One Companies Success Protecting Elms from Dutch Elm Disease

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Dutch elm disease ranks amongst the most devastating diseases of trees in North American history. While this may be old news, technology and chemicals used to protect elms from Dutch elm disease are not. With dozens of "cures" or protective formulations for this disease proposed in the past 50 years, there has been a lot to choose from and a lot of information to wade through. Dutch elm disease is difficult to control, unfortunately most proposed "cures" do not work.

My job is to keep 5500 elms disease free. Clients pay us to do this. We guarantee these trees will remain disease free or we refund their money. This is a big promise. Some people have said I walk on glass. However, we lose less than one percent of our treated trees over a 3-year period. In the past 22 years, our company has treated more than 25,000 elms. Some of the earlier methods and chemicals we used gave much worse results then we get today. Disease mortality in Minneapolis/St. Paul and its surrounding suburbs ranges from approximately seven percent to over 30 percent, during a normal 3-year period, depending on the suburb. The intensity of the Dutch elm disease sanitation program is directly related to the percentages of trees lost.

Dutch elm disease is a fungus, which grows in the vascular system of elms. The disease is spread 2 ways: insect transfer & root-graft transfer. Approximately 90% of new infections are transferred by the Elm bark beetle whose life cycle revolves around elms. These beetles lay their eggs in dying or recently dead elms with the bark still attached. The newly emerged adults then fly to nearby elms and feed on elm tissue in the crotches of two to four year old branches. These beetles can fly for many miles. If the beetle hatched in a diseased elm, the beetle will carry spores of the disease to another tree and infect the tree as it feeds. The major reason that this disease is so serious is the ease it can move from elm to elm on this beetle. One diseased elm can produce thousands of disease-carrying beetles all looking for a tree to feed on. It is a wonder that all the elms have not died. Unfortunately, in many places they all have.

The second way this disease spreads is through root grafts. (See diagram). While only about 10 percent of all Dutch elm disease is spread this way, it is very important to be aware of grafting because current chemical injections will NOT stop this. **Every tree injection chemical I have used or tested has not stopped or prevented root graft infection with Dutch elm disease.** The only way to stop root graft infections from occurring is to physically or chemically sever the roots between the diseased tree and the healthy tree. Root grafts must be taken into account when saving elms and be either physically broken, the neighboring tree removed, or uninfected root-grafted trees must be treated as well. If the elms are being monitored two or more times a season, the root graft issue can be dealt with after a neighboring tree becomes diseased. There must be a genetic similarity in the two elms for root grafts to exist. I have found that if two different elms are growing close together and they have very different shaped bark, they do not necessarily graft.

How Tree Injections Work

Dutch elm disease only grows in the current years xylem (water conducting vessels) of an elm. This is because elms only use the current year's xylem for transport and they plug last year's xylem with tyloses. This also means that any chemical injected into an elm will only move in the current year's xylem.

The purpose of an injection is to evenly and completely cover the entire crown of the tree with enough chemical so that if a disease carrying beetle happens to feed on that tree, the chemical is there to either kill the disease spores or not allow the spores to germinate. Thorough distribution of a chemical in the vascular system of a tree is not easy to do and requires the excavation of the root flares. This gives a larger surface area in which to put the injection tees. Because this tissue is not as rigid as the trunk tissue, the chemical spreads out more laterally and moves up the tree more uniformly than trunk injection.

As a rule, you install 1.5 – 2 injection tees per diameter inch. Never drill deeper than 1 inch as this causes unnecessary wounding. For exact specifications on injecting elms, a good reference is the pamphlet "How to Inject Elms with Systemic Fungicides" available from the University of Minnesota.

How the Chemical acts in the Tree is the Key to Success

It is important to note that the EPA, who gives a company the label and the legal right to sell a chemical, does not require that the chemical show efficacy for the uses listed on the label. As many people already know, it is a "buyers beware" market. Our company has found many chemicals ineffective in treating diseases listed on their product labels. I have found this to be especially so with chemicals claiming to prevent or cure Dutch elm disease. For a chemical to be effective at protecting an elm from Dutch elm disease, it must possess all the following properties and capabilities:

1. Stay actively fungicidal or fungistatic inside the trees vascular tissue for an extended period of time.
2. Be able to move in the xylem and distribute itself throughout the crown, especially in the two to four year old branches where the beetle feeds.
3. Be water soluble, stay mobile, and remain in the tree in large enough quantities to be effective.
4. The chemical must stay in the vascular tissue of the tree, and not move into the leaves in large quantities.
5. Be able to move into newly-formed wood in large enough quantities to give multiple years of protection.
6. Not harm the tree by being toxic or excessively low in pH.

Many chemicals have shown at least one of these properties; I have found only one material that possesses all of these properties. I have worked with a number of chemicals that have been proposed since 1976 with varying results.

Thiabendazole *(Arbotect 20-S & Elmsafe)*– Thiabendazole has been around since the late 70's. Research done at the University of Minnesota in the late 1970's, supervised by Dr. David French, showed that if the original label rate was multiplied by 12 times, there was efficacy. They built on an earlier discovery that below ground, root flare injection, could virtually give 100% distribution of the chemical in the tree. Additionally, the fact that Thiabendizole both remains chemically stable (does not degrade) and is biologically mobile (moves into new sapwood); allows for multiple years of protection. Thiabendazole is the only chemical I have used that has given predictable and outstanding results. We believe the chemical is effective for 2 ½ years. We retreat trees every 3 years because we want to keep injection wounding to a minimum, however we inspect all of our trees late in the 3rd season because 80% of our losses become infected at this time.

We have numerous examples of estates, golf courses and neighborhoods that still have 95% or more of their original treated elms, while next door every elