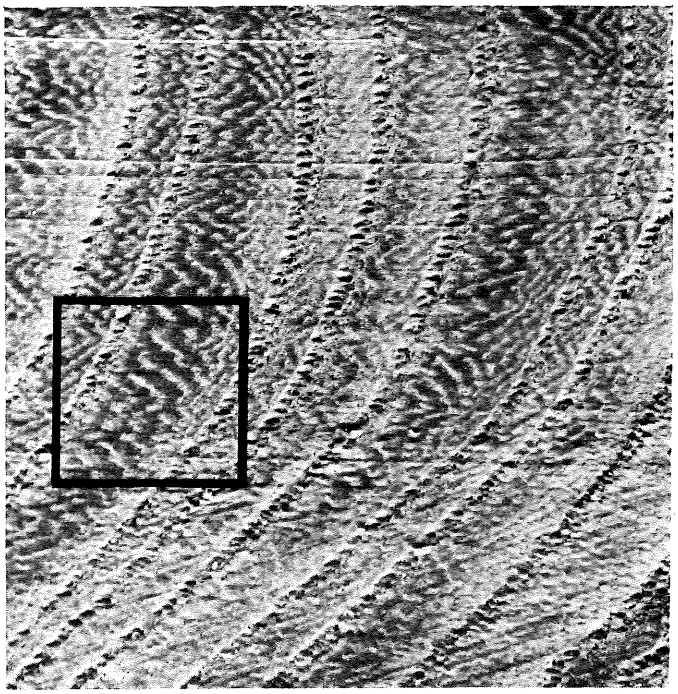

Figure 4. Wavy line pattern of elm wood, magnification 3x.

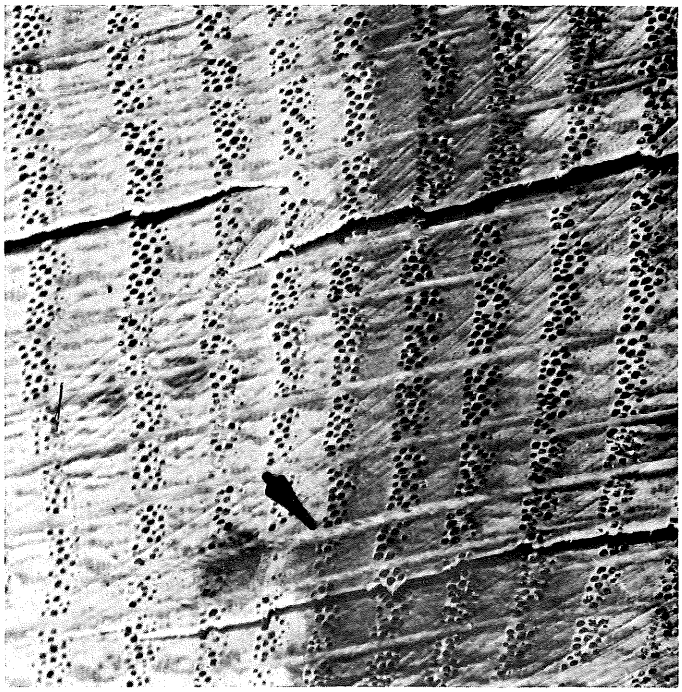

Figure 5. Characteristic rays of oak, magnification 3x.

the same magnification. Note the rays (see arrow) that are a special feature of oak. No other common hardwood has rays of comparable size.

You can usually see the wavy lines on a freshly sawn end of an elm log. If you do have difficulty finding them, make a sharp axe cut as shown in figure 6 and the lines should be quite visible. Hackberry, a close relative of elm does show the same wavy pattern. However, it is not a very common kind of firewood and if you have some in your woodpile, you can easily identify it by its warty bark.

Elm is usually thought of as difficult to split because of its interlocking grain, but this is not a hard and fast rule. It is generally true for American and rock elm, but not slippery elm which is normally straight-grained and easily split with a maul or axe.

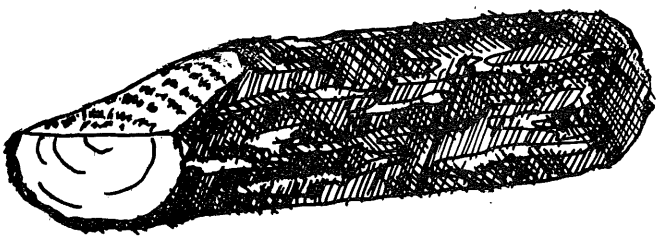

Figure 6. Cutting angle for elm identification.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Roland H. Abraham, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55108. The University of Minnesota, including the Agricultural Extension Service, is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, creed, color, sex, national origin, or handicap.

MNA Clipping Bureau
WADENA
PIONEER-JOURNAL
APR 5 1975

Exhibit 3

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ELM FIREWOOD. Elm firewood can be easily recognized by the alternating light and dark layers of bark, usually visible on the ends of logs.

Asked to get rid of elm firewood now

The season for enjoying fireplaces is nearly at an end, but not the season for worrying about firewood.

Elm logs with the bark still on can help increase Dutch elm disease in a community. Extension specialists at the University of Minnesota urge homeowners to dispose of or debark their elm firewood immediately.

By law, homeowners may not keep elm firewood with bark intact between Apr. 1 and Sept. 15. And, in some communities, ordinances allow local officials to confiscate any elm wood they find between these dates.

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The biggest problem Phillipsen sees is firewood from diseased elms that were taken down last summer. This wood was generally too green to burn this past winter, so people may be saving it for use later on in the year. However, it is an excellent place for the beetles to lay their eggs. "The best thing to do with any elm wood you may have in your firewood pile is to completely debark it or get rid of it," Phillipsen advises. "This will accomplish two things," he says. "It will destroy any beetles that are still in the logs, and it will reduce the number of places the new beetles will have to lay their eggs this summer. In general, it will mean fewer beetles available to infect healthy elm trees."

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Elm bark beetles fly around and feed generally between Apr. 1 and Sept. 15, so it is important to properly dispose of or debark a dead or dying elm wood during that time.

Questions aired about Dutch Elm disease

Q. Can Dutch elm disease be controlled?

A. No. Dutch elm disease cannot be controlled in the sense of being completely eliminated. Common techniques, such as crop rotation, which are used to get rid of epidemics in other kinds of crops cannot be used with a crop such as elms. And, unlike field crop epidemics that die down at the end of the growing season when the field crop is harvested, Dutch elm disease survives to the next season and affects trees in even larger numbers.

Dutch elm disease can be managed, however, so it slows down considerably. This is accomplished by using sanitation measures which are geared against both beetle and root graft transmission. These sanitation measures consist of identifying diseased trees early, promptly removing dead or dying elms, properly disposing of the trees which have been removed, and installing root graft barriers to prevent root graft transmission. Injecting chemicals within the tree sap stream should be done with caution.

Q. If we cannot stop Dutch elm disease, then why should we try to manage it?

A. There are two very strong reasons to have a DED management program. The first is money. Studies have shown that an intensive sanitation program based on frequent surveys and prompt removal of diseased trees keeps the diseases under control and keeps costs more stable than when there is no control program. With sound management practices, over a period of fifteen years, total sanitation costs and losses in property value can be from 35 percent to 75 percent lower than the total costs and losses when no control is used, depending on the program the community chooses to follow. In addition, there will be considerable savings in tree replacement costs because fewer new trees will have to be planted at one time.

A second reason for DED management relates to the aesthetics of a community. Without a management program, a community can lose all of its elms within ten years. However, with intensive management efforts trees can be around from 50 to 80 years. In the latter case, there will be ample time for a town to plan and conduct a proper tree planting program and the existing trees will be around to rpovide protection and beauty.

Q. Why does the elm wood have to be burned?

A. Bruning is a popular method of disposal and is recommended because it destroys both the beetle breeding sites and any of the fungus that may be growing inside the wood. There are alternatives for disposing of diseased elms, though. The wood may be debarked and the logs then used for veneer, sawlogs, pellets, crating, firewood, or railroad ties. Elm may also be chipped and used for mulch, animal bedding, woodland trails, or pulp. Unfortunately, many communities do not have chippers or debarkers big enough to handle large logs. Elm logs may also be buried, though this disposal method requires a lot of landfill space.

Q. Why do we have to debark our elm firewood?

A. Debarking destroys the beetle's home. The eggs and young beetles live under the bark next to the wood where there is enough moisture, food and protection for them to survive. When the bark is removed, the young beetles quickly die from lack of moisture. Chipping also promote drying and takes away space and food from the young beetles. Adult female beetles will not make breeding galleries if the wood area is too small.

AGRICULTURAL EXTENSION SERVICE UNIVERSITY OF MINNESOTA • (612) 373-1785

TREE WATCH

June 4, 1979

Dutch Elm Symptoms

During these summer months remember to keep a daily check on your elm trees to discover any early symptoms of Dutch elm disease.

"The most obvious sign of Dutch elm disease is leaves that are beginning to wilt and droop downward," explains Asimina Gkinis, extension plant pathologist from the University of Minnesota. "At first, the leaves turn dull green, then yellow. As the disease progresses, the leaves curl upwards, turn brown and dry out."

Another method of recognizing the disease is by taking a live branch with yellowing leaves from the tree and peeling back the bark. If Dutch elm disease is the problem, there should be the characteristic brown streaking in the wood under the bark compared to the creamy color typical of healthy trees.

The development of Dutch elm symptoms depends upon how a tree has been infected.

"If the leaves on larger elm branches suddenly begin to wilt and droop downward in late May or early June, then the disease has been carried over from last year," Gkinis said. "It's possible that the tree will die in two or three weeks and all you can do is remove the tree."

"However, if small branches in the crown of the tree show Dutch elm symptoms, it indicates a new beetle infection," according to Gkinis. The disease may be stopped at this stage by pruning the infected branches down to the trunk of the tree.

Dutch elm disease can also be passed to healthy elms through root graft transmission. If a healthy elm is close to where a diseased tree has been left standing, it's possible that the healthy elm will be infected through its root system. If this happens, the leaves on the smaller, lower branches of the tree usually begin to wilt and change color first.

"You can't save a tree showing these symptoms," Gkinis said, "because the disease progresses so fast from the roots to the trunk of the tree. If any healthy elms are located 40 feet or less from a diseased tree, a chemical or mechanical barrier should be installed to stop root graft transmission of the disease."

Gkinis believes the best way to control the spread of the disease is for homeowners to be alert for such Dutch elm disease symptoms as wilting leaves and browning of the sapwood, to allow for early detection and removal of diseased elms.

CA, P2-p # # # # gjd

elm disease is leaves that are beginning to wilt and droop downward," explains David Hart, Scott County extension director. "At first, the leaves turn dull green, then yellow. As the disease progresses, the leaves curl upwards, turn brown and dry out."

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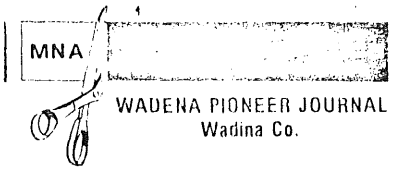
"You can't save a tree showing

Exhibit 4



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Check this summer for Dutch Elm symptoms

201

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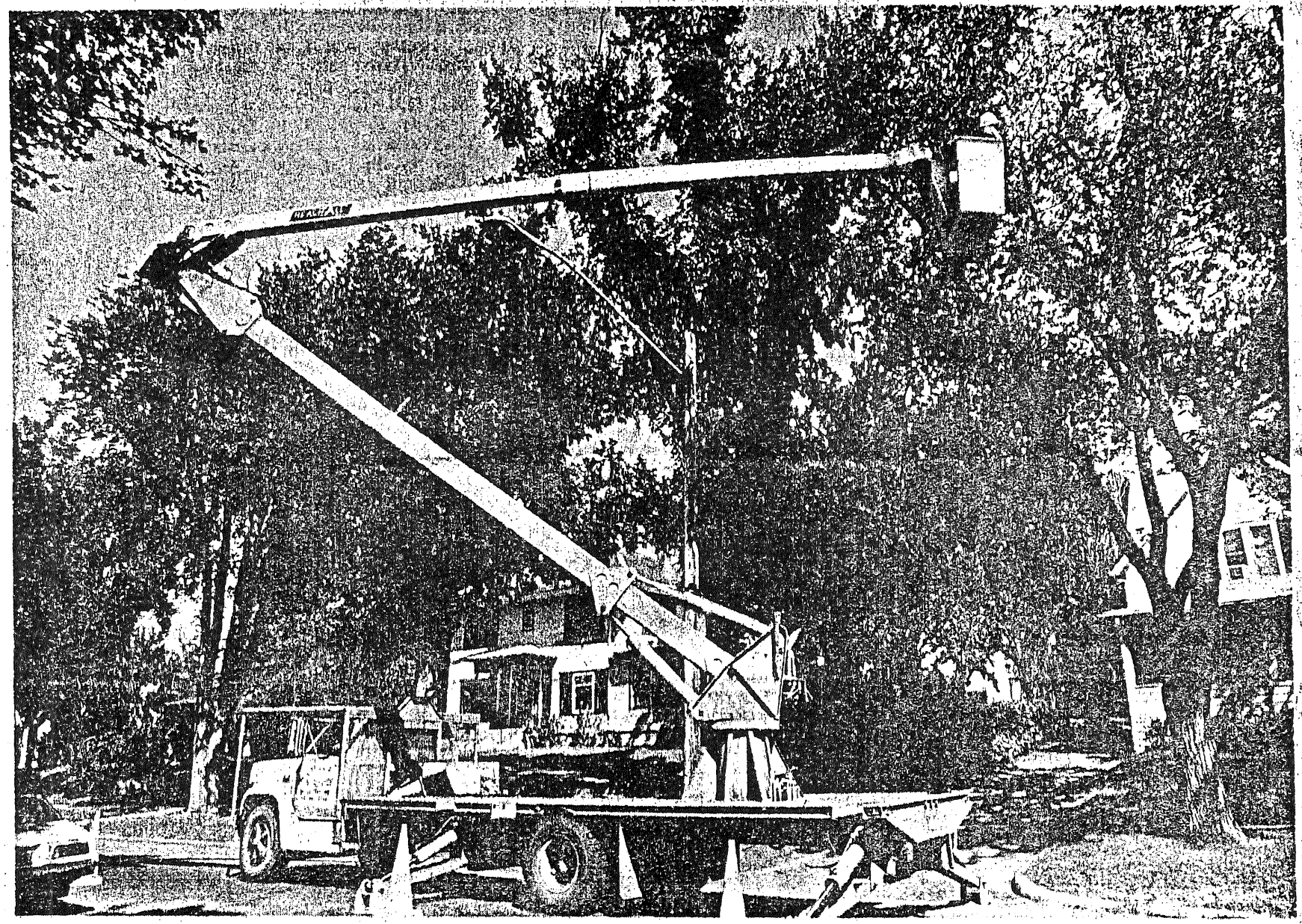

REACHING NEW HEIGHTS—City Forester Bernie Pretts is spending his working hours this week in a bucket sampling trees for Dutch elm disease. Using equipment from Carr's Tree Service, Pretts is testing trees which have symptoms of the disease but are too tall to be reached from the ground. Of 35 trees tested Monday, Pretts said seven probably have Dutch elm disease. (Journal photo by Harley Oylo)

Exhibit 4

AGRICULTURAL EXTENSION SERVICE UNIVERSITY OF MINNESOTA • (612) 373-1785

TREE WATCH

June 25, 1979

Don't Prune Elms This Summer

If you've been thinking about pruning your elm this summer so it will look nicer, you could be setting yourself and your tree up for some big problems. Elms with open pruning wounds are good candidates for Dutch elm disease. Experts say it's best to avoid pruning until later in the year.

Pruning elms during the summer is hazardous primarily because of elm bark beetles, says extension entomologist William Phillipsen. These beetles, which frequently carry the Dutch elm disease fungus on their bodies, are very attracted to open wounds on elm trees. Thus, a healthy tree, which the beetles might have passed by, can become a real target for beetles and, therefore, the disease after it has been pruned.

"Both European and native elm bark beetles are feeding and reproducing right now," says Phillipsen. "In fact, very large numbers of the native beetle have been reported in the Little Falls and Hinckley areas. However, between mid-October and March they will be inactive, so it will be safer to prune during this period."

Phillipsen points out that these recommendations apply to aesthetic pruning and that elms can be trimmed for therapeutic reasons this summer. "Trees in the early stages of Dutch elm disease may have just a few yellowing branches at the crown caused by beetle-induced infections. Sometimes by pruning off these branches it is possible to save a tree," he says. "In these cases, wound dressings may help make the trees less attractive to the beetle." Wound dressings are not recommended when elms are aesthetically pruned later in the fall.

Frequently, pruning dead or dying limbs from elms is suggested as part of a community's Dutch elm disease sanitation program. Here, pruning helps to reduce the number of breeding sites for the beetles. "Pruning for sanitation should also be done during the fall and winter, as much as possible," says Phillipsen.

CA, PII-p # # # # ljc

Exhibit 5

Eastlund new city Dutch Elm inspector

Wadena Pioneer Journal

New summertime Dutch Elm Inspector Carl Eastlund, a native of Red Wing, has been working with Vince Brown, City planning and zoning coordinator, in keeping close tab on possible Dutch Elm disease.

Eastlund, a 1979 Bemidji State university graduate with a bachelor of science degree in biology, has been inspecting trees throughout the city and has a detailed map of where the trouble might be within the city limits. Working under the Dutch Elm control program, Eastlund said, "Our office located above city hall wants the public to cooperate in keeping the disease from spreading."

"If you see yellowing or wilting elm tree leaves please call us at 631-2884 between the hours of 8 a.m. and 5 p.m.," Eastlund emphasized.

Both Vince Brown and Eastlund attended a two-day training session at the University of Minnesota, St. Paul last week on acomplicated process of tree injections.

The pair was in a one-day workshop, briefed on tree injections while the following day both were on a field trip to do four tree injections at the state fairgrounds. All injections involved elm trees.

Eastlund is also a certified tree inspector having completed the required examination earlier this spring.

Both Eastlund and Brown urge the public to participate in tree tours within the city limits starting Thursday at the county courthouse lawn area. The project is being coordinated by the County Extension office and the City planning department. It's free to the public.

Through cooperation of the city council, the federal elm tree and State Shade Tree Program, 80 diseased elms were removed in Wadena last year.

The city had 4,800 elm trees.

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Frequently, pruning dead or dying limbs from elms is suggested as part of a community's Dutch elm disease sanitation program. Here, pruning helps to reduce the number of breeding sites for the beetles. "Pruning for sanitation should also be done during the fall and winter, as much as possible," says Phillipsen.

Stingers' queenly culture

Is mother nature trying to tell us something?

Wasps, hornets (Which are also wasps), bees and ants, all members of the Hymenoptera order, are the aristocrats of the insect world. No other six-legged creatures have as highly developed a nervous

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TREE WATCH

Common Questions About Dutch Elm Disease -- Part 2

Q. Can Dutch elm disease be controlled?

A. No. Dutch elm disease cannot be controlled in the sense of being completely eliminated. Common techniques, such as crop rotation, which are used to get rid of epidemics in other kinds of crops cannot be used with a crop such as elms. And, unlike field crop epidemics that die down at the end of the growing season when the field crop is harvested, Dutch elm disease survives to the next season and affects trees in even larger numbers.

Dutch elm disease can be managed, however, so it slows down considerably. This is accomplished by using sanitation measures which are geared against both beetle and root graft transmission. These sanitation measures consist of identifying diseased trees early, promptly removing dead or dying elms, properly disposing of the trees which have been removed, and installing root graft barriers to prevent root graft transmission. Injecting chemicals within the tree sap stream should be done with caution.

Q. If we cannot stop Dutch elm disease, then why should we try to manage it?

A. There are two very strong reasons to have a DED management program. The first is money. Studies have shown that an intensive sanitation program based on frequent surveys and prompt removal of diseased trees keeps the disease under control and keeps costs more stable than when there is no control program. With sound management practices, over a period of fifteen years, total sanitation costs and losses in property value can be from 35% to 75% lower than the total costs and losses when no control is used, depending on the program the community chooses to follow. In addition, there will be considerable savings in tree replacement costs because fewer new trees will have to be planted at one time.

A second reason for DED management relates to the aesthetics of a community. Without a management program, a community can lose all of its elms within ten years. However, with intensive management efforts trees can be around from 50 to 80 years. In the latter case, there will be ample time for a town to plan and conduct a proper tree planting program and the existing trees will be around to provide protection and beauty.

Q. Why does the elm wood have to be burned?

A. Burning is a popular method of disposal and is recommended because it destroys both the bettle breeding sites and any of the fungus that may be growing inside the wood. There are alternatives for disposing of diseased elms, though. The wood may be debarked and the logs then used for veneer, sawlogs, pellets, crating, firewood, or railroad ties. Elm may also be chipped and used for mulch, animal bedding, woodland trails, or pulp. Unfortunately, many communities do not have chippers or debarkers big enough to handle large logs. Elm logs may also be buried, though this disposal method requires a lot of landfill space.

Q. Why do we have to debark our elm firewood?

A. Debarking destroys the beetle's home. The eggs and young beetles live under the bark next to the wood where there is enough moisture, food, and protection for them to survive. When the bark is removed, the young beetles quickly die from lack of moisture. Chipping also promote drying and takes away space and food from the young beetles. Adult female beetles will not make breeding galleries if the wood area is too small.

CA, P-II P

ljc

Little Falls Transcript

Experience shows Dutch elm disease not always hopeless

Although people throughout Minnesota have been grappling with Dutch elm disease for nearly two decades, it still remains a widely misunderstood problem. Many myths about what causes the disease, how it spreads, and how to control it have been passed around.

The result has been that many people feel nothing can be done about Dutch elm disease, so there is no point in even trying to manage it. Past experiences have shown, however, that the situation is not hopeless, and that certain kinds of efforts can make a definite difference. This is the first part of a four-part series from the University of Minnesota Agricultural Extension Service, discussing some of the common questions about Dutch elm disease.

Q. Why is Dutch elm disease such a serious problem?

A. Dutch elm disease is such a serious problem because of the nature of the fungus that causes it and because of the nature of the "crop" affected by the disease—perennial trees. The fungus lives and multiplies within the water-conducting system of elm trees. This is a well protected environment, so neither environmental conditions nor chemicals applied externally can affect the growth of the fungus significantly. In addition, once in the tree, the fungus multiplies rapidly and is easily transported long distances within the branches and the trunk by water movement. Thus, it can take only a few hours for the infection to be distributed throughout the tree.

The fungus alone is not the reason why Dutch elm disease is such a big problem. Elm bark beetles have also been important because they carry the fungus from diseased to healthy trees. Two species of elm bark beetles lay their eggs beneath the bark of dead or dying elm trees. If those trees have died of Dutch elm disease, when the new adult beetles emerge and go to feed on healthy elms, they carry the fungus on their bodies. In feeding, the beetles chew through the bark, leaving openings where the fungus can enter the tree's vessels.

Still another reason why the disease has been so serious is because many elms were planted very close together along boulevards and other areas of many communities. When elms grow so close to each other, very often the roots of the different trees become fused. The fungus is very often transmitted through these "root grafts" from diseased trees to healthy trees.

Q. Do other insects spread Dutch elm disease?

A. In the United States, only two beetles have been proven to spread Dutch elm disease, the native elm bark beetle and the European elm bark beetle. The life cycles of both beetles are closely linked with elms; they feed and breed only on elms of all kinds. Other types of insects frequently found on or near elms may damage the trees in other ways, but they do not help spread Dutch elm disease.

Q. What is "beetle hitchhiking?"

A. Because of the current concern about energy conservation, more and more people are transporting firewood to use as fuel for their homes. Some of this firewood is elm which contains elm bark beetles and the Dutch elm disease fungus. When beetles are carried long distances in logs in various kinds of vehicles, this is known as "hitchhiking." It is believed that "hitchhiking" accounted for the spread of Dutch elm disease to Crookston and a number of other Minnesota communities.

Q. Can Dutch elm disease be spread by any means other than root grafts and elm bark beetles?

A. No. Beetle transmission and root grafts are the only ways that the disease is carried to healthy elms. Blowing wind does not spread the disease because the fungal spores cannot be transported by air. Smoke from fireplaces is also harmless to healthy elms because the fungus does not survive the burning process. Rain water leaching from an elm wood pile through the soil to the roots of healthy elms does not transmit the disease because the fungus cannot survive exposed in the soil.

Q. Can the elm bark beetles kill the tree?

A. No, beetles themselves do not kill elms. The native elm bark beetle was on our continent long before Dutch elm disease arrived and its activities did not kill elms. The European elm bark beetle came into the United States in 1909 and, likewise, has rarely damaged elms. American elms did not start dying in large numbers until the Dutch elm disease fungus arrived on veneer logs in 1930. Then, the beetle became carriers of the fungus and spread the disease when feeding on healthy trees. The beetles breed only on dead or dying elms, therefore their tunneling activity during breeding does not kill healthy trees.

Exhibit 6

Wadena Pioneer Journal

Common questions about Dutch elm disease

Q. Are there any chemicals which will stop Dutch elm disease?

A. Hundreds of chemicals have been tested against Dutch elm disease since it was first introduced into this country, but none have proven satisfactory. Chemicals have been sprayed on the leaves, painted on the bark, and incorporated into the soil to reach the root system, however, such approaches have done little to protect elm trees.

In addition, sometimes non-laboratory tested products have been used to control the disease. For example, "carpole," a fertilizer produced from ground carp, has been applied on healthy elms from an airplane. And, while the carpole helps elms to look greener and more vigorous, it cannot prevent a tree from becoming infected or repel the beetle. Similarly, injecting elms with vinegar or turpentine is a wasted effort. And, pounding zinc nails into a tree trunk will neither prevent the fungus from spreading within the tree nor release chemicals or nutrients to kill the fungus or make the tree more vigorous.

Q. What about injecting our elms with chemicals?

A. Two kinds of injection have been tried; to kill the fungus and to kill the bettle.

To date, the best fungicide for injection is Arbotect 20.S and Arbotect S. Both chemicals are registered with the EPA and may be used for protective or therapeutic treatments. Injections does not solve the problem though, and quite often fails to protect even healthy trees. In addition, such injection causes physical damage to the trees that may bring on other kinds of disease problems.

Systemic insecticides, such as Bidrin have also been inject into the trunks of elms. The chemical is transported inside the tree to its bark where it reduces the amount of feeding by the beetles. However, the chemical lasts only a few days and is poisonous to the tree even in low concentrations. And, a great deal of skill is required to inject it properly. the chemical is not registered with the EPA.

Another frequently mentioned insecticide, methoxychlor is sprayed on the tree trunk and limbs rather than injected. It is currently the only insecticide registered with the EPA for use against elm bark beetles. Unfortunately it is not very effective when used for this purpose. To kill beetles methoxychlor must enter their stomach before it can work and so does not kill the beetle quickly. This means that the beetle has time to chew through the bark and introduce the disease fungus into the tree's vessels. Methoxychlor can kill and repel bark beetles, but again, it is extremely difficult to apply st amounts uniformly thr tree.

Q. Is there a chemical spray on the wood ins debarking it?

A. No. Many peopl that it is possible to pentachlorophenol o wood instead of debar However, this chemic not kill the beetles in th it is not legal to use purpose and is hazar man and enviro Research is current derway to find a s secticide so that elm safely stored with the b on.

2. If you use a liquid starter, let it soak into the coals for a couple of minutes before igniting it. Avoid pouring more fluid on the coals once they're lighted - a vapor explosion is the possible result.

Use your outdoor grill away from flammable materials such as that stack of wood for next winter's fire or the gallon can of gasoline for you power

The Bill Smiths, Mike, and Brian and Alice and Smith visited at the (Bryce home Monday e and the company the Bryces, Jennifer and J Kansas, and the J Bryces, Jeff and Gine of also had birthday cake cream in honor of Lisa 4th birthday.

Tuesday evening, the

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TREE WATCH

Common Questions About Dutch Elm Disease -- Part 4

Q. Why are river bottoms and wild elm areas hazardous to a DED management program?

A. The banks of streams and rivers provide an especially good environment for elms and therefore many wild elms are found in such areas. Because these riverbanks are often quite steep, it is difficult to bring people and equipment in to remove diseased trees. And, in the absence of good sanitation efforts, Dutch elm disease can spread very rapidly, moving from elm to elm all along the river. When the river or stream runs through or near a town, there is an additional threat to the town elms from the diseased river elms.

Q. Can we have a good DED management program in our community when there are wild elm areas nearby?

A. Though managing Dutch elm disease is more difficult for communities threatened by wild elm population, it is possible to have an effective program. The elm bark beetles prefer to fly the shortest distances possible in search of trees in which to breed or feed. They will stay within a fairly localized area as long as these basic needs are being met. If there is no diseased or dead wood in a community to attract the beetles from the wild elm areas, these areas are not likely to pose a major threat.

Q. Are all elms doomed to die?

A. All kinds of elms are susceptible to Dutch elm disease, including American, slippery (red rock), Siberian, Chinese, Japanese, and other trees in the same family. However, in any plant disease epidemic there are always individual trees that manage to survive, and Dutch elm disease is no exception. There will always be a few elms that escape infection because as the dense populations of elms die off, the chances for remaining trees to become infected are reduced. Furthermore, some elms are resistant to the disease and may either escape it entirely or recover after infection. Control measures also sometimes protect elms from infection or help them to recover.

Q. Can we plant Dutch elm disease resistant elms now?

A. In communities where elms have been thinned out considerably by DED or other factors, it is possible to use resistant American or hybrid elms as replacement trees. However, resistant American elms, such as the "Urban" and "L'Assumption" are not immune to Dutch elm disease and so they always run the risk of being infected. The oriental elms, Japanese, Siberian, and Chinese, are moderately resistant. Crosses between these trees have produced the hybrid, "Sapporo Autumn Gold" which is highly resistant. However, because these trees are not native to the state, they are not well adapted to the harsh winters. Special attention needs to be given to their degree of winterhardiness before they are widely used in planting programs. The exotic elms which were introduced to the United States as shelterbelt trees are not immune to Dutch elm disease and not the best landscape trees. They are widely known for their relatively short life spans and low winter hardiness.

Whatever the choice for replacement trees, a town should be careful not to plant large numbers of any single kind of shade tree. There is safety in having a variety of trees since disease epidemics develop primarily when an area has many trees of the same kind.

Questions on Dutch elm disease asked

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MINNESOTA TREE LINE
Agricultural Extension Service
University of Minnesota

Shade Trees for West Central Minnesota

No. 13—1978
Jane McKinnon

Lakes and woods merge into prairie country in west central Minnesota. Before settlers came, mixed woods covered the eastern part of the region where yearly precipitation was slightly higher and lakes, marshes, and streams watered the land. Most of what is now Becker, Ottertail, Douglas, and half of Grant counties were native woods. Oaks grew over grass on the drier sites, and lake shores and stream edges supported elm, willow, and cottonwood wherever such moist sites occurred. But prairie grasses dominated the lands that became Clay, Wilkins, Traverse, Stevens, and Pope Counties. Trees were planted for communities and farmsteads as the prairie was opened for agricultural use.

Because of the general differences in soil and moisture conditions from east to west, and local changes in slope, exposure or soil drainage, trees must be selected with care for new plantings in western Minnesota. Trees chosen for dry land conditions must be different from those to be planted in poorly drained locations. Sites where soils are alkaline will not support trees requiring acid soils for iron uptake. Winter temperatures, drying winds, exposure to winter sun, summer heat and drought combine to limit tree species suitable for prairie locations. Sunscald is a common and serious problem in western Minnesota, therefore newly planted and thin-barked trees such as maple, linden, mountain ash, or flowering crabapples may need protection for five to seven years. This is done by wrapping trunks each fall until outer bark becomes rough and heavy. Planting thin-barked species where buildings or windbreaks shade trunks from the west and south also helps to avoid sunscald damage.

All tree plantings need care to become established, but a community tree program including several kinds of adapted trees has a better chance of long-term success. Pest epidemics may devastate a town planted with a single tree species, or severe weather at a critical time for a particular kind of tree may damage large numbers of that selection.

Shade trees described in this publication are examples of species and cultivars (cultivated varieties) that have succeeded in west central Minnesota. The brief descriptions of each tree's appearance, site preference, and common problems indicate that any tree may have advantages and disadvantages for a particular location. Winter hardiness, tolerance of heat and drought, mature size and shape, appearance of summer foliage and pest resistance are essential qualities to consider. Seasonal aspects of flowers, fruits, bark and winter silhouettes are pleasant extras.

Taking a critical tour of your own community to identify successful trees is a good way for you to begin your new planting plans. Further suggestions are available from the Agricultural Extension Service publications, The Minnesota Landscape Arboretum, your country Extension office and experienced nurserymen.

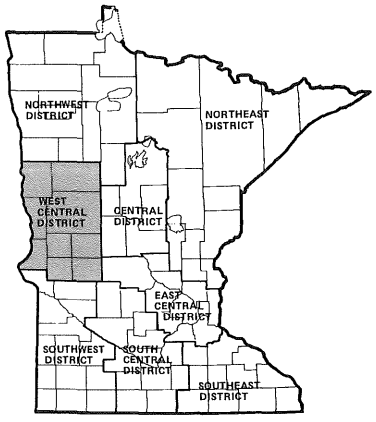
Silver Maple *(Acer saccharinum).* Silver Maple is an extremely large tree that grows throughout Minnesota except on dry or alkaline sites. It transplants easily and can be moved bare-root at sizes up to 2 inches in diameter. Leaves are light green in summer, silvery beneath, and light yellow in fall. Silver maple is a wide-spreading shade tree, but its rapid growth and open shape makes it subject to wind damage should storms occur. Silver Maple is best suited to parks and large properties open enough to accommodate its mature height and spread of 75 to 100 feet. These trees should not be used for street plantings unless they can be spaced 100 feet apart on wide boulevards or parkways without overhanging power lines.

Silver Maple develops a pale green to yellow summer color in alkaline soils that prevent uptake of iron. This chlorotic condition is common in many western Minnesota locations. Leaf galls caused by mites are also common, especially on young trees, but they do not seriously affect tree growth.

Sugar Maple *(Acer saccharum).* Sugar Maple is a native Minnesota maple, popular for its strong round-headed shape, attractive summer foliage and yellow orange or red autumn color. Sugar Maples are suitable for street and boulevard planting on fertile, moist, well-drained soil. Careful site selection, watering and fertilizing will adapt this species to many Minnesota communities if soils are not alkaline. Fertilizer and water also help to keep lawns growing under maple shade. Trees are winter hardy, but need protection from sunscald by wrapping young trunks. Verticillium wilt may kill trees under stress, thus good maintenance is important.

Ohio Buckeye *(Aesculus glabra)* is winter hardy in Minnesota, and tolerant of droughty soils. It is a good choice for public or private properties because of its medium height—25 to 50 feet— strong rounded shape and deep root system. Ohio Buckeye has showy cream-colored blossoms in spring, interesting light green compound leaves during the growing season, and a yellow to apricot autumn color. The large shiny brown buckeye seeds enclosed in a leathery hull mature in fall. Not all trees fruit heavily. Ohio Buckeye may be planted from seed, but are sold by nurserymen as balled and burlapped specimens or in containers. The long tap root makes bare-root transplanting difficult.

Hackberry *(Celtis occidentalis).* Hackberry is a sturdy, oval-crowned tree with a strong central trunk. Since leaves are similar in appearance to elm foliage, Hackberry has been used as a replacement for American Elm in street plantings for many years. Hackberry leaves are light green in summer, clear yellow in fall. Small purple fruit mature in late summer. These trees are winter hardy, drought resistant and are



suited to most Minnesota soils. However, hackberries may become established slowly after transplanting. They are best planted as small trees, 1½ to 2 inch caliper (diameter 6 inches above the ground) or smaller. Newly planted Hackberries should be staked, especially in windy locations. Leaf galls and clusters of small branches ("witches' brooms") are caused by psyllid insects and eriphyid mites, but this damage is not serious. Psyllids, however, may be annoying to people for a short time in late summer.

Russian Olive *(Elaeagnus angustifolia).* Russian Olive has long been used as a windbreak tree in western Minnesota, but with pruning of lower limbs it can develop as a handsome specimen for public or private grounds. It is not suited to narrow boulevard strips because of its irregular shape. However, Russian Olive is one of the fastest growing ornamental trees suited to the region, and its graceful gray-green foliage is attractive throughout the growing season. It matures to a height of about 25 feet, tall enough for shading a one-story house. Russian Olive is tolerant of dry and alkaline sites and is winter hardy. Verticillium wilt can kill Russian Olives when trees are infected. Watering, mulching and fertilizing trees planted for landscape use reduces loss from this disease.

Green Ash *(Fraxinus pennsylvanica)* **and its cultivars, Marshall's Seedless and Summit Ash.** Green Ash is the most widely planted shade and street tree replacement in Minnesota at present, but should not be used to the exclusion of other species in a neighborhood or community. Green Ash has a strong central trunk and a sturdy opposite branching habit. These trees are not suitable for pruning to an arching shape and attempts to shape boulevard ash trees to resemble elms will result in weak and broken limbs.

Green Ash leaves are compound, smooth and green on both surfaces. Fall color is brilliant yellow. Summit Ash is a straight-trunked erect form. Marshall's Seedless Ash is broader than other Green Ash, and has darker green, glossier leaves, especially clean and attractive throughout the growing season. Marshall's Seedless Ash is a male, budded selection and does not produce the winged seeds of female Green Ash trees. The seeds do, however, provide food for some winter birds and add landscape interest during leafless months.

Green Ash street planting, 30 years old.

Green Ash transplant easily and are tolerant of poor, droughty soils, although they are more vigorous on better sites. Their rather open shade allows good lawn growth beneath. Ash plant bugs or aphids can cause distorted and discolored foliage, but do not seriously damage trees. Developing male flowers can become enlarged through feeding by a mite. The resulting flower galls harden and turn black in the fall. Trees are seldom danaged by the galls, although green foliage can be reduced. Young ash trees may be sprayed to protect against all of these pests if noticeable infestations occur.

Flame and Red Splendor Flowering Crabapples *(Malus* hybrids). These two varieties of Flowering Crabapples grow to a height of 25 feet, and are large enough to serve as small shade trees. Flame blooms white in spring, Red Splendor is purplish-pink. Fruit of both is bright red, but Flame produces a larger crabapple than does Red Splendor, whose small red apples hang through the winter until eaten by birds. Fruits of Flame drop in the fall, thus it should not be planted near a sidewalk.

When used as shade trees, Flowering Crabapples should be interspersed with other species to reduce the risk of fireblight infection, cankerworms and other apple pests. Cultural practices to reduce damage from diseases and insects affecting apples should be followed. Young crabapple trees must also be protected from sunscald and animal damage.

Ironwood or Hop Hornbeam *(Ostrya virginiana).* Ironwood is a medium-sized tree native to most of Minnesota. It matures to 40 feet, with medium green foliage similar in appearance to that of the elm. Fall color is golden yellow, fruits are hoplike. Ironwood is extremely pest resistant, and adapts to many kinds of soils and sites. It is attractive when grown as a single specimen or in clump form. Ironwood is not yet available in large numbers in Minnesota nurseries, but transplanting small trees from the wild is a possibility.

Bur Oak *(Quercus macrocarpa).* Bur Oak is native to west Minnesota and many handsome specimens grow along the slopes of rivers and streams. Minnesota nurseries are beginning to offer small specimens in containers, since large oaks are difficult to transplant. Bur Oaks are hardy, resistant to weather damage, and their rugged shape and corky bark is attractive at all seasons of the year. Since oak wilt is a problem in the state, no oaks should be planted near existing oaks where the disease is present. Oaks are subject to insect-induced leaf and twig galls, but these galls rarely affect a tree's vigor.

Japanese Tree Lilac *(Syringa reticulata,* formerly *Syringa amurensis japonica).* Japanese Tree Lilac matures to a height of 25 feet, and is usually grown in clump form. Pruning lower branches allows the tree to be used near sidewalks, and it is low enough to be grown under utility wires. Japanese Tree Lilac is winter-hardy in Minnesota and adapted to soils with high lime content. It has no serious pests. Summer foliage is clean, medium green, and large trusses of cream-white flowers appear early in the season. Seed pods persist through winter months, and their bright brown color contrasts with the shiny black bark of trunks and larger branches.

American Linden, Basswood *(Tilia americana).* American Linden is a winter-hardy, native tree, growing to a mature height of 50 to 75 feet. American Linden may develop with several stems, or single trunk specimens can be maintained by pruning when young. Mature American Linden are often strongly columnar in shape. Leaves are large, heart-shaped, deep green in summer, turning gold in autumn.

American Linden prefers moist, fertile soil, but adapts to most locations in Minnesota, given reasonable care. Young trees must be protected from sunscald. Cankerworms and spiny elm caterpillars are common insect pests. Neither causes substantial harm, although cankerworms can cause spring defoliation. In hot dry summers, leaf scorch is common on small trees.

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Roland H. Abraham, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55108. The University of Minnesota, including the Agricultural Extension Service, is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, creed, color, sex, national origin, or handicap.

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FERGUS FALLS DAILY
JOURNAL—Otter Tail Co.
MAY 3-

replacement trees wisely

The tree crew took away your favorite elm late last summer, and now that the snow has finally melted, your front yard seems like an empty Minnesota prairie.

Your first impulse is to rush down to a local nursery or garden shop and buy whatever replacement trees are readily available. A second thought you have is to try and transplant some of those small, wild trees you saw growing on a friend's farm.

However, both of these moves could turn out to be a waste of time and energy. Not all trees will grow equally well in all parts of the state, nor do well in all spots in a community. Extension specialists at the University of Minnesota say that, for the best results, you should do a little investigating and planning before you plant anything.

"Choosing trees for long-term landscape value is not easy," says Jane McKinnon, extension horticulturalist. "Although there may be many tree species suitable for planting within a community, each species or cultivar (cultivated variety) may have advantages or disadvantages for a particular site. Trees chosen to replace those that have been lost or for new landscape plantings should be selected considering hardiness, pest resistance, ease of handling and maintenance, ultimate size and shape, rate of growth, and especially the quality of summer foliage."

In the past, many of these factors were not given serious consideration. Today, evidence of poor planting decisions can be found in nearly every Minnesota community. Some trees have been brutally pruned because attention was not given to their mature size when they were planted. Others waste away because of salt damage, and still others litter sidewalks with messy leaves, twigs, or fruit. A few minutes of discussion with a nurseryman or other professionals could have helped to avoid these kinds of problems.

McKinnon points out that there is no single perfect tree for all situations and emphasizes the importance of planting a well designed mix of trees in a community. "Having different kinds of trees is important because it provides variety to the landscape as well as protection from pest epidemics or weather injuries that might affect a particular species," she notes.

One of the best things you can do to determine what kinds of trees are likely to grow well in your area is simply to look around your community. Try to find healthy trees of various kinds and look for these trees of different ages and in different locations. This should give you a pretty good idea of what will work well in your particular situation.

An extremely important factor in selecting trees in Minnesota is hardiness. Because this state has such a harsh climate, a particular species' ability to withstand extreme temperature fluctuations must be taken into consideration. Though a certain tree may be able to survive all parts of the state, temperature differences, between rural and urban areas for example, may mean dramatic differences in a tree's vigor and thus, appearance. There are four distinct "hardiness zones" in Minnesota. Again, a local nursery is a good source of information about what trees will do well in which zones.

Below is a partial list of species recommended by the Agricultural Extension Service for west central Minnesota. County extension offices can provide more detailed information on any of the species mentioned.

AMERICAN LINDEN (Basswood)—a winter hardy, native tree which grows to a mature height of 50 to 75 feet; leaves are large, heart-shaped, and deep green in summer, turning golden in autumn; fragrant blossoms appear early in summer.

BURROAK—native to southwest Minnesota; hardly, resistant to weather damage; rugged shape, corky bark attactive during all seasons; susceptible to oak wilt and insect-induced leaf and twig galls.

FLAME and RED SPLENDOR CRABAPPLE—grow to a height of 25 feet and can serve as small shade trees; flame blooms white in spring; red splendour is purplish-pink; fruit of both is bright red, but flame produces the larger crabapple; fruits of flame drop in the fall, while those of red splendour hang throughout the winter.

GREEN, MARSHALL'S SEEDLESS and SUMMIT ASH—trees are not suitable for pruning into an arching shape; compound leaves which are smooth and green on both surfaces; fall color is brilliant yellow; trees transplant easily and are tolerant of poor, droughty soils.

HACKBERRY—sturdy, oval-crowned tree with strong central trunk; leaves similar in appearance to elm foliage; light green leaves in summer, clear yellow fruit in fall; small purple fruits mature in late summer; trees are winter hardy and drought resistant and are suitable to most Minnesota soils; they establish slowly after transplanting: one-and-a-half to two-inch caliper best for planting.

IRONWOOD—medium tree native to most of Minnesota; matures to 40 feet; medium green foliage similar to elm; fall color is golden yellow; fruits are hoplike; extremely pest-resistant and adapts to many kinds of soils and sites.

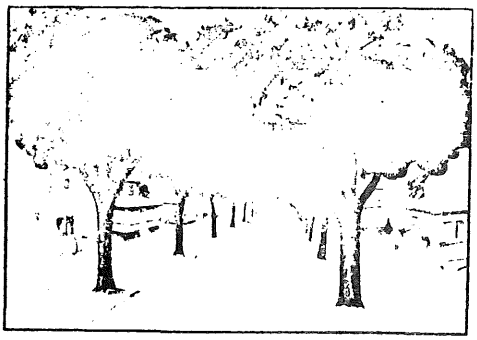
JAPANESE TREE LILAC—matures to height of 25 feet; usually grown in clump form; low enough to be grown under utility wires; winterhardy in Minnesota and adapted to soils with high lime content; no serious pests; summer foliage is clean, medium green; large trusses of cream-white flowers appear early in the season; seed pods persist through winter.

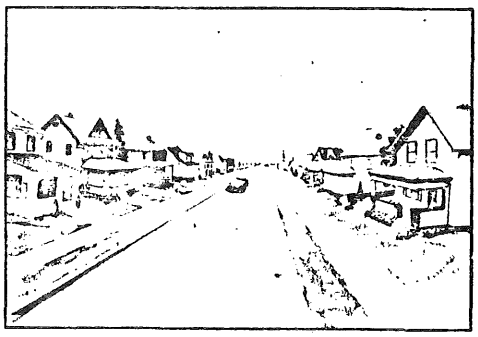
OHIO BUCKEYE—winterhardy in Minnesota and tolerant of dry sites; mature height is 25 to 50 feet with strong rounded shape and deep root system; showy cream-colored blossoms in spring, interesting light green compound leaves during growing season and yellow-to-apricot autumn color; large, shiny brown buckeye seeds inclosed in a leathery hull mature in fall.

RUSSIAN OLIVE—long used as a windbreak tree, this tree is not suitable for boulevard strips. Graceful, gray-green foliage. Matures to height of 25 feet; tolerant of dry, alkaline sites; winterhardy, but susceptible to verticillium wilt.

SILVER MAPLE—extremely large tree that grows throughout Minnesota except on dry or alkaline sites; transplants easily; leaves are light green in summer, silvery beneath, and light yellow in the fall. Best suited to parks and large properties, because the mature height is 75 to 100 feet.

SUGAR MAPLE—strong, round-headed shape, attractive summer foliage, with yellow, orange or red autumn color. Suitable for street or boulevard plantings on fertile, moist, well-drained soil; winterhardy, but young trees need protection from sunscald.





Elm-shaded boulevards, top left, can turn into treeless plains, right, as Dutch Elm disease threatens the species; replacement plantings' bottom left, provide privacy and shade.

One final comment on the public use of the mass media information prepared at the University of Minnesota is that much of the material has appeared in other states' publications.

IV. Project Assessment

The budgeted amount of money Minnesota communities involved in Dutch Elm Disease/Shade Tree Management were to spend in 1979 was about 25×10^6 dollars. This is based on estimated losses and projected removal costs. Human and environmental factors reduced disease losses in communities with management efforts, while disease losses continue to be high in non-managed areas. The nature and importance of all the factors involved in reducing elm losses are not clearly known or understood. Certainly better public understanding of Dutch Elm Disease Management efforts by communities and the public involvement in community Dutch Elm Disease Management contribute to the drop in disease rate. On the other hand, severe winters also reduce the beetle vector and this may thus lower disease losses. Who knows what factors are most important?

Interest in shade trees and diseases has increased as is evident by numerous phone calls, mail requests, radio and TV messages, personal contacts and community involvement (survey, removal, disposal, utilization, pruning therapeutically, and even chemical injection and tree spraying). Certainly this does reflect greater public awareness of shade trees. Has the Federal Demonstration and Utilization Project done this? Certainly it is a significant part of the shade tree activities in Minnesota. Is the program effective? Certainly not all communities have decided to develop a shade tree

program or even a Dutch elm disease management plan. Some individuals at the County Extension Staff level don't see trees as important and the public attitudes of "we all know about Dutch Elm Disease" or "you can't stop it anyway" or "we know what to do", still prevail in many areas. Yet more and more communities are asking for help and will begin a shade tree program or at least examine what the community tree resources are and what it costs to manage them. Other communities have examined their efforts as reduced losses do appear desirable and the beauty of new trees does attract public interest in shade trees as a community resource, however, the high cost may mean limited efforts.

V. Project Supported Activities

PUBLICATIONS

Tree Line -- Shade Trees for Central Minnesota
Tree Line -- Pruning Evergreens
Tree Line -- Transplanting Trees from the Wild
Tree Line -- Urban Inventory Systems
Tree Line -- Portable Debarker for Elm Wood
Tree Line -- Deciduous Defoliators
Tree Line -- Conifer Defoliators
Tree Line -- Sap Sucking Insects
Tree Line -- Wood Boring Insects
Tree Line -- Leaf Mining Insects
Tree Line -- Diagnosing Disease Problems
Folder -- How to Inject Elms with Systemic Fungicides
Folder -- Dutch Elm Disease Symptoms (Color Flyer)
Folder -- An Integrated Approach to Dutch Elm Disease Management
Folder -- Shade Tree Management in Minnesota Communities
Folder -- Landscape Design Services in Minnesota
Folder -- Diseases of Replacement Trees
Folder -- Iron Deficiency of Trees
Bulletin -- New Shade Tree Resource List
Folder -- Techniques for Debarking Elm Wood
Tree Line -- Identifying Elm Wood
Folder -- Leaf Spot Diseases of Deciduous Trees
Bulletin -- Planting Trees in Minnesota
Bulletin -- Evergreens
Bulletin -- Woody Plants for Minnesota
Tree Line -- Cankerworms
Tree Line -- Scale Insects
Tree Line -- Drying Elm Lumber
Tree Line -- Portable Bandmill
Tree Line -- Specifications for Sawlogs

Tree Line -- Shade Trees for Northern Minnesota
Tree Line -- Fertilizing Shade Trees
Tree Line -- Protecting Trees Against Winter Damage
Folder -- Planting Landscape Trees

AUDIO VISUAL

Signs for Tree Tour
Injection slide set
Publication rack and tables
Insects of Shade Trees
Diseases of Shade Trees
Oak Wilt slide set
Dutch elm disease symptoms

MEETINGS

Plant Pathology and Entomology Combined

March 8, 1979 -- St. Cloud
March 27, 1979 -- Little Falls) radio talk shows, consulting training
March 28, 1979 -- Fergus Falls) and technical advice
March 29, 1979 -- Litchfield - met with High school teacher and Litchfield Chamber of Commerce Chairwomen
April 9, 1979 -- Litchfield - Teaching Senior High School students
April 19, 1979 -- Wadena
April 23, 1979 -- Litchfield - Appeared on radio talk show
April 23, 1979 -- Little Falls
April 24, 1979 -- Granite Falls - High school presentation and laboratory
April 25, 1979 -- Granite Falls session
April 24, 1979 -- Fergus Falls
April 25, 1979 -- Wadena
April 30, 1979 -- Wadena
May 1, 1979 -- Fergus Falls
May 8, 1979 -- Hutchinson - Met with High School teacher to arrange presentations
May 9, 1979 -- Hutchinson - presentations of High School students
May 29, 1979 -- Little Falls - public meeting to organize "elm watch" groups
May 29, 1979 -- Little Falls - Tree watch
June 1, 1979 -- Fergus Falls
June 6, 1979 -- Little Falls
June 7, 1979 -- Wadena
June 13, 1979 -- Tree Inspectors workshop, St. Paul
June 14, 1979 -- Tree Inspectors workshop, St. Paul
June 19, 1979 -- Wadena
June 20, 1979 -- Fergus Falls
June 16, 1979 -- Wadena - Consult with tree inspector on elm problems (DED, native wilt, etc.)
June 16, 1979 -- Wadena
July 18, 1979 -- Hutchinson, Litchfield - Consult with tree inspector, city foresters on elm and other tree disorders
July 24, 1979 -- Fergus Falls
July 27, 1979 -- Little Falls
August 1, 1979 -- Hutchinson - consulted with tree inspectors on injection and root graft barriers

August 6, 1979 -- Granite Falls - consulted with tree inspectors on tree injection and other elm disorders
August 13, 1979 -- Fergus Falls - consult on tree injection and other elm disorders
August 13, 1979 -- Wadena
August 14, 1979 -- Fergus Falls - consult on tree injection and other elm disorders
August 19, 1979 -- Hutchinson - visit the DED display at Co. fair and man the DED booth for an afternoon
August 29, 1979 -- Little Falls
August 30, 1979 -- Fergus Falls
September 5, 1979 -- Hutchinson, Granite Falls, Litchfield - visited southern towns to assess the DED program effectiveness and needs
September 18, 1979 -- Little Falls
September 19, 1979 -- Wadena
September 25, 1979 -- Fergus Falls

PERSONNEL

Dr. Mark Ascerno
Dr. William Phillipsen
Ms. Linda Camp
Dr. Asimina Gkinis
Dr. Ward Stienstra
Mr. Harlan Petersen
Dr Lewis Hendriks
Dr. Randolph Cantrell
One clerical position

COOPERATORS

University of Minnesota - Extension Faculty

State Staff
Field Staff

University of Minnesota - Research Faculty

Minnesota Depatment of Natural Resources

Minnesota Department of Agriculture

Cooperating Communities

VI. Budget Information

A. Expenditures: 10-1-78 - 9-30-79

Salaries	$ 94,732.63
Travel	4,949.68
Supplies	497.51
Printing	212.13
Fringe	1,713.07
Services	174.00
	$102,279.02

Encumbrances: 9-30-79

Supplies	$ 3,643.54
Printing	20,000.00
	$ 23,643.54
TOTAL	$125,922.56

B. Projected Budget

Salary	$ 89,414.00
Fringe	13,500.00
Travel	5,000.00
Publications and training aids	15,000.00
Supplies	10,000.00
Equipment	5,000.00
TOTAL	$137,914.00

Appendix

INDEX

1. Shade Tree Resources
2. Municipal Tree Inspector's Workshop
3. Special Training Program
4. Tree Inspector Training Session on St. Paul Campus
5. "A windshield Tour of Trees"
6. Dutch Elm Disease Display
7. Elm Tree Injection Slide Set and Syllabus
8. How to Inject Elms with Systemic Fungicides
9. Leaf Spot Diseases of Deciduous Trees

SHADE TREE RESOURCES
from the
Agricultural Extension Service
University of Minnesota

PUBLICATIONS

Available from the Agricultural Extension Service; contact:

Bulletin Room
Room 3, Coffey Hall
1452 Eckles Avenue
University of Minnesota
St. Paul, Minnesota 55108

Tree Disease Detection and Control

Tree Line 4. "Root Graft Spread of Dutch Elm Disease and Its Control" by John Mizicko and Ward Stienstra. (1977) Includes description of root grafts, how Dutch Elm disease spreads through roots, controlling root graft spread through soil trenching, soil fumigation, and other methods. Illustrated with drawings and photos. (2 pages)

Tree Line 5. "Dutch Elm Disease—Community Experiences" by Ward Stienstra. (1977) Includes brief historical information on the disease, statistics on cities with and without disease control programs, descriptions and impacts of sanitation efforts. (2 pages)

Tree Line 6. "Dutch Elm Disease Detection" by John Mizicko and Ward Stienstra. (1977) Gives rationale for detection efforts, describes ground survey and aerial survey techniques and the advantages and disadvantages of each, combination surveys, and the importance of sanitation programs. (2 pages)

Tree Line 8. "Tree Injection" by Ward C. Stienstra, David W. French, and Mark Stennes. (1978) Discusses various aspects of tree injection and circumstances under which it is appropriate. Includes description of specific tree injection procedures with drawings to illustrate apparatus and techniques. (2 pages)

Tree Line 22. "Noninfectious Diseases of Trees" by Ward Stienstra. (Revised 1978) Describes different kinds of diseases, including those related to high temperatures, low temperatures, water-related, mechanical injury, and chemical damage. Useful for people who are involved in replanting efforts. (2 pages)

Tree Line 24. "The Bronze Birch Borer" by Mark E. Ascerno. (1979) Discusses the bronze birch borer and its effect on birch trees. Explains borer life cycle and how it causes damage to trees. Includes suggestions for damage prevention as well as photos of the borer and typical borer damage to trees.

Miscellaneous Report 118. "Oak Wilt in Minnesota, 1972" (Agricultural Experiment Station) by D.W. French and Dale Bergdahl. (1973) Technical report on oak wilt; symptoms, distribution of the disease in Minnesota, brief disease projections. Not for the general public. (8 pages)

Miscellaneous Report 146. "Dutch Elm Disease Projections in Minnesota" by Robert Shrum and David French. (1977) More technical than publications previously mentioned. Discusses Dutch Elm disease problems in several communities and sanitation efforts. Graphs and tables included showing projected progression of the disease under different sanitation conditions, as well as cost projections for sanitation efforts. (6 pages)

Extension Folder 211. "The Dutch Elm Disease" by David W. French, Mark E. Ascerno, and Ward Stienstra. (1977) Gives historical background of Dutch Elm disease, symptoms and causes. Discusses transmission by beetles and root graft transmission, sanitation procedures, control methods, disposal prevention of root graft spread, pruning diseased trees, insecticides, fungicides, detection, and recommended trees for replanting in Minnesota. (16 pages)

Extension Folder 310. "Oak Wilt" by D.W. French and Ward C. Stienstra. (Revised 1978) Gives background on oak wilt, symptoms and causes, with color photos to illustrate. Describes how the disease is spread, how it can be detected and control techniques. (6 pages)

Extension Folder 401. "How's Your DED/ST I.Q.?" (1978) Contains a quiz on ten basic points about Dutch elm disease and shade trees with responses. An eye-catching, basic informational piece. (flyer)

Tree Selection

Tree Line 1. "How to Buy a Tree" by Jane McKinnon. (1977) Includes description of ways trees are sold in nurseries, tree size grades, and other purchasing information. Also discusses using trees growing in the wild for planting. (2 pages)

Tree Line 2. "Shade Trees for East Central Minnesota" by Jane McKinnon. (1977) Discusses tree species most appropriate for replanting in the East Central District of Minnesota. Includes detailed descriptions of each specie mentioned. (2 pages)

Tree Line 7. "Shade Tree for Southeastern Minnesota" by Jane McKinnon. (1977) Discusses tree species most appropriate for replanting in the Southeastern District of Minnesota. Includes detailed description of each specie mentioned. (2 pages)

Tree Line 12. "Shade Trees for Southwestern Minnesota" by Jane McKinnon. (1978) Discusses tree species most appropriate for replanting in the Southwestern District of Minnesota. Includes detailed descriptions of each specie mentioned. (2 pages)

Tree Line 13. "Shade Trees for West Central Minnesota" by Jane McKinnon. (1978) Discusses tree species most appropriate for replanting in the West Central District of Minnesota. Includes detailed descriptions of each specie mentioned. (2 pages)

Tree Line 14. "Shade Trees for Northeastern Minnesota" by Jane McKinnon. (1978) Discusses tree species most appropriate for replanting in the Northeastern District of Minnesota. Includes detailed descriptions of each specie mentioned. (2 pages)

Tree Line 16. "Shade Trees for North Central Minnesota" by Jane McKinnon. (1978) Discusses tree species most appropriate for replanting in the North Central District of Minnesota. Includes detailed descriptions of each specie mentioned. (2 pages)

Tree Line 18. "Shade Trees for Northwestern Minnesota" by Jane McKinnon. (1978) Discusses tree species most appropriate for replanting in the Northwestern District of Minnesota. Includes detailed descriptions of each specie mentioned. (2 pages)

Tree Line 23. "Shade Trees for South Central Minnesota" by Jane McKinnon. (1978) Discusses tree species most appropriate for replanting in the South Central District of Minnesota. Includes detailed descriptions of each specie mentioned. (2 pages)

Horticulture Fact Sheet 22. "Street Trees for Minnesota" by M. C. Eisel. (1977) Discusses important considerations in selecting trees for street plantings, tips on care of plantings, and gives lists of trees suitable and not suitable for street plantings. Includes map of tree hardiness zones. (2 pages)

Extension Folder 298. "Fitting Trees and Shrubs into the Landscape" by Mervin Eisel. (1974) Discusses trees commonly used in landscape plantings. Includes detailed lists of trees with color and height indicated to facilitate planning. (6 pages)

Extension Folder 445. "Shade Tree Evaluation" by Patrick J. Weicherding. (1978) Tells how to assess the economic value of various shade trees. Discussion is supplemented with step-by-step examples. Includes tables to help make calculations. Intended for professionals and not the general public. (4 pages)

Tree Planting and Care

Tree Line 3. "How to Plant a Tree" by Harold Scholten. (1977) Step-by-step planting procedures described and illustrated with drawings. Instructions summarized at the end. (2 pages)

Tree Line 15. "Fertilizing Shade Trees" by Richard Rideout. (Revised 1978) Discusses the importance of fertilizing, what fertilizer to apply, when to fertilize, and several fertilizing techniques. (2 pages)

Tree Line 17. "Protecting Trees and Shrubs Against Winter Damage" by Richard Rideout. (1978) Describes types of winter damage and symptoms, including sun scald, browning of evergreens, die back, root injury, heaving, and rodent damage. Gives details on how to protect trees. Diagrams illustrate. (2 pages)

Tree Line 19. "Minimizing Salt Injury to Shade Trees" by Patrick J. Weicherding. (1978) Describes how salt injures shade trees, symptoms of such injury and ways to minimize damage. Includes a chart showing the relative salt tolerance of various shade and ornamental trees. (2 pages)

Tree Line 20. "Trees for Modifying Home Energy Consumption" by Patrick J. Weicherding. (1978) Discusses how to plant trees around the home for maximum temperature control throughout the year. Includes description of the home heat exchange process role of trees in heat exchange, and planting hints for homeowners for year-round energy conservation. (2 pages)

Tree Line 21. "Protecting Shade Trees from Construction Damage" by Patrick J. Weicherding. (1978) Describes the kinds of damage that typically occurs to trees near areas where construction is underway. Tells how to diagnose construction damage and gives tips on preventing damage, such as controlling traffic, caring for tree roots, watering and pruning. Detailed diagrams. (2 pages)

Extension Folder 402. "Planting Landscape Trees" by Richard Rideout. (1978) A detailed discussion of the techniques for planting small shade trees. Describes ways trees are sold, pruning, staking, preparing the planting hold. Line drawings illustrate techniques described. (6 pages)

Using Diseased Wood

Tree Line 9. "Drying Elm Lumber" by Thomas Milton. (1977) Makes the point that wood from diseased elm trees can be a useful resource. Describes elm wood characteristics and uses, seasoning elm lumber by air drying and by kiln drying. Illustrated with drawings and photos. (2 pages)

Tree Line 10. "The Portable Bandmill for Sawing Diseased Elm and Oak" by Dennis Dark. (1977) Discusses use of portable bandmill in tree sanitation programs, sawing wood into lumber or ties. Talks about conventional sawmills and their disadvantages, how the portable bandmill works, its advantages and disadvantages. Includes price tables for hardwood lumber and ties. (2 pages)

Tree Line 11. "Basic Specifications for Elm Sawlogs" by Lewis Hendricks. (1977) Includes description of sawlogs, hardwood log-use classes and practices in Minnesota. Includes tables of standard grades and information on sanitation measures. (2 pages)

Extension Bulletin 412. "Utilizing Diseased Elm in Minnesota" by Dennis M. Dark. (1978) Discusses the ways in which diseased elm wood may be used in different wood products. Describes basic elm wood characteristics, log specifications, solid wood, veneer, roundwood and fuelwood products. Describes deterrents to marketing and potential solutions. Appendix lists sawmills in Minnesota that use elm logs. (20 pages)

FILMS

Films and slide programs may be borrowed by contacting:

Audio Visual Scheduling
442 Coffey Hall
1452 Eckles Avenue
University of Minnesota
St. Paul, Minnesota 55108

Rental price for non-Extension groups is listed at the end of descriptions below.

No. 3111. "Dutch Elm Disease" (10 min., color, Sly Fox Films, 1976) Using a series of still images, this film outlines the origin and spread of Dutch elm disease. It discusses actions to be taken to help curb the spread of the disease. General in its approach, the film is useful for opening community discussions. ($4.50 rental for non-Extension)

No. 3577. "Time for Decision" (10 min., color, Iowa State University, 1967) This film shows three steps in the control of Dutch elm disease: sanitation, preventing root graft transmission, and chemical treatment. Explains each step as well as the life history of the beetle which carries the fungus causing the disease. Focus is on experiences of communities in Iowa. Excellent for community groups. ($7.50 rental for non-Extension)

PUBLICATIONS

Tree Line 25. "Identifying Elm Firewood" by William Phillipsen and Harlan Petersen. (1979) Discusses the significance of elm firewood piles in the spread of Dutch elm disease. Gives characteristics of elm wood so people can identify it easily. Photos illustrate characteristics. (2 pages)

Extension Folder 488. "Leaf Spot Diseases of Deciduous Trees" by Asimina Gkinis. (1979) Describes conditions under which leaf spots develop and general characteristics of leaf spot diseases. An extensive chart gives information about leaf spot diseases of various trees, including cause of infections and control measures. (6 pages)

Extension Folder 504. "How to Inject Elms With Systemic Fungicides" by Asimina Gkinis, Mark Stennes, and Linda J. Camp. (1980) A practical guide to injecting elm trees. For general public. Discusses how to select a tree to inject, when to inject, equipment and chemical needed, and step-by-step injection instructions. Many illustrations. (To be used in conjunction with slide set #333 "Elm Tree Injection") (6 pages)

SLIDE SETS

No. 333. "Elm Tree Injection" (Asimina Gkinis, assistant extension plant pathologist; Mark Stennes, graduate assistant, Plant Pathology; and Linda J. Camp, extension communicator, University of Minnesota. 55 slides, color, cassette tape—automatic, inaudible 1000 Hz pulses, 14 min.) Gives detailed information on how to inject elms with systemic fungicides to protect them against Dutch elm disease. Goes through the injection process step-by-step. Describes equipment needed, explains how to calculate the solution, and shows how to set up and use the injection apparatus. Also discusses how to select appropriate trees for injection. For the general public. (Folder 504. "How to Inject Elms With Systemic Fungicides" must be used with this slide set.)

SIGNS

A collection of signs is available for people interested in conducting "tree tours" of various kinds. Twenty-six species are included. The sturdy, wooden signs measure 1' by 2' and are mounted on 18" wooden stakes so signs can be placed in the ground. Black lettering on bright yellow background makes signs easy to read from a distance of up to 75 feet away. Two copies of some signs, 3 copies of others, are available. May be borrowed for up to two weeks through: Audio Visual Scheduling, Room 1 Coffey Hall, University of Minnesota, 1420 Eckles Ave., St. Paul, MN 55108. A complete list of the signs is available from Audio Visual Scheduling.

No. 3059. "The Urban Forest" (15 min., color, Kansas State University, 1976) Explains the need for proper forest management in urban areas. Stresses development of permanent urban community forestry programs in cooperation with state and extension forestry departments. Looks at some successful community programs. For adolescent or adult audience. $4.50 rental for non-Extension)

SLIDE SETS

No. 133. "Shade Trees for Southern Minnesota" (Jane McKinnon, extension horticulturist, University of Minnesota. 44 slides, color, cassette tape—automatic, inaudible 1000 Hz pulses, 22½ min.) Suggests a variety of shade trees to plant to replace lost elms most suited to the southern part of Minnesota. Includes information on care of trees and gives hints on landscaping. (1977) ($3.00 rental for non-Extension)

No. 120. "Dutch Elm Disease in Minnesota" (John R. Mizicko, assistant specialist, pesticide training; Ward Stienstra, extension plant pathologist; and Mark Ascerno, extension entomologist, University of Minnesota. 63 slides, color, cassette tape—automatic inaudible 1000 Hz pulses, 19 min.) Covers the development of Dutch elm disease in the United States, and particularly in Minnesota. Includes its causes, symptoms, spread, and control. Describes the life cycles of the fungus and elm bark beetles, and explains their interaction with one another in the disease complex. Discusses all phases of disease control which are commonly practiced. For use with the general public, but has enough detail to be useful in training tree inspectors and others involved in Dutch elm disease detection and control. (1977) ($3.00 rental for non-Extension)

No. 223. "Shade Trees for Minnesota" (Jane McKinnon, extension horticulturalist, 80 slides, script) Discusses trees which may be suitable for replacing lost elms. Gives examples of large, medium, and small trees and discusses whether they are appropriate for home landscaping purposes or better suited to parks, boulevards, or other public locations. Includes details on how trees are sold, care, and placement of new trees. Designed so set may be used in its entirety or in sections.

DISPLAYS

To reserve a display contact:

Joe Jovanovich
Room 1, Coffey Hall
1452 Eckles Avenue
University of Minnesota
St. Paul, Minnesota 55108
(612) 373-1254

Dutch Elm Disease Displays. These are portable, table-top displays on Dutch elm disease. Color photographs illustrate disease symptoms, spread of the disease and proper sanitation techniques. They are accompanied by Dutch elm disease "I.Q. Test" flyers for public distribution. Ideal for placement in public places such as banks, libraries, and at county fairs. They are easily assembled and transported. (48" high, 90" wide, and 10" deep when assembled, folds to 48" x 48" x 5", weight, approx. 70 lb.)

Municipal Tree Inspector's Workshop

Who: Municipal Tree Inspectors

Why: The Shade Tree Program Office of the Minnesota Department of Agriculture will recertify inspectors attending this workshop. To maintain certification, Minnesota state law requires each municipal tree inspector to attend one approved program of continuing education each year. This workshop is approved by the Commissioner of Agriculture and it will be the only one offered in 1979 to meet this requirement. It will also provide new inspectors with the opportunity to obtain their original certification.

Date	Location
March 5	Rochester — Midway Motor Lodge
March 7	North Mankato — Holiday Inn
March 12	St. Paul — Earle Brown Continuing Education Center, St. Paul Campus, University of Minnesota (park on State Fairgrounds)
March 19	Marshall — Ramada Inn
March 20	Detroit Lakes — Holiday Inn
April 4	Grand Rapids — Holiday Inn

Fee:

$3.00 per person, includes instructional materials and coffee. There will be no charge for those taking the test.

Registration:

There will be no advance registration by mail or telephone. Registration will be at the door beginning at 12:30 p.m. at each location.

Program, Shade Trees:

p.m.

12:30	Registration
1:00	Planning and Selection — Richard Rideout
1:40	Diseases — Asimina Gkinis
2:20	Insects — William Phillipsen
3:00	Refreshment Break
3:15	'79 Rules and Regulations — Dwight Robinson
3:30	Review for Certification Exam — Dwight Robinson
4:15	Test — for people not certified

Who's Who

Eugene Anderson, Assistant Professor and Extension Specialist Program Development, Office of Special Programs, University of Minnesota

Asimina Gkinis, Assistant Extension Specialist, Department of Plant Pathology, University of Minnesota

William Phillipsen, Assistant Extension Specialist, Department of Entomology, Fisheries and Wildlife, University of Minnesota

Richard Rideout, Assistant Extension Specialist, Department of Horticultural Science and Landscape Architecture, University of Minnesota

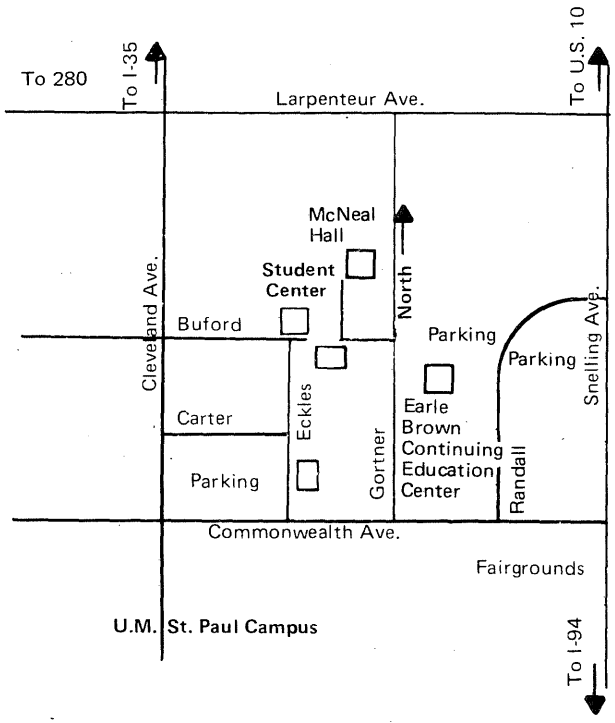
Dwight Robinson, Plant Health Specialist, Shade Tree Program, Department of Agriculture, State of Minnesota

Ward Stienstra, Associate Professor and Extension Plant Pathologist, Department of Plant Pathology, University of Minnesota

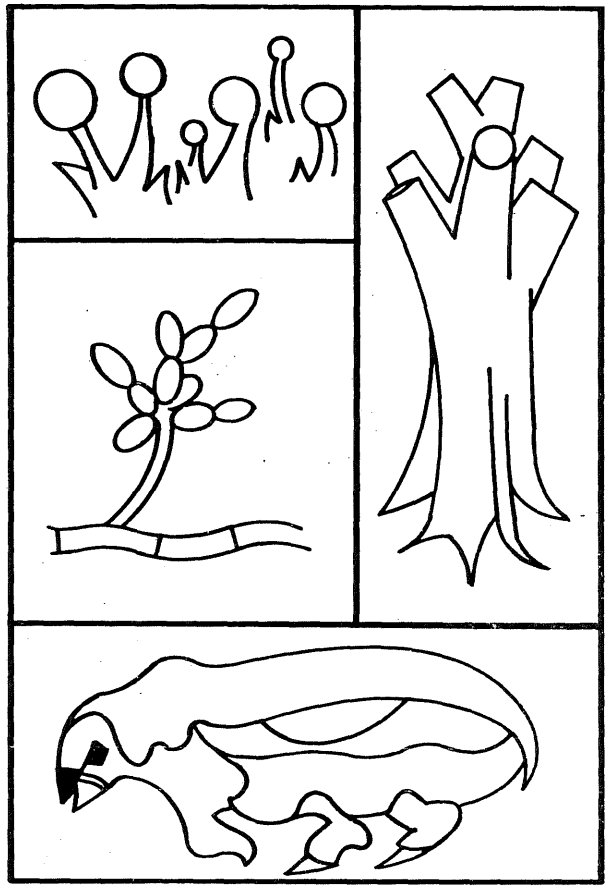
For further information contact:

Dwight Robinson
Department of Agriculture
State of Minnesota
600 Bremer Building
St. Paul, MN 55101
(612) 296-8580

Eugene Anderson
Office of Special Programs
405 Coffey Hall
1420 Eckles Avenue
St. Paul, MN 55108
(612) 373-0725



Municipal Tree Inspector's Workshop



Sponsors:

Minnesota Department of Agriculture
Shade Tree Program

University of Minnesota
Department of Entomology, Fisheries and Wildlife
Department of Horticultural Science and Landscape Architecture
Department of Plant Pathology
Agricultural Extension Service
Office of Special Programs

March-April 1979

Office of Special Programs
405 Coffey Hall
1420 Eckles Avenue
University of Minnesota
St. Paul, Minnesota 55108

AGRICULTURAL EXTENSION SERVICE

UNIVERSITY OF MINNESOTA

Institute of Agriculture, Forestry and
Home Economics
St. Paul, Minnesota 55108

June 8, 1979

Dear Tree Inspector:

As part of our efforts in the Federal Dutch Elm Disease Demonstration Project, the Agricultural Extension Service has developed a special training program for you and other tree inspectors with the demonstration communities. The workshop will be held on the St. Paul Campus of the University of Minnesota on Wednesday, June 13 and Thursday, June 14. During these two days we will be emphasizing the most current Dutch elm disease management procedures in an effort to enhance your expertise with this problem in your community. A detailed agenda is attached. Since this program is a part of the demonstration project, your participation is strongly encouraged.

The Agricultural Extension Service is covering all costs for the workshop (coffee breaks, meals and room) with the exception of transportation. Rooms have been reserved for participants at the Holiday Inn (St. Paul North, 2540 Cleveland Ave North, phone: 636-4567). Formal room assignments have not been made, however, we are asking thatyou share a room with one other person. Dinner on June 13, and breakfast on June 14, will be covered if you eat these meals at the Holiday Inn and charge them to your room. Should you wish to eat elsewhere, you will be expected to pay for your own meals.

All sessions will be informal. You may wish to bring old clothes for the tree injection session, since you will be asked to help with the excavation of the root flares and participate in the root graft barrier installation. If you are able to bring along an extra hoe or spade, it will speed up the operation.

We look forward to seeing you on the 13th and hope you will find the workshop worthwhile.

Best regards.

Sincerely,

Mina Gkinis
Extension Specialist

enclosure

MG:sl

TREE INSPECTOR TRAINING SESSION

June 13 and 14, 1979

Earl Brown Continuing Education Center - Room 166

University of Minnesota

St. Paul Campus

June 13 Room 166

10:00	Check-in (coffee and sweet rolls)
10:30	Film: The Urban Forest
10:50	DED Federal Demonstration Program: history, scope, accomplishments and future directions -- Charles Evenson and Steve Cook from DNR
11:10	Everything You Always Wanted to Know About Dutch Elm Disease, or, What Makes a good Tree Inspector -- Asimina Gkinis (Agricultural Extension)
11:55	Lunch -- Captain John Dining Room, Earl Brown Center
1:00	Thoughts on elm bark beetles and firewood identification -- William Phillipsen (Agricultural Extension)
1:40	University of Minnesota injection research report and comments on tree injection -- Mark Stennes (Department of Plant Pathology)
2:30	Refreshment break (coffee and pop)
2:45	Open discussion
3:25	Move to Stakman Hall, Plant Pathology Laboratory
3:35	How to isolate the DED fungus -- Asimina Gkinis
4:45	Adjourn. Dinner on your own at the Holiday Inn

June 14 Fairgrounds

8:30	Demonstration of tree injection, pruning, sampling for DED -- Mark Stennes
12:00	Lunch -- Earl Brown Center
1:00	Vapam root graft barrier installation
2:30	Evaluation and adjourn

"A Windshield Tour of Trees"

With Dutch elm disease taking its toll of elms throughout Minnesota, many communities are becoming interested in replanting. But not all people know what and where to replant.

In Martin County, Extension Director Floyd Bellin, Jr. has come up with a good idea for helping people make better planting decisions. In the fall of 1977 he initiated a "windshield tour of trees" that proved to be so popular, it was repeated the following spring. Those of you involved with Dutch elm disease educational programs may wish to try a similar tour in your own communities.

Description

The windshield tour was a simple idea. For one week during the latter part of September, residents of Fairmont, MN had the opportunity to drive around the community at their leisure and view some 41 different tree species growing successfully in the area. The trees were labeled with professional signs and the specific tour route was identified on a map published in the local paper (see _____). The tour was especially useful for making people aware of potential trees for replanting. However, it also helped individual property owners evaluate how certain species might fit into their own landscaping plans.

Planning Guidelines

The following guidelines will help you in setting up a windshield tour in your community.

1. Several weeks prior to the tour, go around the community and identify trees to be included. Look for trees in front yards and on public property along streets with minimal traffic. This will enable people on the tour to drive

slow enough to get a good view of the tree without blocking traffic.

2. If some of the trees to be included are on private property, be sure to get permission from the individual property owners to include the tree in the tour. Respecting people's property is crucial to the success of the tour.
3. Get some signs that can be easily read to identify trees. It helps if they are professionally done and placed in sturdy holders, if possible.
4. Plan follow-up activities, such as public meetings on Dutch elm disease or replanting, for soon after the tour. In this way you will be able to capitalize on the interest that has been generated.
5. Publicize both the tour and the follow-up activities in all local media. This will include publishing the tour route in the local paper and the names and locations of the species included. Stress that it is a driving tour and caution people not to walk on private property.
6. Check the signs just before the tour and several times during the tour to make sure they are still in their proper positions.
7. Offer the tour for a specific and brief period of time, such as one week. This will keep the idea fresh and make it possible to repeat during different seasons.
8. Involve as many local people as possible in setting up and running the tour.

WADENA TREE TOUR: Plan Before You Plant

With the advent of Dutch Elm Disease in Wadena, more people are giving thought to shade trees and the value that they have for the community. The following tells why:

Trees perform useful functions in the community. They provide environmental, social, architectural, engineering and climatic benefits.

Trees are a dominant landscape feature in the community.

A community rich in trees and green spaces has a character and personality its citizens can be proud of. This produces a healthier business and residential climate.

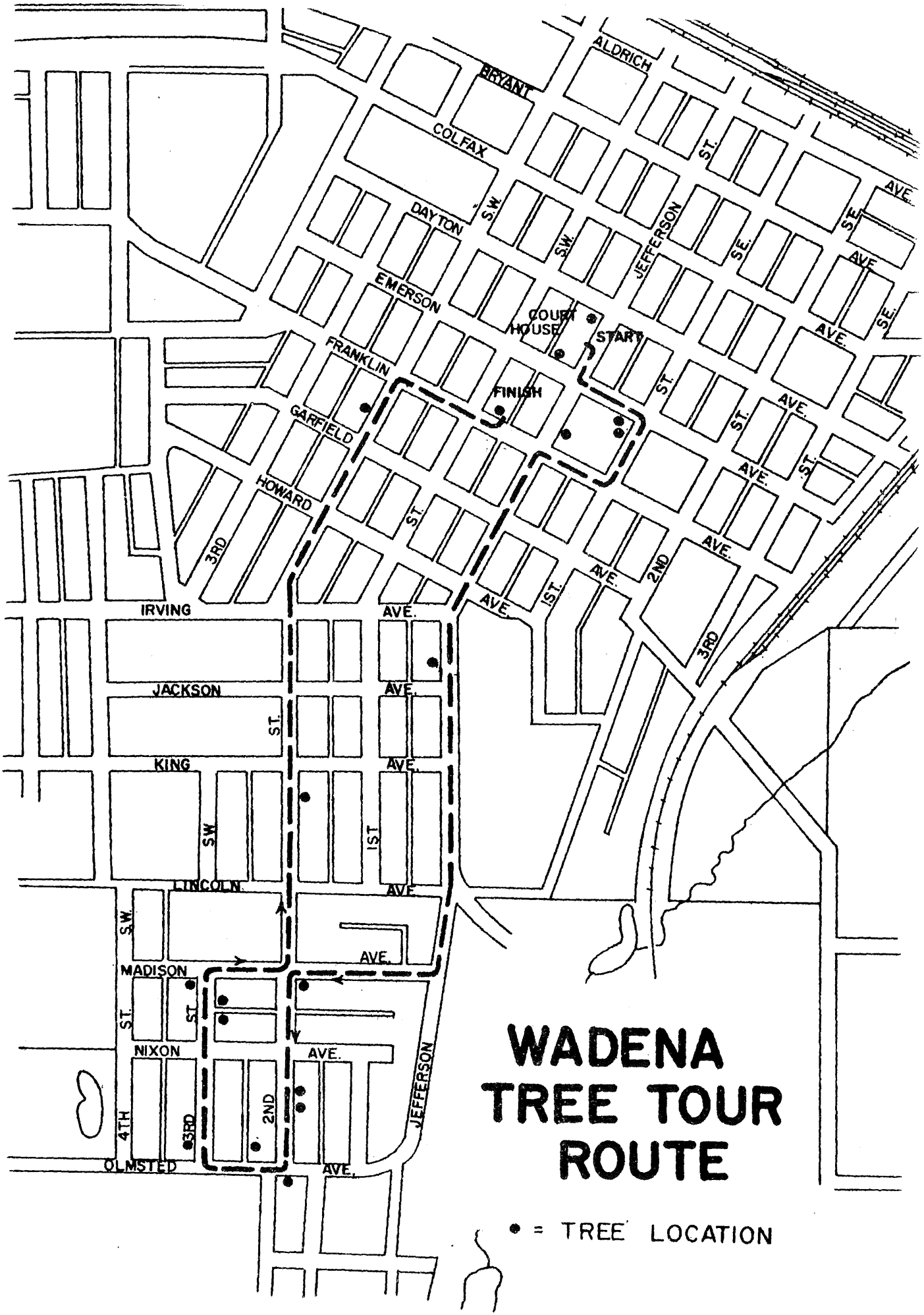
Trees create wealth. They have an actual dollar-and-cents value that is recognized by real estate experts, landscape professionals, arborists, tree experts, foresters, tree nurserymen and others. The value of homes along tree-lined streets is usually higher than the value of homes along streets without trees. Trees are an investment that should be protected.

Trees conserve energy and make good windbreaks, especially evergreens, which, properly planted, could help cut winter fuel bills.

Some trees, like the green ash and the hackberry, cut air pollution by absorbing airborne particles. On the same token some species do poorly on "high use" streets with much vehicle exhaust emmission and wintertime salt runoff. Evergreens, for example, have tiny needle pores which easily become clogged, causing the tree to die.

The tree tour will run from June 27th to July 8th. Hopefully, as a result, the variety of new trees to be planted will be carefully selected to suit Wadena soil and climate.

For further information on trees contact either Carl Eastlund at 631-2884 or Gene Bromenshenkel at 631-2332. Indicate to Carl or Gene if you would like to participate in a guided tour.


ALDRICH
BRYANT
COLFAX
DAYTON
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EMERSON
COURT HOUSE
START
FINISH
FRANKLIN
GARFIELD
HOWARD
3RD
IRVING
JACKSON
KING
SW
1ST
2ND
LINCOLN
MADISON
NIXON
4TH
OLMSTED
JEFFERSON
WADENA
TREE TOUR
ROUTE
• = TREE LOCATION

Addresses and Tree Information

1. North Courthouse lawn

Flame and Red Splendor Flowering Crabapples *(Malus* hybrids). These two varieties of Flowering Crabapples grow to a height of 25 feet, and are large enough to serve as small shade trees. Flame blooms white in spring. Red Splendor is purplish-pink. Fruit of both is bright red, but Flame produces a larger crabapple than does Red Splendor, whose small red apples hang through the winter until eaten by birds. Fruits of the Flame Crabapple drop in the fall, thus it should not be planted near a sidewalk.

When used as shade trees, Flowering Crabapples should be interspersed with other species to reduce the risk of fireblight infection, cankerworms and other apple pests. Cultural practices to reduce damage from diseases and insects affecting apples should be followed. Young crabapple trees must also be protected from sunscald and animal damage.

2. South Courthouse boulevard

Ulmus americana (American Elm) 60 feet. Large tree with widespread branches and vase-shaped form. Widely planted in shelterbelts, boulevards, and lawns. Several horticultural varieties have been selected and propagated. Of these the Lake City and Minneapolis Park elms have been most commonly planted in Minnesota. **As all Elms are, these are very susceptible to Dutch Elm Disease.**

3. 23 Emerson S.E.

Ulmus pumila (Siberian Elm)—40 feet. Small tree with leaves much smaller than those of American elm. Trees grow rapidly when young. Nonhardy strains often suffer branch die-back as a result of low winter temperatures and failure to "harden off" new growth. Generally short-lived. Sometimes planted for clipped hedges. Plant only hardy strains of Siberian origin, which are hardy in all zones. Harbin, Chinkota, and Dropmore strains are improved selections, especially suited for shelterbelts and field windbreaks. The species is often called mistakingly the Chinese Elm.

4. 23 Emerson S.E.

Hackberry *(Celtis occidentalis).* Hackberry is a sturdy, oval-crowned tree with a strong central trunk. Since leaves are similar in appearance to elm foliage, Hackberry has been used as a replacement for American Elm in street plantings for many years. Hackberry leaves are light green in summer, clear yellow in fall. Its small purple fruit mature in late summer. These trees are winter hardy if grown from northern seed stocks, drought resistant, and suited to most Minnesota soils. However, Hackberries may become established slowly after transplanting. They are best planted as small trees, 1½- to 2-inch caliper (diameter 6 inches above ground) or smaller. Newly planted Hackberries should be staked, especially in windy locations. Leaf galls and clusters of small branches (witches' brooms) are caused by psyllid insects and eriophyid mites, but this damage is not serious. Psyllids, however, may be annoying to people for a short time in late summer.

5. 516 South Jefferson

Acer platanoides 'Crimson King' (Crimson King Maple)—A form of Schwedler maple that was selected in Europe for its brilliant crimson leaves that keep their color all summer. This species and its variety is subject to sunscald and must be protected to prevent injury. It is also hardy and slower growing than Norway Maple

6. 1017 South Jefferson

Ohio Buckeye *(Aesculus glabra)* is winter hardy in Minnesota, and tolerant of droughty soils. It is a good choice for public or private properties because of its medium height—25 to 50 feet—strong rounded shape, and deep root system. Ohio Buckeye has showy cream-colored blossoms in spring, interesting light green compound leaves during the growing season, and yellow to apricot autumn color. The large shiny brown buckeye seeds enclosed in a leathery hull mature in fall. Not all trees fruit heavily. Ohio Buckeye may be planted from seed, but are sold by nurserymen as balled and burlapped specimens or in containers. The long tap root makes bare-root transplanting difficult.

7. 123 Madison S.W.

Betula papyrifera (paper birch)—This is our native white-barked species. It is often called the canoe birch since this is the tree that the Indians used to build their birchbark canoes. This species with its various botanical varieties is found all the way across Canada and down into the Central and Northeastern States. In Minnesota, it is common throughout the natural wooded areas of the state.

In nature this species reaches its best development on north-facing slopes and in or around the edges of swamps. This suggests that the tree likes a cool, moist soil. Under favorable conditions, the trees reach a mature height of from 40 to 50 feet with a trunk diameter of a foot or more.

When planted in exposed sites or where the soil becomes dry and compacted, the paper birch is short-lived. Whenever the trees are under a moisture stress, they are more subject to borer damage. It is for this reason that many nurseries are reluctant to sell the paper birch or any of the white-barked species for planting in any but the most favorable sites.

8. 1508 2nd St. S.W.

American Linden, Basswood *(Tilia americana).* American Linden is a winter-hardy, native tree, growing to a mature height of 50 to 75 feet. American Linden may develop with several stems, or single trunk specimens can be maintained by pruning when young. Mature American Linden are often strongly columnar in shape. Leaves are large, heart-shaped, deep green in summer, turning gold in autumn.

American Linden prefers moist, fertile soil, but adapts to most locations in Minnesota, given reasonable care. Young trees must be protected from sunscald. Cankerworms and spiny elm caterpillars are common insect pests. Neither causes substantial harm, although cankerworms can cause spring defoliation. In hot dry summers, leaf scorch is common on small trees.

9. 1508 2nd St. S.W.

Acer platanoides (Norway Maple) 50 feet, large, spreading, dense. Leaves large, dark green, producing very dense shade. It is difficult to grow a good lawn under these trees because of their dense shade and shallow rooting habits. Planted in parks and along boulevards.

height of tree at 10 years/

10. Olmstead & 2nd St. S.W.

Scots Pine *(Pinus sylvestris)*, 15-18 feet,* is a European native that has been widely planted in Minnesota. It is a fast growing tree that is pyramidal when young, but it becomes open and picturesque as it matures. Needles grow in bundles of two, are bluish-green, 2-3 inches long, and slightly twisted. Bark on older branches is quite smooth and cinnamon brown or reddish.

Because of its rapid growth, Scotch pine is adapted to large mass plantings or for use as specimen trees in parks or on large grounds. This pine cannot endure long dry periods because of its shallow root system. The tree is not well suited for planting in western Minnesota.

11. Alley behind 1523 2nd St. S.W.

Russian Olive *(Elaeagnus angustifolia)*. Russian Olive has long been used as a windbreak tree in western Minnesota, but with pruning of lower limbs it can develop as a handsome specimen for public or private grounds. It is not suited to narrow boulevard strips because of its irregular shape. However, Russian Olive is one of the fastest growing ornamental trees suited to the region, and its graceful gray-green foliage is attractive throughout the growing season. It matures to a height of about 25 feet, tall enough for shading a one-story house. Russian Olive is tolerant of dry and alkaline sites and is winter hardy. Verticillium wilt can kill Russian Olives when trees are infected. Watering, mulching and fertilizing trees planted for landscape use reduces loss from this disease.

12. 1517 3rd St. S.W.

Showy Mountainash *(Sorbus decora)*. Showy Mountainash is native to the North Shore of Lake Superior. The tree reaches medium height—25 to 35 feet—often growing with multiple stems. Large clusters of white flowers appear in spring, followed by bright red fruit—the tree's most striking feature. Fruit colors in August and usually persists into the winter until eaten by birds. Mountainash succeeds best on cool, moist, slightly acid sites. Trunks must be protected from sunscald. Fire blight, a bacterial disease affecting apples and crabapples as well, is the most serious pest of mountainash. Because of the danger of spread infection, mountainash and flowering crabapples should not be planted in large numbers or without an intermixture of non-susceptible species. For further information about fire blight and its control, see Plant Pathology Fact Sheet No. 17, Fire Blight.

13. 216 Nixon

Norway or Red Pine *(Pinus resinosa)*, 15-18 feet,* is native and grows commonly in northern Minnesota. It is widely known in the lake states as Norway pine. In 1953 the Minnesota legislature recognized it as the state tree. It grows rapidly when young and attains considerable size when mature.

This pine can be distinguished from other two-needle pines by the softness of its 4-6 inch long needles. The bark is reddish, and older branches and the trunk have broad, flat scales.

Because of its rapid growth and large size, red pine is not desirable for landscape purposes on small grounds. However, it is useful for large scale screens, windbreak, shelterbelt, and Christmas tree purposes. It also is valuable for park and roadside plantings. In western regions of this state, winter injury may deform the tree or kill it.

14. 221 Madison

White Spruce *(Picea glauca)* 12-15 feet.* This tree, native to northern Minnesota, grows rapidly to form a fairly compact, spire-shaped tree 50 or more feet tall. Its needles are not as long or as sharply pointed as those of Colorado spruce. The color varies from green to bluish green. The cones are about 2 inches long.

The white spruce is used for windbreak and shelterbelt plantings and for specimen and background plantings throughout Minnesota except on the dry, high lime soils of the western area. It is not a popular species for Christmas tree purposes because of its poor needle retention, but it continues to be planted and cultured for this purpose. The tree does best in rich, moist soil.

Black Hills Spruce (*Picea glauca densata*), 10-12 feet,* is a geographical variety of white spruce. It differs from the species in that it has a more compact habit and slower growth. Like the species, the color ranges from green to bluish green. Black Hills spruce is a good lawn specimen in spaces large enough for it. Since it is more drought resistant than the native form, it is especially useful in windbreaks and shelterbelts.

15. 1403 3rd St. S.W.

Colorado Spruce *(Picea pungens)*, 12-15 feet.* This popular evergreen is grown throughout Minnesota because of its striking appearance. It has a nearly perfect pyramidal outline, with horizontally spreading branches that grow in close whorls. This growth habit produces a layered appearance.

Colorado spruce varies from green to bluish green in seedling lots. Bluish forms are usually sold as Colorado blue spruce, while green forms are sold as Colorado spruce. The needles are stiff and sharp, coming out at right angles to the stem. The year-old twigs are a bright brown and the cones are 3-5 inches long.

Colorado spruce is better adapted to western parts of Minnesota than other spruces. It is favored by the heavier, richer soils of those regions and can tolerate a higher pH than many other species. However, it is

16. 1210 2nd St. S.W.

Green Ash *(Fraxinus pennsylvanica)* and its cultivars, Marshall Seedless and Summit Ash. Green Ash is the most widely planted shade and street tree replacement in Minnesota at present, but should not be used to the exclusion of other species in a neighborhood or community. Green Ash has a strong central trunk and a sturdy opposite branching habit. These trees are not suitable for pruning to an arching shape; attempts to shape boulevard ash trees to resemble elms results in weak and broken limbs.

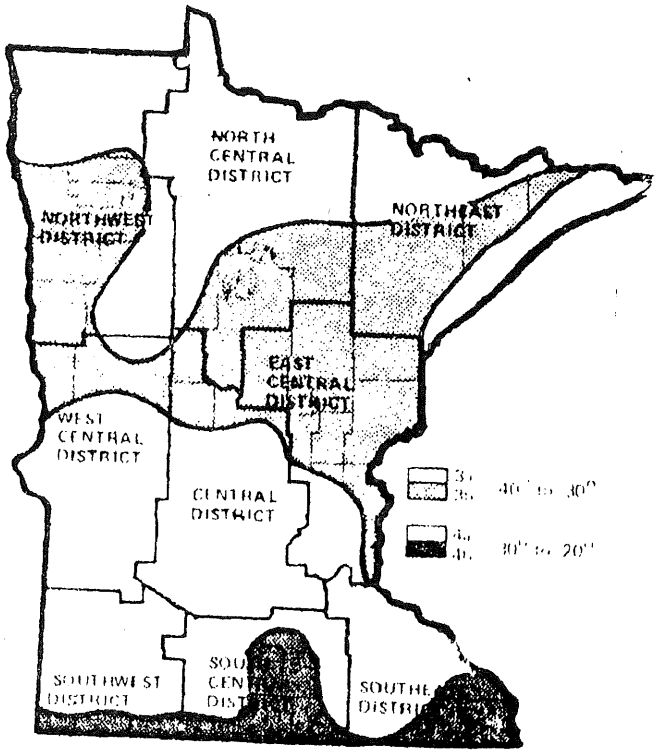
Green Ash transplant easily and are tolerant of poor, droughty soils, although they are more vigorous on better sites. Their rather open shade allows good lawn growth beneath. Ash plant bugs or aphids can cause distorted and discolored foliage, but do not seriously damage trees. Sometimes developing male flowers are attacked by mites and the resulting flower galls harden and turn black in the fall. These trees are seldom damaged by the galls, although green foliage can be reduced. Young ash trees may be sprayed to protect against all of these pests if noticeable infestations occur.

17. 615 2nd St. S.W.

Silver Maple *(Acer saccharinum)*. Silver Maple is an extremely large tree that grows throughout Minnesota except on dry or alkaline sites. It transplants easily and can be moved bare-root at sizes up to 2 inches in diameter. Leaves are light green in summer, silvery beneath, and light yellow in fall. Silver maple is a wide-spreading shade tree, but its rapid growth and open shape makes it subject to wind damage should storms occur. Silver Maple is best suited to parks and large properties open enough to accommodate its mature height and spread of 75 to 100 feet. These trees should not be used for street plantings unless they can be spaced 100 feet apart on wide boulevards or parkways without overhanging power lines.

Silver Maple develops a pale green to yellow summer color in alkaline soils that prevent uptake of iron. This chlorotic condition is common in many western Minnesota locations. Leaf galls caused by mites are also common, especially on young trees, but they do not seriously affect tree growth.

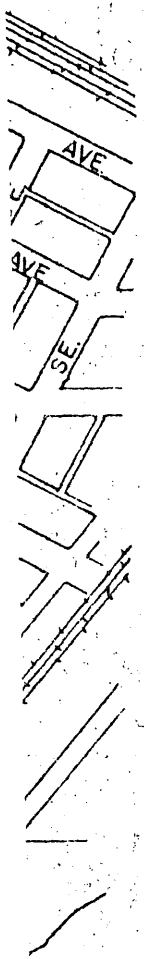
PLANT HARDINESS ZONES



18. 16 Franklin S.W.

Red Maple *(Acer rubrum)*. Red Maple, native to Northeast Minnesota, blooms with conspicuous red flowers in early spring and colors red, yellow, or orange in early fall. Summer color is green. Red Maple grows best on moist, slightly acid sites and, because of its thin bark when young, must be carefully protected from sunscald for several winters. Mature trees are medium-sized, possibly reaching 50 feet in height on favorable sites. The greatest difficulty with Red Maple for shade trees in Minnesota is in finding nursery-grown material from northern seed stock. Varieties developed in other sections of the United States may not be hardy in Minnesota conditions. Propagation experiments are now underway at the Minnesota Landscape Arboretum to increase the supply of Red Maple from Minnesota collected selections.

City tree tours planned here beginning Thursday



Wadena County Extension office and City planning office have organized a self-guided shade tree tour two miles long to be travelled by car, foot or bicycle.

This will give the participants a look at 18 species of shade trees growing in Wadena Thursday to July 8.

Persons planning the tour should come to the front entrance of the Wadena county court house where they can pick up a packet of information including a map of the route, information on the value of shade trees, and information on the trees themselves.

The 18 trees will be marked with large signs visible from the street and participants are asked not to walk on private lawns.

If persons desire further information they should contact either Carl Eastlund at 631-2884 or Eugene Bromenshenkel at 631-2332. If interest warrants, a guided tour with presentation will be conducted later in the summer.

Following is the list of addresses and tree species:

North courthouse lawn, flowering crabapple; south courthouse boulevard, American Elm; 23 Emerson SE., Siberian elm; hackberry; 516 Jefferson S., Crimson King Norway maple; 1017 Jefferson S., Ohio Buckeye; 123 Madison SW., Paper (white) birch; 1508 2nd SE., basswood (American Linden); Norway maple; Olmstead and 2nd SW., Scots Pine; alley behind 1523 2nd SW. Russian Olive; 1517 3rd SW., Mountain ash; 216 Nixon, Norway (red) pine; 221 Madison, White spruce; 1403 3rd SW. Colorado blue spruce; 1210 2nd SW., green ash; 615 2nd SW., silver maple and 16 Franklin SW., red maple.

"With the advent of Dutch Elm Disease in Wadena more people are giving thought to shade trees and the value that they have for the community," according to Carl Eastlund, city summer tree inspector.

The following tells why:

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Trees are a cominant landscape feature in the community.

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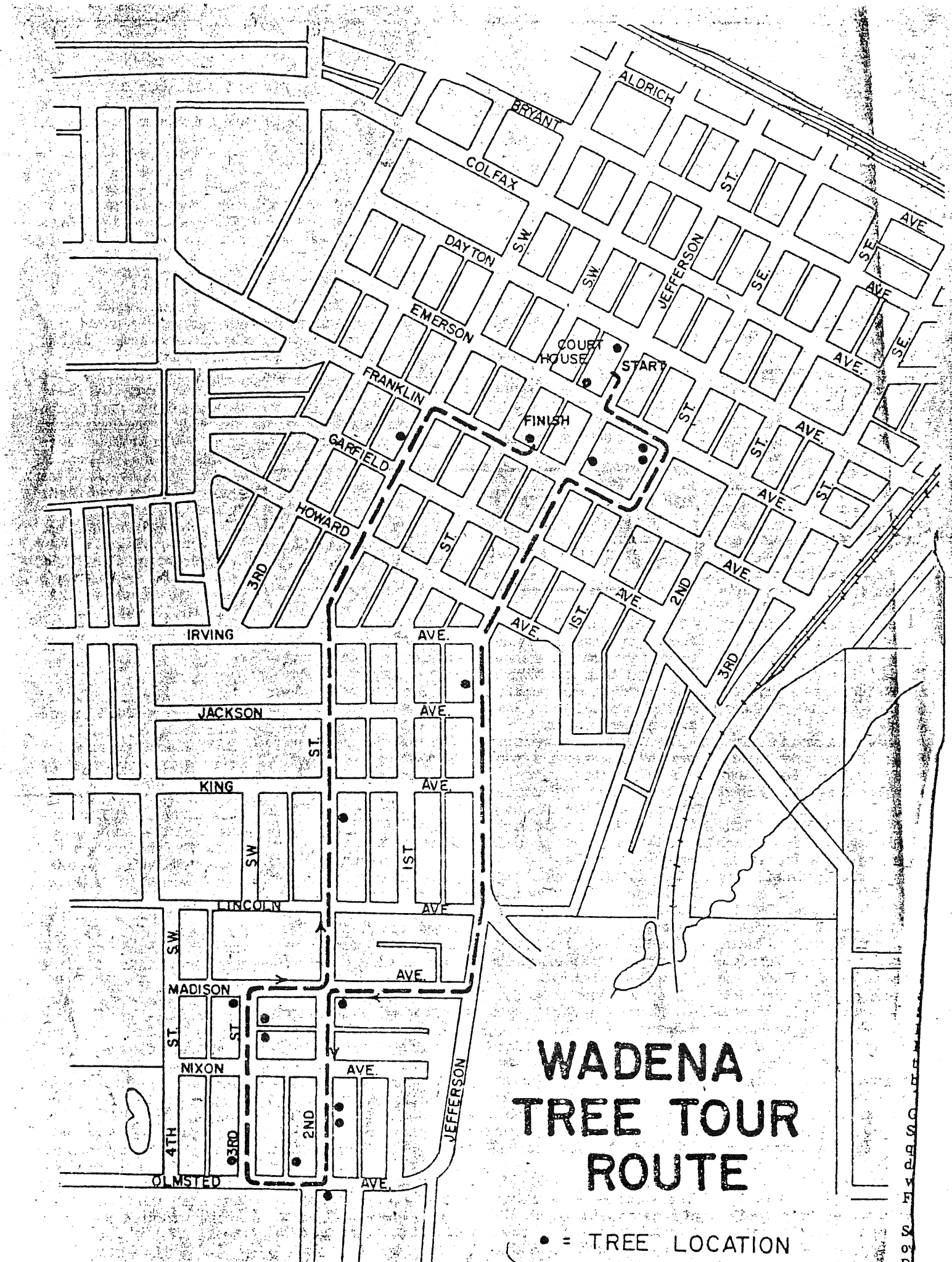
Some trees, like the green ash and the hackberry, cut air poolution by absorbing airborne particles. On the same token, some species do poorly on "high use" streets with much vehicle exhuast emmission and wintertime salt runoff. Evergreens, for example, have tiny needly pores which easily become clogged, causing the tree to die. Careful selection of trees suited for Wadena soil and weather is a must if the tree replacement and new tree plantings are to succeed.


ALDRICH
BRYANT
COLFAX
DAYTON
EMERSON
FRANKLIN
GARFIELD
HOWARD
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OLMSTED
JEFFERSON
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WADENA
TREE TOUR
ROUTE
• = TREE LOCATION

TREE SIGN REQUEST FORM

Signs may be reserved for **up to two weeks** from: Visual Aids, 442 Coffey Hall, University of Minnesota, 1420 Eckles Ave., St. Paul, MN 55108. (612) 373-1252

Persons requesting signs are responsible for picking them up and returning them.

Name _____

County _____

Address _____
(Street)

_____
(State) (Zip)

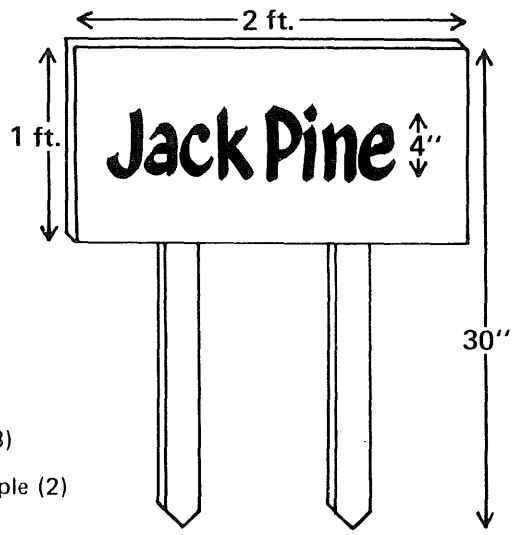
Phone _____

I would like to borrow the signs checked below, I will pick them up on _____

and return them on _____

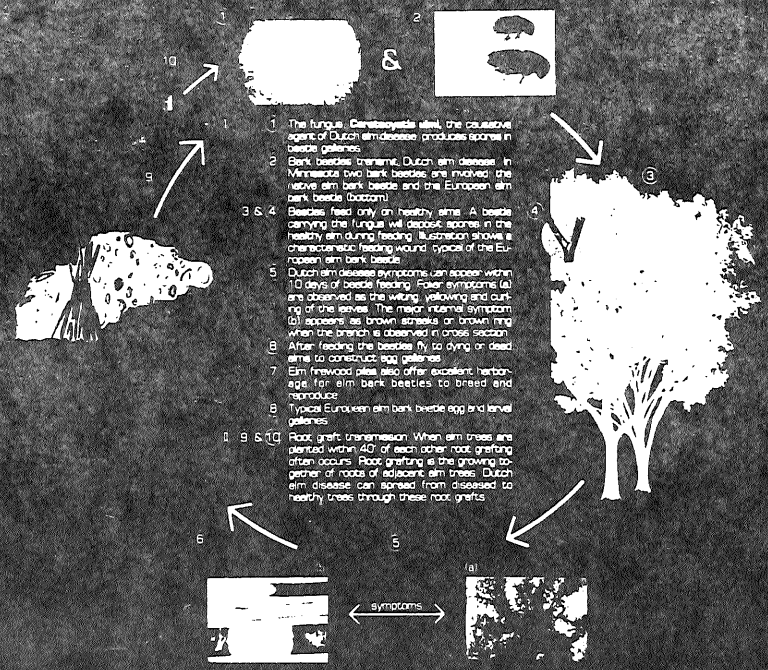
(Please indicate the number of copies of each sign needed in the space at the left of each sign. Number in parentheses indicates total signs available.)

_____American Elm (3)
_____American Maple (3)
_____Arborvitae (2)
_____Aspen (2)
_____Basswood (3)
_____Black Locust (2)
_____Black Walnut (3)
_____Blue Colorado Spruce (3)
_____Boxelder (3)
_____Bur Oak (3)
_____Catalpa (3)
_____Corkscrew Willow (2)
_____Cottonwood (3)
_____Crabapple (3)
_____Crimson King Norway Maple (2)
_____Cutleaf Weeping Birch (2)
_____Douglasfir (2)
_____Eastern Red Cedar (3)
_____Green Ash (3)
_____Hackberry (3)
_____Honeylocust (3)
_____Ironwood (2)
_____Jack Pine (2)
_____Japanese Tree Lilac (2)
_____Japanese Yew (2)
_____Kentucky Coffeetree (2)
_____Larch (2)
_____Littleleaf Linden (2)
_____Mountain Ash (3)
_____Mulberry (2)
_____Norway Maple (3)
_____Norway Spruce (3)
_____Ohio Buckeye (3)
_____Paper Birch (3)
_____Pin Oak (2)
_____Red Maple (2)
_____Red Oak (2)
_____Red Pine (2)
_____River Birch (2)
_____Russian Olive (3)
_____Shubert Chokeberry (3)
_____Schwedler Norway Maple (2)
_____Scotch Pine (3)
_____Siberian Elm (3)
_____Silver Maple (3)
_____Sugar Maple (3)
_____Sycamore (2)
_____Weeping Willow (3)
_____White Oak (2)
_____White Pine (2)
_____White Poplar (2)
_____White Spruce (2)



TREE WATCH

THE SPREAD OF DUTCH ELM DISEASE



1 The fungus, **Ceratocystis ulmi**, the causative agent of Dutch elm disease produces spores in beetle galleries.

2 Bark beetles transmit Dutch elm disease. In Minnesota two bark beetles are involved: the native elm bark beetle and the European elm bark beetle (bottom).

3 & 4 Beetles feed only on healthy elms. A beetle carrying the fungus will deposit spores in the healthy elm during feeding. Illustration shows a characteristic feeding wound typical of the European elm bark beetle.

5 Dutch elm disease symptoms can appear within 10 days of beetle feeding. Foliar symptoms (a) are observed as the wilting, yellowing and curling of the leaves. The major internal symptom (b) appears as brown streaks or brown ring when the branch is observed in cross section.

6 After feeding the beetles fly to dying or dead elms to construct egg galleries.

7 Elm firewood piles also offer excellent harborage for elm bark beetles to breed and reproduce.

8 Typical European elm bark beetle egg and larval galleries.

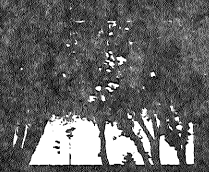
1, 9 & 10 Root graft transmission. When elm trees are planted within 40' of each other root grafting often occurs. Root grafting is the growing together of roots of adjacent elm trees. Dutch elm disease can spread from diseased to healthy trees through these root grafts.

MANAGING DUTCH ELM DISEASE

The spread of Dutch elm disease will be drastically reduced with the initiation and implementation of an intense sanitation program. A good sanitation program depends on:

1. Early identification

Surveys prior to April 1 will detect elm firewood, elm stumps, dead elm trees that harbor bark beetles. Additional surveys conducted frequently throughout the summer will locate diseased elms for prompt removal. Homeowners can aid their community Dutch elm disease program by identifying diseased elms or dead elm wood and relaying this information to their tree management representative.



2. Isolation

Dutch elm disease trees are isolated from healthy elms by mechanically trenching around the infected trees or by injecting a soil sterilant (VAPAM). These methods prevent disease spread by disrupting the root grafts between adjacent trees.

3. Prompt removal

Elm firewood removal debarking of elm stumps or firewood, pruning of dead elm branches, and removal of dead elms prior to April 1 eliminates a substantial number of overwintering adult beetles before they emerge and spread the disease. Prompt removal also destroys the fungal reservoir. Immediate removal of declining and isolated dying elms throughout the spring and summer also reduces the population of infectious beetles.

4. Proper disposal

The ultimate step in the sanitation program requires the elimination of all dead elm material. Burning or burying are two methods that destroy developing bark beetles and chipping the wood renders it unsuitable for beetle development.

AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF MINNESOTA--U.S. DEPARTMENT OF AGRICULTURE
INSTITUTE OF AGRICULTURE, FORESTRY AND HOME ECONOMICS, ST. PAUL, MN 55108

Syllabus for Slide Set #333

ELM TREE INJECTION

Linda J. Camp, extension communicator, University of Minnesota
Asimina Gkinis, assistant extension plant pathologist; University of Minnesota
Mark Stennes, graduate assistant, Plant Pathology, University of Minnesota

Cassette tape: automatic, inaudible 1000 Hz pulses, time 14:00

Extension Folder 504, HOW TO INJECT ELMS WITH SYSTEMIC FUNGICIDES, must be used with this slide set. Order from your local county agent or the Bulletin Room, Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108.

Slide No.	Script
1 Title slide (Project slide #1 on screen and start tape)	"Elm Tree Injection"
2 Diagram of fungus in tree	Dutch elm disease is a problem that affects all species of elm trees. It is caused by a fungus that lives and multiplies in the tree vessels. The presence of the fungus triggers chemical reactions in the tree that plug up the vessels and block the water movement. Thus, the tree wilts and ultimately dies.
3 Old injection apparatus	Since the mid-1930s, many chemical treatments to control Dutch elm disease have been tested. Of these, injecting chemicals into the vascular system of the tree--right where the fungus lives--seems to be the most effective.

Slide No.	Script
4 Drawing of internal fungicide movement	Chemical injection has been aided by the development of "systemic fungicides." These are chemicals that can move within the tree and thus provide protection to portions of the tree far from the injection sites.
5 Healthy, highly valued elms	Currently approved treatments with systemic fungicides rarely cure a tree of Dutch elm disease. Therefore, injection serves primarily as a preventative measure on healthy, highly valued elms.
6 Tree with 5 percent crown wilt	Injecting diseased trees is generally recommended only when there is less than 5 percent crown wilt.
7 Tree with root graft infection	Injection will not cure trees with massive wilt or those infected through root grafts. In these cases, the fungus is usually well established in the main trunk and the fungicide can't get to all of the vessels the fungus occupies.
8 Small elm	Trees with a diameter of 5 inches or less should not be injected because there will be too much mechanical damage.
9 Comparison of leaf stages	Elm trees may be injected at any time during the growing season. However, the best time is soon after the leaves reach full size--usually

more...

Slide No.	Script
9 (contd.)	the second or third week in June. Injecting before the tree is fully leafed out will not be effective because the tree is not able to adequately take up and transport the chemical to the uppermost branches.
10 Subtitle, "Methods and Equipment"	The goal of tree injection is to distribute the chemical completely and uniformly throughout all branches and the twigs of the crown. Therefore, placement of the injection tees on the tree is crucial.
11 Root flare injection	The best place for the tees is at the root flares at points below the ground line. This results in uniform uptake and even distribution of the chemical solution.
12 Trunk injection	Injection at any level above ground will cause the chemical to be distributed unevenly.
13 Injection tank	Most equipment for injection can be purchased at garden stores. The following items are essential:- First, a corrosion-proof injection tank with a large volume capacity. These tanks come in a wide variety of sizes.

Slide No.	Script
14 Close-up of pressure gauge	Second, a pressure system that will provide a constant 5 to 12 pounds of pressure per square inch throughout the injection cycle.
15 Injection tees	Third, two different kinds of tees; connecting tees and injection tees. Any type of injection tees are satisfactory as long as they meet the following requirements:
16 Word slide summarizing points	- the tees should fit into holes between 3/16 and 5/16 of an inch in diameter, - they should not leak, - they should not penetrate into the sapwood far enough to block the outermost growth rings, - and they should not injure the tree unnecessarily.
17 Poor injection heads	Don't use lag bolts, or other metal screw-in tees, nor those that need to be secured with staples or nails because they cause excessive damage to the tree. The ones shown here are poor because they are larger than 5/16 of an inch in diameter.
18 Tubing	The fourth item you will need is connecting tubing. Use a high quality polyvinyl tubing; one that fits tightly on the injection tees.

Slide No.	Script
19 Drill and bits	Fifth, you will need an electric hand drill with a sharp, high quality wood boring bit. The drill bit should be between 3/16 and 5/16 of an inch in diameter. Cleveland High Helix wood boring bits (left) and Greenley #177 spur bits (right) are suggested because they cut clean holes. This facilitates uptake of the chemical and minimizes injury to the tree.
20 Chemical	The most promising commercially labeled systemic fungicide is Arbotect 20-S. It is available from local garden stores and agricultural chemical retailers.
21 Subtitle, "Steps in Injection"	Before you can assemble the necessary equipment, you'll need to figure out the amount of chemical required and the number of injection tees needed.
22 Illustration of DBH	Both are calculated on the basis of the trunk diameter at breast height measured in inches--DBH. This is approximately 4½ feet above the ground on the tree you plan to inject.
23 Drawing and calculation Circumference $\frac{94.3}{3.14}$ = 30" DBH	Measure the circumference of the tree trunk at breast height and divide that number by 3.14 (pi). For example, if our tree has a circumference of 94.3 inches, that number when divided by 3.14 will yield a DBH of 30 inches.

Slide No.	Script
24 Chart on label	The Arbotect 20-S label lists several dosages which have been approved by the Environmental Protection Agency and thus are legal to use. Research has shown that even higher dosages protect a tree more effectively. However, because these higher dosages are not currently legal, the best treatment available is the highest approved label dose--4 ounces of the chemical per 5 inches DBH.
25 Calculation for chemical 30" DBH x 4/5 = 24 oz. Arbotect 20-S	On this basis, to determine the total amount of Arbotect you will need, multiply the DBH you just found by 4/5. In our example we will multiply 30 inches DBH by 4/5 and come up with 24 ounces of Arbotect needed.
26 Calculation of number of injection tees	To achieve complete and even distribution of the chemical throughout the tree, you will need at least 1½ to 2 injection sites, and thus tees, per inch of DBH. For example, our tree has a DBH of 30 inches, therefore, we will need at least 45 and preferably 60 injection tees.
27 Connecting tees	In addition, you will need three connecting tees.
28 Diagram showing hose calculations	Once you have figured out the number of injection tees, you can better estimate the length of connecting tubing required. You will need about

more...

Slide No.	Script
28 (contd.)	12 inches of tubing between the injection tees, and 6 to 8 feet plus 10 feet to hook the injection tees to the supply tank.
29 Equipment	With these and the other items assembled, you can begin setting up the equipment for injection.
30 Tees hooked together	You must put together the injection harness first. Cut part of the polyvinyl tubing into enough 12-inch lengths so that you can connect all of the injection tees together.
31 Tubing lengths	Cut the remaining tubing into the following sizes and lay aside for later: - two pieces each 3 to 4 feet long, - one piece 10 feet long, - and two pieces each 12 inches long.
32 Excavating root flares	Next, to properly prepare the tree for root flare injection, excavate the sod and soil from the base of the tree, taking care not to injure the parts of the tree below ground. The excavated area should extend 2 to 3 feet away from the base of the tree and be from 8 to 18 inches deep.
33 Calculation of Arbotect solution 24 oz. Arbotect x 40 = 960 oz. water.	You can now prepare the chemical solution. To find out the amount of water needed using label recommendations, multiply the amount of Arbotect

more...

Slide No.	Script
33 (contd.)	you found previously by 40. We found we needed 24 ounces of Arbotect, therefore we will need 960 ounces of water.
34 Pouring chemical	To mix the solution, first pour the chemical into the injection tank...
35 Pouring water	and then add the required volume of water. By mixing the solution in this order, you eliminate the chances that the chemical will settle out and make the solution ineffective.
36 Faucet with water running	Most local water supplies from rivers or lakes are satisfactory for mixing with Arbotect 20-S. However, you should avoid well water because it may be hard and will cause the main ingredient to settle out.
37 Measuring cups	To check your water source for hardness, add 1 teaspoon of the Arbotect to 4 fluid ounces of the water to be tested and stir. Observe the solution for 2 to 3 hours for cloudiness or settling. If either occurs, the water is unsuitable and should not be used. In such cases, distilled or deionized water is suggested.
38 Two people drilling	The best procedure for inserting the injection tees is to have one person drill the holes and another follow closely behind and tap the tees

more...

Slide No.	Script
38 (contd.)	in place. In this way, the holes do not dry out. When the holes are dry, the rate of chemical uptake is reduced and the time required to inject a tree will increase.
39 Diagram of correct hole	Drill injection holes perpendicular to the root flare surface and not deeper than 1 inch into the sapwood.
40 Spacing of sites	Injection tees should be spaced from 4 to 8 inches apart around the tree. They will be furthest apart on widespreading buttress roots and closest together where there is no flare.
41 Man and tank	When you have inserted all the injection tees into the tree, you are ready to connect them to the injection tank with the extra pieces of tubing cut previously.
42 Diagram of first connection	Hook one end of the 10-foot length to the injection tank and attach one of the connecting tees to the other end.
43 Diagram, second connection	Attach the 3-foot lengths of supply tube to this first connecting tee and then place one of the remaining two connecting tees on the ends of each of these second pieces of tubing.

Slide No.	Script
44 Attaching final piece of hose (close-up with arrow)	Finally, add one of the 12-inch pieces of tubing to each of the two end connecting tees. You can now attach this supply hose to the injection harness around the tree by pulling out a piece of hose from one tee and hooking in a connecting tee.
45 Summary diagram	The supply hose should be connected to the harness on opposite sides of the tree.
46 Tree and hookup	By setting up the apparatus in this way, you eliminate differences in pressure and unequal distribution of the chemical between injection tees on the harness.
47 Evacuation diagram	To evacuate air from the system, pull out two injection tees on opposite sides of the tree and perpendicular to the two connecting tees you just hooked in and turn on the supply.
48 Solution coming out of tree	Wait until the solution comes out from these injection tees. When most of the air has been evacuated and the solution comes out from both directions,...
49 Tapping in last tees	tap these last two injection tees back into the tree. Injection is now underway.

Slide No.	Script
50 Removing injection heads	When the tree has absorbed all of the solution or it has been several hours since the tree stopped taking up any chemical, remove the injection tees. Allow the holes to air dry for at least 30 minutes before you fill in the excavation. Wound dressings are not necessary and you should never use wooden dowels to plug the holes.
51 Artwork of pruning	If you treated a diseased tree, you must do radical pruning of the infected portion to the main stem immediately following injection. If you can't prune to the main stem, prune to 10 feet below the end of the internal symptom--the brown streaks.
52 New holes	Should you decide to inject your tree again later on, drill holes 2 to 3 inches above or below and to the side of the holes you made previously.
53 Cleaning equipment	When you have completed injection, if there is any of the chemical left and you don't plan to inject another tree, dispose of the extra solution according to label instructions. If you do plan to inject again, the solution may be stored indefinitely as long as it is not exposed to freezing temperatures. Rinse all equipment before storing.

Slide No.	Script
54 Tree removal	Systemic fungicides, when properly applied, have protected some healthy trees from Dutch elm disease and have helped to save some infected ones. However, injection is not a substitute for sanitation--the early detection and prompt removal of diseased trees.
55 Summary of points	Therefore, injection serves primarily as an augment to a good sanitation program and you should consider it only: - as a preventative treatment for healthy elms, - as a therapeutic treatment on trees with 5 percent or less crown wilt, - and for select, highly valued trees.

Agricultural Extension Service
University of Minnesota

Extension Folder 504—1980

How to Inject Elms With Systemic Fungicides

By Asimina Gkinis, Mark Stennes and Linda J. Camp

(To be used in conjunction with Extension slide set #333 "Elm Tree Injection" available from: Visual Aids, Agricultural Extension Service, 1 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108)

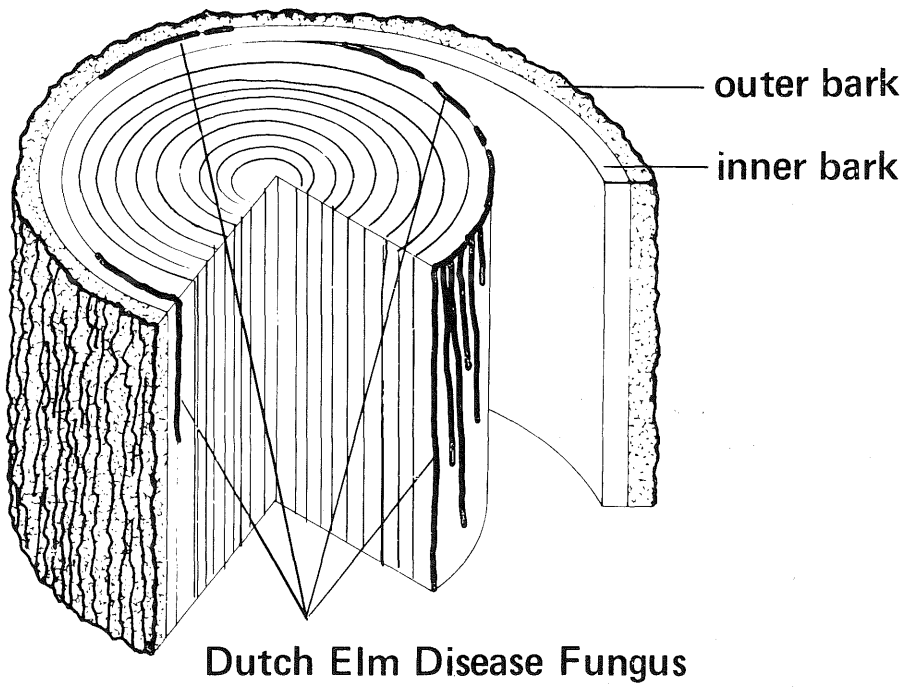
Dutch elm disease is a problem that affects all species of elm trees (figure 1). It is caused by a fungus that lives and multiplies in the tree vessels. The presence of the fungus triggers chemical reactions in the tree that plug up the vessels and block the water movement. Thus, the tree wilts and ultimately dies.

Since the mid 1930s many chemical treatments to control Dutch elm disease have been tested. Of these, injecting chemicals into the vascular system of the tree—right where the fungus lives—seems to be the most effective. Chemical injection has been aided by the development of "systemic fungicides." These are chemicals that can move within the tree and thus provide protection to portions of the tree far from the injection sites. Injection with systemic fungicides rarely cures a tree of Dutch elm disease, though, and can fail to protect even healthy trees. In addition, such injection causes physical damage to the tree that may bring on other kinds of disease problems. Therefore, it is important to analyze your own situation carefully before you get involved with injection.

SELECTING A TREE TO INJECT

In general, you should consider injecting only those elms that are particularly valuable to you. Because injection is most effective as a preventive measure, the best candidates are healthy trees. Treating trees that have Dutch elm disease is less successful and generally is recommended only when there is no more than 5 percent crown wilt (1 or 2 small branches) and then only if symptoms appear after mid-July. Injection will not cure trees with massive wilt because the disease is usually well established in the main trunk and this interferes with fungicide movement. Likewise, injection cannot help trees infected through root grafts because the fungicide has a limited ability to move downward.

Figure 1. Dutch elm disease fungus in vessels of a tree



WHEN TO INJECT

Elms may be injected at any time during the growing season (June-September), however, the best time is soon after the leaves reach full size. In Minnesota, this is usually not until the second or third week in June. Injecting before the tree is fully leafed out will not be effective because the tree is not able to adequately take up and transport the chemical to the uppermost branches. For the same reason, you should not inject trees late in the summer or those that have been defoliated by cankerworms or other causes. In the case of defoliated trees, it is best to wait until the second flush of leaves has appeared before you inject.

EQUIPMENT AND CHEMICAL

You will need the following items for injection. Most can be purchased at garden stores.

A corrosion-proof injection tank with a large volume capacity—preferably one that will hold 30 or more gallons of solution. These tanks come in a wide variety of sizes.

A pressure system that will provide a constant 5 to 12 pounds of pressure per square inch throughout the injection cycle.

Connecting tees and injection tees (figure 2). Any type of injection tees are satisfactory as long as they meet the following requirements:

—the tees should fit into holes between 3/16 and 5/16 of an inch in diameter.
—they should not leak.
—they should not penetrate into the sapwood far enough to block the outermost growth rings.
—and, they should not injure the tree excessively.

The number of injection tees needed is calculated on the basis of the trunk diameter at breast height measured in inches (DBH). This is approximately 4½ feet above the ground on the tree you plan to inject. To find the DBH, measure the circumference of the tree trunk at breast height and divide that number by

Figure 2. Connecting tees (left) and injection tees (right)

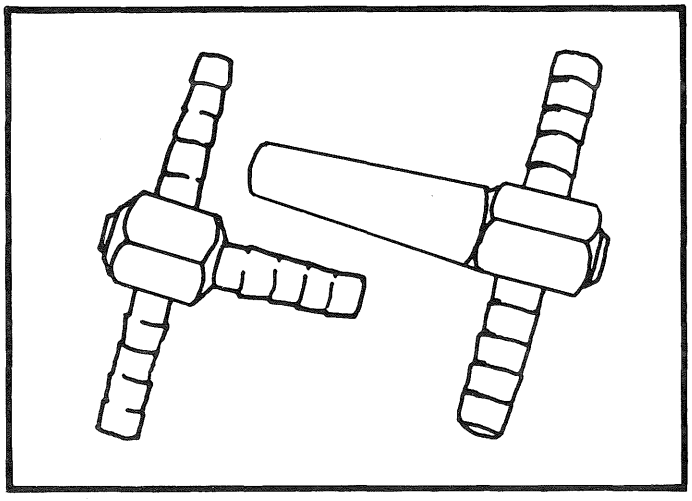
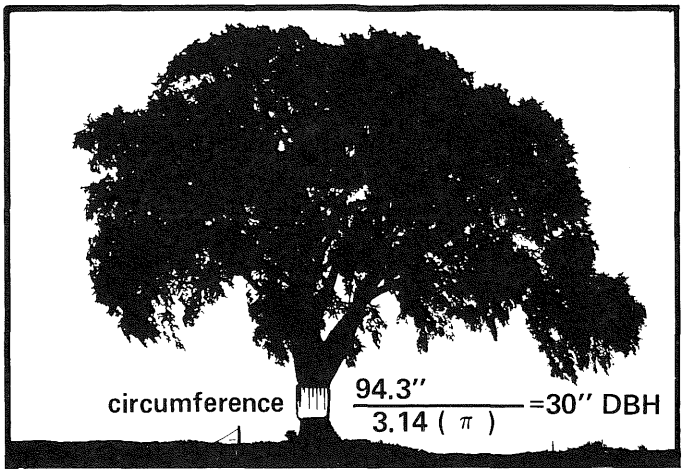


Figure 3. Circumference measured approximately 4½ feet above ground



3.14 (pi). Example: tree circumference of 94.3 inches ÷ 3.14 inches = 30 inches DBH (figure 3). For best results, you should have 1½ to 2 sites, and thus tees, for each inch of DBH. Therefore, a tree with a DBH of 30 inches would require at least 45 and preferably 60 injection tees.

30" x 1½ tees/inch DBH = 45 tees
30" x 2 tees/inch DBH = 60 tees

High quality polyvinyl tubing. You will need about 12 inches of tubing between each two injection tees and another 16 to 18 feet to hook the injection tees to the supply tank. Cut this tubing into the following sizes before you begin:

—enough 12-inch pieces to hook all of the injection tees together.
—2 pieces each 3 to 4 feet long.
—one piece 10 feet long.
—and, 2 additional 12-inch pieces.

An electric hand drill with a sharp, high quality wood boring bit. The drill bit should be between 3/16 and 5/16 of an inch in diameter. Cleveland High Helix wood boring bits and Greenley #177 spur bits are suggested because they cut clean holes. This facilitates uptake of the chemical and minimizes injury to the tree.

A chemical solution. The most promising commercially labeled systemic fungicide is Arbotect 20-S.* The Arbotect label lists several dosages which have been approved by the Environmental Protection Agency

**Arbotect has recently been available in two formulations—Arbotect S and Arbotect 20-S. Both contain exactly the same active ingredient, with the Arbotect 20-S being 20 times stronger than the Arbotect S. In the long run, it is cheaper to use the stronger formulation, particularly if you are injecting more than one tree.*

and thus are legal to use. Research has shown that even higher dosages protect a tree more effectively. However, because these higher dosages are not currently legal, the best treatment available is the highest approved label dose—four ounces of the Arbotect per five inches of DBH.

To determine the total amount of Arbotect you will need, multiply the DBH of your tree by 4/5 (4 ounces per 5 inches DBH). For example, a tree with a DBH of 30 inches would require 24 ounces of Arbotect 20-S.

30" DBH x 4/5 = 24 oz. Arbotect 20-S

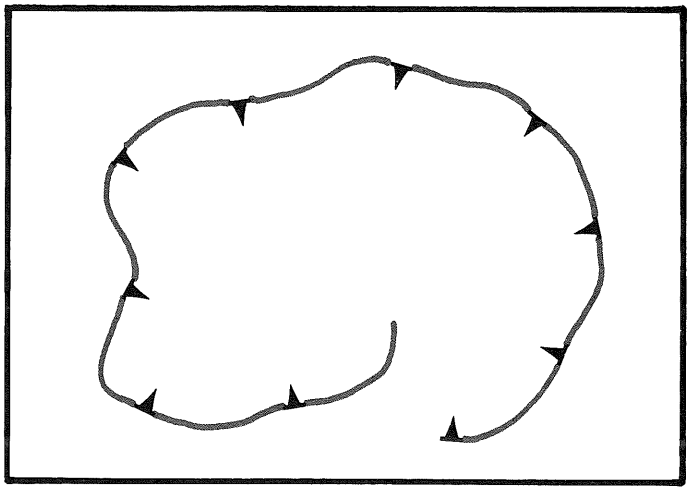
INJECTION STEPS

With these items assembled, you can begin setting up the equipment for injection.

1. Assemble the injection harness.

You must put together the injection harness first. Using the 12-inch lengths of polyvinyl tubing you cut earlier, connect all of the injection tees together (figure 4).

Figure 4. Injection harness assembled



2. Prepare root flares of tree.

The goal of tree injection is to distribute the chemical completely and uniformly throughout all branches and the twigs of the crown. Therefore, placement of the injection tees on the tree is crucial. University of Minnesota research has shown that the best place for the tees is at the root flares at points below the ground line (figure 5a). This results in a uniform uptake and good distribution of the chemical solution. Injection at any level above ground will cause the chemical to be distributed unevenly (figure 5b).

Figure 5a. Correct placement of injection tees on root flares

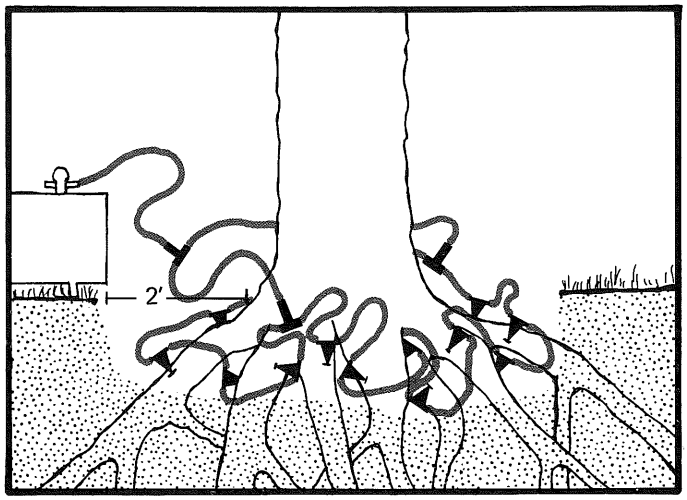
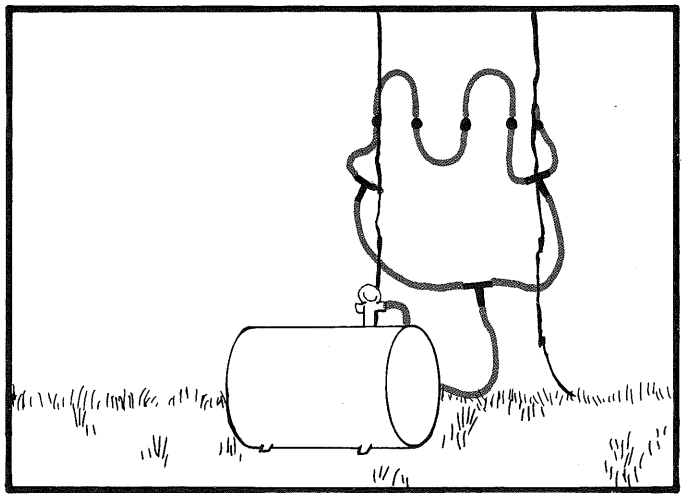


Figure 5b. Injection tees incorrectly placed on tree trunk



To properly prepare the tree for root flare injection, first excavate the sod and soil from the base of the tree, taking care not to injure the parts of the tree below ground. The excavated area should extend 2 to 3 feet away from the base of the tree and be from 8 to 18 inches deep.

3. Prepare chemical solution.

To find out the amount of water needed, using label recommendations, multiply the amount of Arbotect 20-S you found previously by 40. For example,

24 oz. Arbotect 20-S x 40 = 960 oz. water or 7½ gallons water

To mix the solution, first pour the chemical into the injection tank and then add the required volume of

water. By mixing the solution in this order, you eliminate the chances that the chemical will settle out and make the solution ineffective.

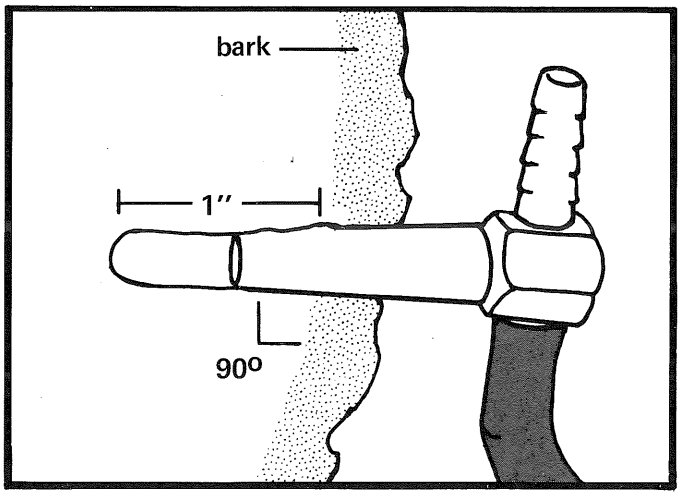
Most local water supplies from rivers or lakes are satisfactory for mixing with Arbotect 20-S. However, you should avoid well water because it may be hard and will cause the main ingredient to settle out.* You can check your water source for hardness ahead of time by adding one teaspoon of the Arbotect to 4 fluid ounces of the water to be tested and stir. Observe the solution for 2 to 3 hours for cloudiness or settling. If either occurs, the water is unsuitable and should not be used. In such cases, distilled or deionized water is suggested.

4. Insert injection tees into tree.

The best procedure for inserting the injection tees is to have one person drill the holes and another follow closely behind and tap the tees in place. In this way the holes do not dry out. (Dry holes reduce the rate of chemical uptake and thus increase the time needed to inject a tree.)

Drill injection holes perpendicular to the root flare surface and not deeper than 1 inch into the sapwood (figure 6). The holes should be spaced from 4 to 8 inches apart around the tree. They will be furthest apart on the widespreading buttress roots and closest together where there is no flare. If you cannot excavate the root flares as suggested because of obstacles such as sidewalks, then place the injection tees as low on the trunk as possible and closer together than you normally would (i.e. 2 to 4 inches apart rather than 4 to 8 inches).

Figure 6. Injection holes drilled perpendicular to root flare surface



Even hard water that has passed through a water softener is not suitable because it will still cause the chemical to settle out.

5. Hook injection tank to harness around tree.

When you have inserted all the injection tees into the tree you are ready to connect them to the injection tank with the extra pieces of tubing you cut previously. First hook one end of the 10-foot length to the injection tank and attach one of the connecting tees to the other end (figure 7). Then attach the 3-foot lengths of supply tube to this first connecting tee and place one of the remaining two connecting tees on the ends of each of these second pieces of tubing (figure 8). Finally, add one of the 12-inch pieces of tubing to each of these two end connecting tees.

Figure 7. 10-foot length of tubing connected to supply tank

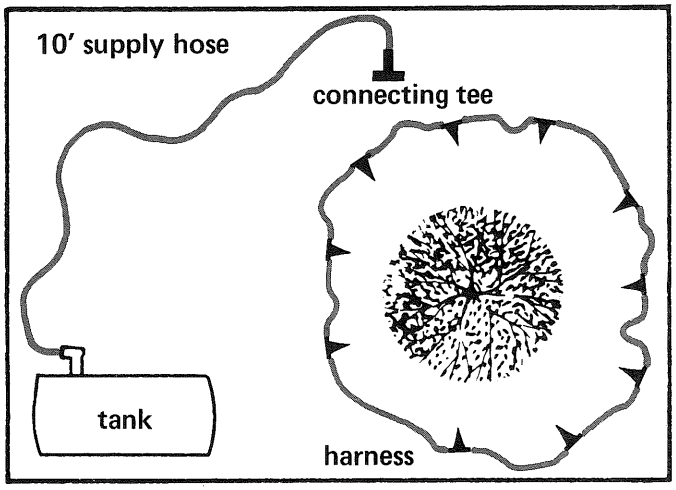
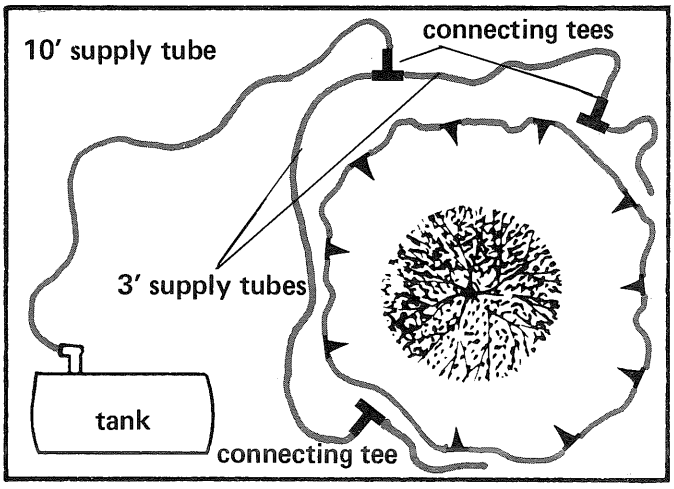


Figure 8. 3-foot lengths of tubing hooked in



You can now attach this supply hose to the injection harness around the tree by pulling out a piece of hose from two tees at opposite sides of the tree and hooking in the connecting tees (figure 9). By setting up the apparatus in this way, you eliminate differences in pressure and unequal distribution of the chemical between injection tees on the harness (figure 10).

Figure 9. Supply tubing connected to injection harness

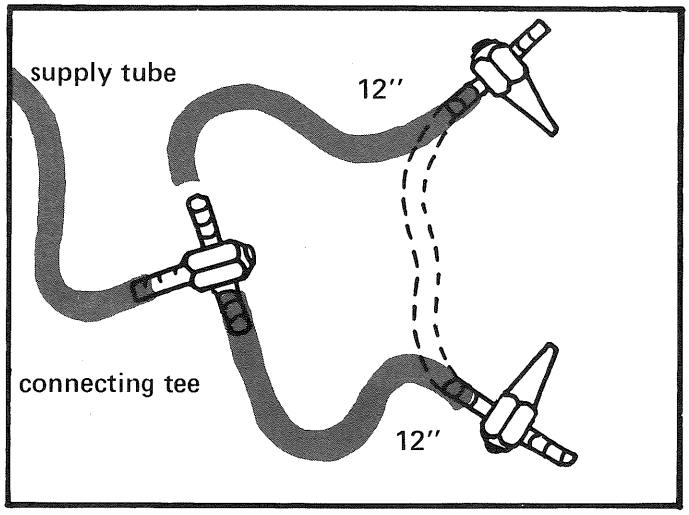
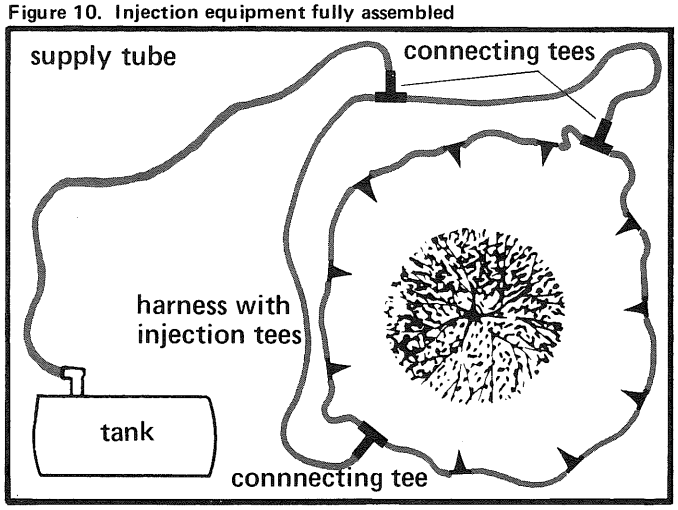


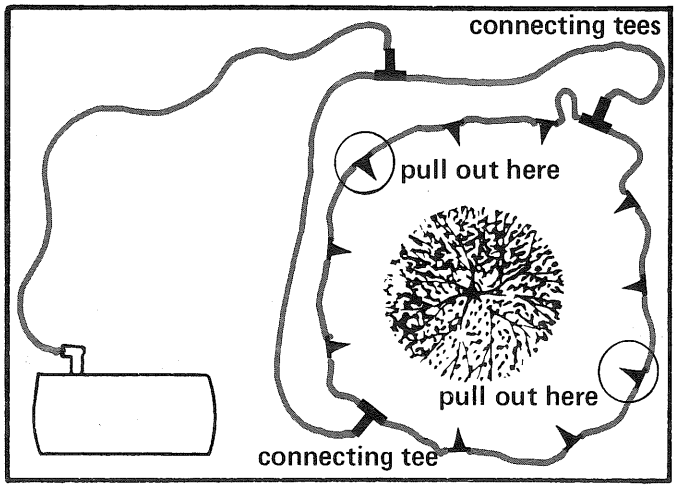
Figure 10. Injection equipment fully assembled



6. Evacuate air from the system.

Pull out two injection tees on opposite sides of the tree and perpendicular to the two connecting tees you just hooked in and turn on the supply (figure 11).

Figure 11. Tees pulled out to evacuate air from system



Wait until the solution comes out from these injection tees. When most of the air has been evacuated and the solution comes out from both directions, tap these last two injection tees back into the tree. Injection is now underway.

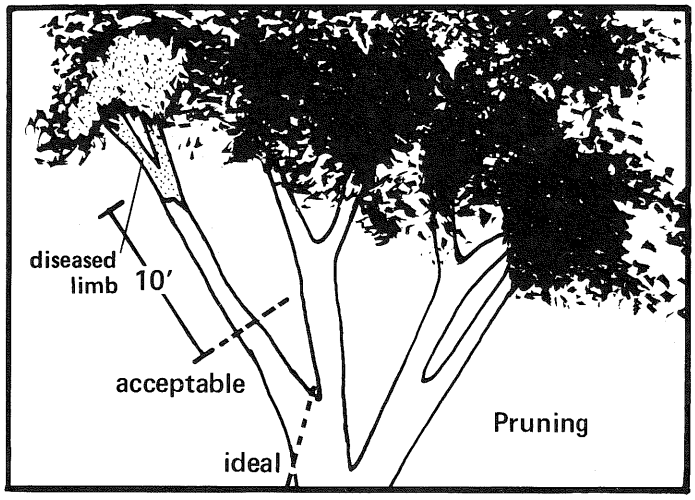
7. Remove injection heads.

When the tree has absorbed all of the solution or it has been several hours since the tree stopped taking up any chemical, remove the injection tees. (Don't leave the injection harness on the tree for more than 48 hours.) Allow the holes to air dry for at least 30 minutes before you fill in the excavation. Wound dressings are not necessary and you should never use wooden dowels to plug the holes.

8. Prune infected branches.

If you treated a diseased tree, you must prune off the infected portion to the main stem immediately following injection. If you can't prune to the main stem, prune to 10 feet below the end of the internal Dutch elm disease symptoms on the branch (brown streaks on the wood under the bark) (figure 12).

Figure 12. Pruning diagram for diseased trees

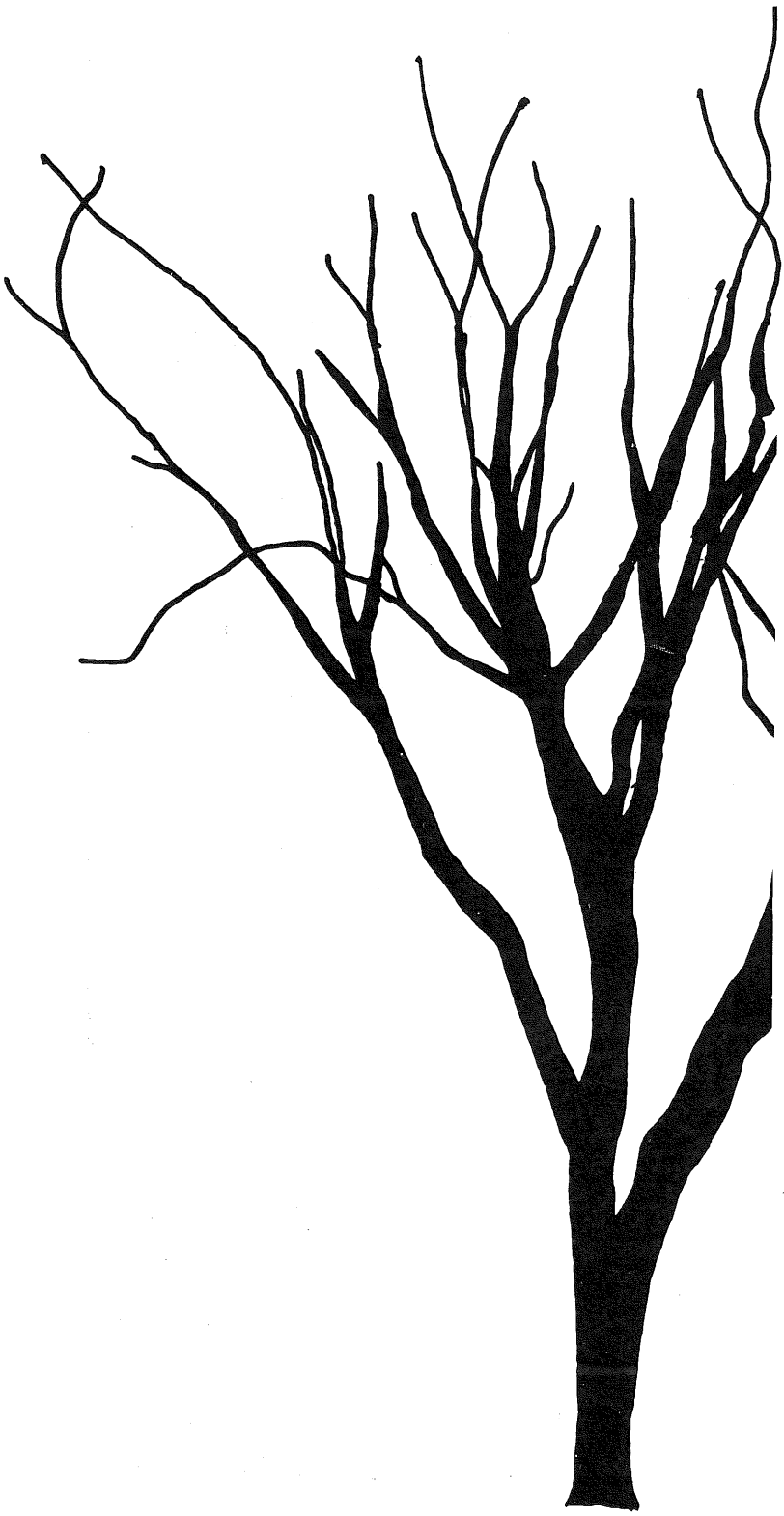


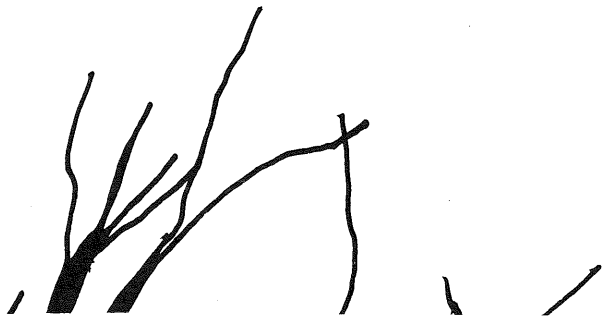
9. Clean equipment and take care of extra solution.

When you have completed injection, if there is any of the chemical left and you don't plan to inject another tree, dispose of the extra solution according to label instructions. If you do plan to inject again, the solution may be stored indefinitely, as long as it is not exposed to freezing temperatures. Rinse all equipment before storing.

10. Injecting again.

Because injecting with the highest therapeutic label dose of Arbotect 20-S usually protects a tree for a year or less (and this is not complete protection), trees generally should be injected every year. It may even be necessary to treat a tree more than once during a single season if a tree becomes infected after being injected. Should you decide to inject your tree again, drill the holes 2 to 3 inches above or below and to the side of the holes you made previously.





SOME FINAL NOTES

—There is another registered chemical on the market for injection against Dutch elm disease—Lignasan. However, it is not very effective against the disease at label doses because, once injected, it moves into the leaves and drops to the ground with them in the fall.

—Arbotect 20-S costs approximately $156.60 per gallon and Lignasan about $10.95 per gallon. The two main distributors of these chemicals in Minnesota are the Castle Chemical Company (12505 Xenwood Ave. South, Savage MN 55378) and Turf Supply Company (2970 Dodd Rd., St. Paul MN 55121).

—Another Dutch elm disease treatment which has been publicized recently is a bacterial antibiotic. Research on the antibiotic is still in its preliminary stages and a substantial amount of work is needed before the effectiveness of the antibiotic can be demonstrated.

—Injection equipment currently on the market is very frequently sold in sets (i.e. tank, tubing, tees etc. together). However, these sets often don't include enough tees to properly inject anything but a small tree. In addition, the tees that are included may be the wrong type. Consequently, it is usually best to buy injection equipment as individual items so you will pay for only what you really need.

—If you don't want to inject your tree yourself, there are professionals available who will do it for you. Shop for this service carefully, though. Make sure you select someone who understands the disease and how the injection chemical works in a tree. And, try to be present when your tree is injected so you can see that the proper amount of chemical is injected in the correct way. If you want help in evaluating injection services in your area, contact your county extension office or the Department of Plant Pathology at the University of Minnesota.

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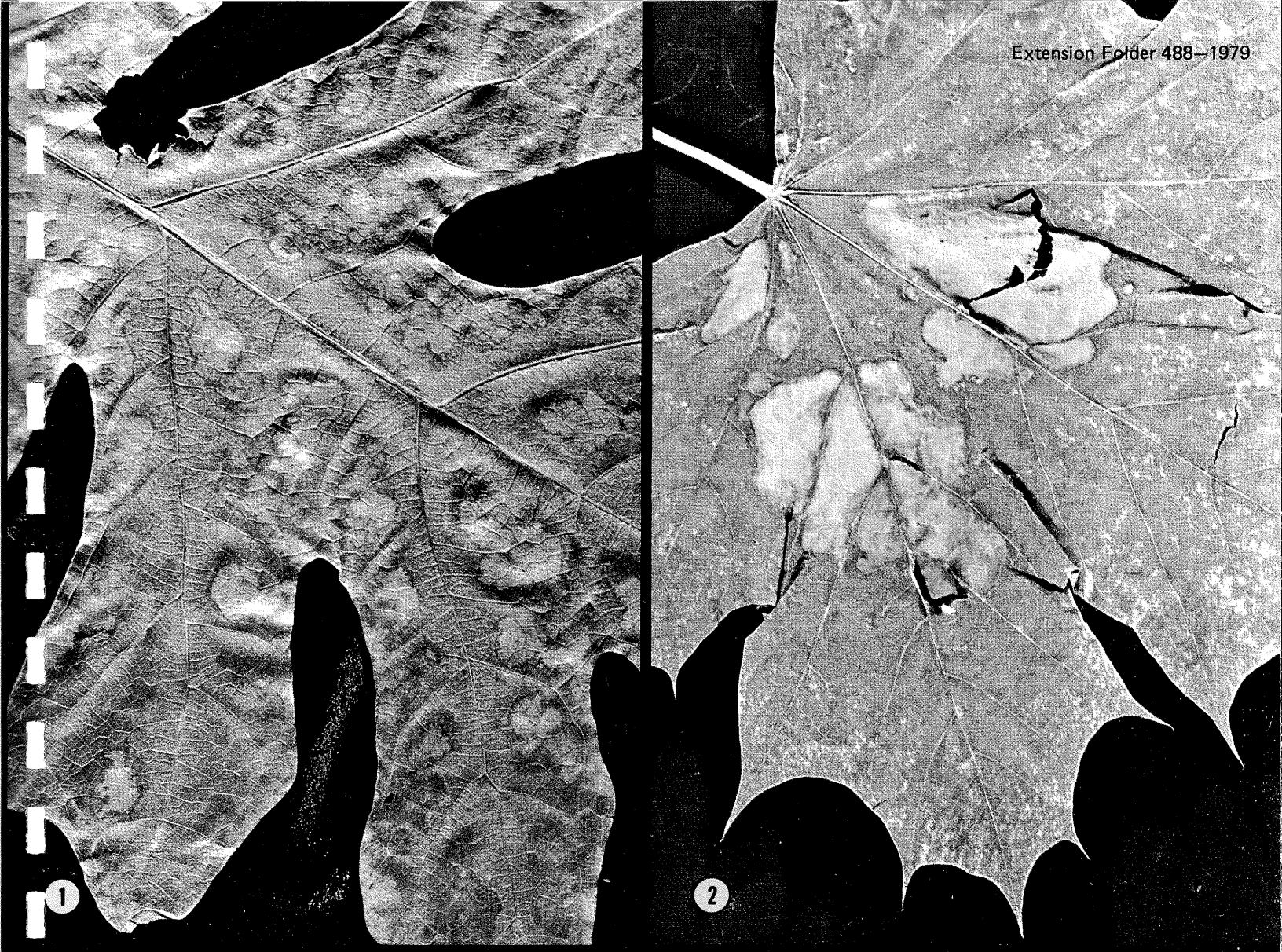

Agricultural Extension Service
University of Minnesota

LEAF SPOT DISEASES of Deciduous Trees

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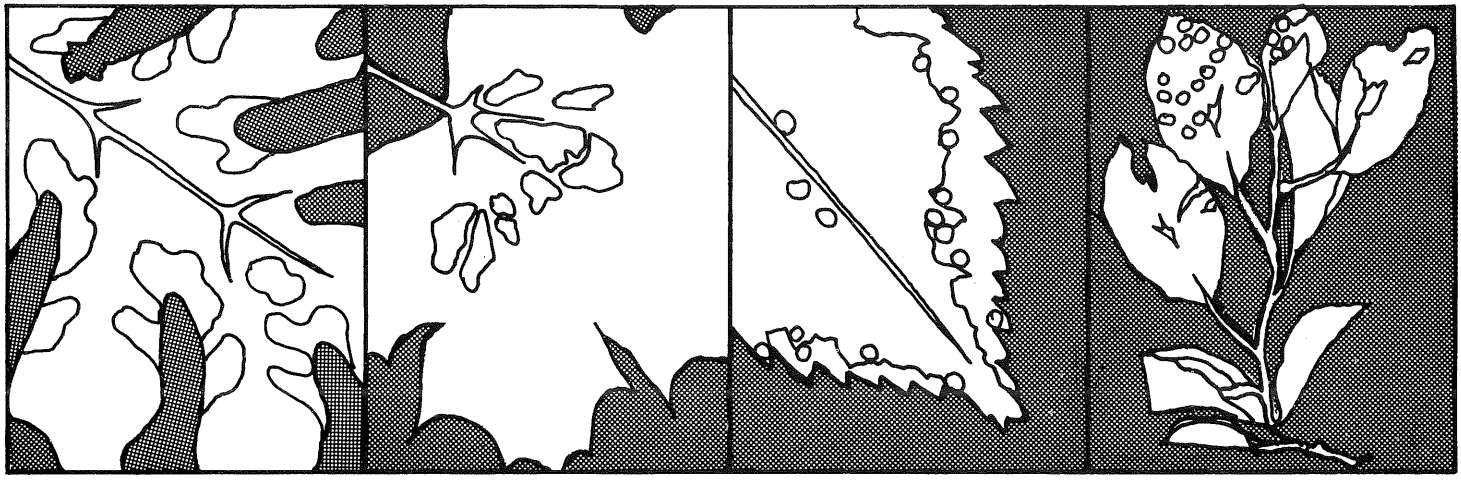

1. Oak anthracnose 2. Maple anthracnose 3. Elm black leaf spot 4. Apple Scab

Leaf spot diseases are a very common problem on many kinds of deciduous trees such as elm, oak, and maple, throughout Minnesota. Air pollutants, chemical sprays, herbicides, and adverse atmospheric and soil conditions are all possible sources of the problem. However, more often serious leaf spot diseases are caused by living organisms, such as insects, bacteria, viruses, and fungi. Of these, fungi are the most frequent cause of leaf spots, blotches, and blights.

In spite of the unsightliness of these kinds of diseases, they usually do only minor damage to established, healthy trees. Repeated attacks by leaf spotting fungi, however, may result in a poorly formed, less vigorous tree. In addition, severe leaf losses due to these diseases during late May or early June in successive years may cause the tree to die.

SYMPTOMS

In general, leaf spots appear as beige to brown, purple, or black irregular areas, usually expanding along the veins. The spots may grow together until they cover more than half the leaf (figures 1 to 4). A very common type of leaf spot is the "anthracnose." Different microorganisms cause anthracnoses on different kinds of trees. However, the symptoms are quite similar and easy to identify. Anthracnose spots usually have a light center separated from the healthy tissue by a darker margin (figures 1 and 2).

When the leaf spot infection is severe, the leafstems may also be attacked, leading to loss of leaves. If infection occurs in the spring, the fungus causing the disease may invade the twigs, via the leafstem and kill small twigs or initiate twig cankers.

Young leaves and small green twigs are the parts of a tree which are most susceptible to the leaf spotting fungi. However, mature leaves may also become infected. Leaves of hardwoods lost to leaf spot diseases early in the season are often replaced with new leaves which are smaller and fewer in number.

HOW LEAF SPOTS DEVELOP

Leaf spot diseases caused by living organisms appear when there are extended periods of cool, moist weather and when there are infected leaves and twigs that carry the fungi from the preceeding year. When cool, moist conditions prevail in spring, large numbers of fungal spores are produced on the infected twigs and leaves. These spores require high relative humidity or free water on healthy leaf surfaces to create new infections. Though there are usually infected leaves around from season to season, the rainy periods may not be long enough for the fungi to grow, multiply, and infect new leaves and twigs. Consequently, leaf spot diseases do not develop every year. When there are long periods of cool, moist weather in May leaf spots are most likely to occur.

Occasionally anthracnoses may be confused with leaf scorch, which appears as a marginal leaf browning progressing between veins, and which lacks the dark margin found in the anthracnoses. Leaf scorch occurs when excessive water is lost from the leaves. It often appears on young leaves during warm, dry weather.

CONTROLLING LEAF SPOTS

The main way to control leaf spots is by using proper cultural practices. First, all infected leaves from the previous season must be destroyed so the microorganisms will not have a chance to survive and multiply. Raking and disposing of infected leaves on the ground and pruning infected twigs will accomplish this. Trees weakened by past infections should be fertilized to increase vigor. Watering, especially during drought periods, can be helpful to such trees. Since leaf spot fungi are encouraged by a cool, humid environment, thinning and pruning the crown to promote air movement and rapid drying of the leaves will make conditions less favorable for the development of leaf spots.

Treating established trees with chemicals for leaf spots is usually not necessary. However, when leaf loss has been severe in the past several years, using protectant fungicides can be considered. The fungicides in the included list have been used to control various leaf spot diseases. And, although these have not been tested on all tree species, they are likely to reduce leaf spots and anthracnoses if applied correctly and at the right time. The fungicides must be applied when the leaves are beginning to emerge from the buds and then 2 to 3 times at 7 to 10-day intervals unless otherwise specified. You cannot wait until leaf spots appear and then expect to control them.

LEAF SPOT DISEASES, SYMPTOMS, AND CHEMICAL CONTROL

Plant and Disease(s)	Symptoms	Chemical Control	Causal Organism(s)
Ash			
Anthracnose	large irregular brown spots, usually along the leaf edge	Captan, Zineb	*Gloesporium aridum*
Leaf spots	spots of various size and appearance	same as above	several fungi (*Mycospaerella, Phyllosticta, Septoria* etc.)
Aspen			
Leaf spots	small, discrete, circular or lens-shaped spots, or brown spots with a darker brown margin, or angular black spots	Bordeaux mixture, Copper fungicides, Captafol	*Marssonina populi* and other fungi (*Mycosphaerella, Phyllosticta, Venturia* etc.)
Basswood (linden)			
Anthracnose	elongated brown spots along the veins, but mainly near the tip of the leaves; a narrow black band separates the dead and the healthy tissues	Maneb, Zineb, Captafol, Bordeaux mixture	*Gnomonia tiliae*
Leaf spots	large brown, circular spots with dark margins, or small, white specks with wide dark margins	same as above	several fungi (*Cercospora Phyllosticta* etc.)
Birch			
Leaf spots	the first fungus produces brown spots with dark brown to black margins, and the second produces smaller spots with no definite margin	Copper fungicides	*Gloesporium betulatum Cylindrosporium betulae*
Boxelder	same as maple diseases		
Buckeye			
Leaf blotch	discolored and water-soaked irregular spots, which later turn a light reddish-brown with a bright yellow margin; very similar to leaf scorch	Dodine, Zineb, Mancozeb	*Guignardia aesculi*
Leaf spot	small, brown, circular spots, which can merge to blight larger leaf areas	same as above	*Septoria hippocastani*
Butternut			
Anthracnose	dark, brown or blackish, angular, subcuticular spots, ranging from pinprick size to 1/2-inch	Benomyl, Dodine, Zineb, Mancozeb, Maneb	*Gnomonia leptostyla*
Bacterial blight	small, water-soaked spots which turn reddish-brown	Copper Oxychloride Sulfate (C-O-C-S), Copper Hydroxide, Streptomycin plus a spreader-sticker; spray when flower buds open, at full bloom, and petals fall	*Xanthomonas juglandis*
Bull's eye leaf spot	dark, round spots with concentric white rings and a target-like appearance	no fungicide has been tested (fertilization with Nitrogen is recommended to increase tree vigor)	*Cristulariella pyramidalis*
Catalpa			
Leaf spots	spots of various size and appearance	Bordeaux mixture	several fungi (e.g. *Phyllosticta, Alternaria, Cercospora)*
Cherry, flowering			
Leaf spot	reddish spots which drop out leaving circular holes on the leaves	Benomyl, Captan, Dodine, Ferbam	*Coccomyces hiemalis*
Shot hole	infected tissue dries up and falls out leaving holes of about 1/8-inch diameter	Dodine	*Xanthomonas pruni*

Plant and Disease(s)	Symptoms	Chemical Control	Causal Organism(s)
Cottonwood	same as aspen diseases		
Crabapple			
Scab	dull, smokey areas, which change to olive-green moldy spots	Benomyl, Dodine, Captan, Polyram, Folpet, Mancozeb	*Venturia inequalis*
Dogwood			
Spot anthracnose	circular to angular dark purple areas, less than 1/25-inch diameter, with light paper-thin centers that often fall out, producing "shot hole"	Benomyl, Zineb, Bordeaux mixture, Mancozeb, Maneb, Chlorothalonil; spray at bud break, when bracts fall, 4 weeks later, and in late summer	*Elsinoe corni*
Leaf spots	small, angular, numerous spots, with sharp and haloed borders or lacking these characteristics	Benomyl, Zineb, Bordeaux mixture, Mancozeb	several fungi (*Colletotrichum, Phyllosticta, Septoria* etc.)
Elm			
Black leaf spot	small white or yellow flecks, which increase in size and turn shiny black, raised and appear only on the upper leaf surface; the leaf turns yellow	Ferbam, Zineb, Fixed Copper, Bordeaux mixture	*Gnomonia ulmea*
Anthracnose	circular brown spots with darker brown margins, or spots elongated on midribs, veins, and leaf margins	same as above	several fungi (*Gloesporium, Mycosphaerella, Septogloeum* etc.)
Leaf spots	spots of various size and appearance	same as above	several fungi (*Cercospora, Cylindrosporium,* etc.)
Hackberry			
Leaf spots	spots of various size and appearance	Copper fungicides, Ferbam, Zineb	several fungi
Hawthorn			
Leaf spot	small, angular, reddish-brown spots	Maneb, Mancozeb, Zineb, Benomyl	*Diplocarpon maculatum*
Scab	see crabapple scab	same as crabapple scab	*Venturia inequalis*
Honey locust			
Leaf spot	very small grayish specks with brown margins	no chemical control described	*Cercospora condensata* and *Cercospora olivacea*
Horsechestnut	same diseases as Buckeye		
Ironwood			
Leaf spots	spots of various size and appearance	Copper fungicides	several fungi (*Cylindrosporium, Gloesporium, Septoria* etc.)
Kentucky coffee tree			
Leaf spots	spots of various size and appearance	Copper fungicides, Ferbam, Zineb	several fungi (*Cercospora, Phyllosticta, Marssonina* etc.)
Linden (basswood)	same diseases as basswood		
Maple (red, silver, sugar, Norway)			
Anthracnose	irregular, light brown, purplish or black spots, very similar to leaf scorch	Fixed Copper, Bordeaux mixture, Zineb, Maneb	*Gloesporium apocryptum*
Leaf spot (purple eye)	irregular, 1/4-inch spots, with brownish centers and purple-brown margins	Bordeaux mixture, Zineb	*Phyllosticta minima*

Plant and Disease(s)	Symptoms	Chemical Control	Causal Organism(s)
Tarspot	irregular, shiny black, tar-like spots, up to 1/2-inch, developing on the upper leaf surface	Ferbam, C-O-C-S	*Rhytisma acerinum*
Mountain ash			
Leaf spot	small purple spots, becoming brownish; small, irregular to round brown spots	no chemical control described	*Fabraea maculata and Phyllosticta sorbi*
Scab	see crabapple scab	same as crabapple scab	*Venturia inequalis*
Mulberry			
Leaf spots	spots of various size and appearance	Copper fungicides	several fungi (*Cercospora, Cercosporella* etc.)
Oak			
Anthracnose	irregular, light brown spots which merge, appearing as leaf blotch or blight	Maneb, Zineb, Captafol, Captan, Bordeaux misture, Dodine, Tribasic Copper Sulfate; spray before bud break, at bud break, and at full leaf stage	*Gnomonia quercina*
Leaf spots	spots of various size and appearance	Copper fungicides, Zineb; apply as above	several fungi (*Gloesporium, Marssonina, Phyllosticta, Septoria,* etc.)
Plane			
Anthracnose	symptoms on very young leaves resemble frost injury, the leaves becoming curled and distorted; symptoms on fully grown leaves appear as light brown dead areas, frequently along the veins, which may enlarge to include the whole leaf; ends of twigs may also be killed; symptoms on old leaves resemble leaf scorch	Maneb, Zineb, Captafol Benomyl, Captan, Dodine, Tribasic copper sulfate	*Gnomonia platani*
Leaf spots	spots of various size and appearance	same as above	several fungi (*Mycosphaerella, Phyllosticta, Septoria* etc.)
Poplar	same diseases as aspen		
Russian olive			
Leaf spots	small circular spots with a whitish-brown center and a definite brown border	no chemical control is justifiable	several fungi (*Cercospora, Phyllosticta, Septoria* etc.)
Sycamore	same diseases as plane		
Walnut	same diseases as butternut		
Willow			
Gray scab	round, irregular, somewhat raised, grayish-white spots with narrow, dark brown margins	Ferbam, Zineb, Copper fungicides	*Sphaceloma murrayae*
Leaf spots	spots of various size and appearance	same as above	several fungi (*Cercospora, Cylindrosporium, Marssonina, Phyllosticta, Rhytisma* etc.)

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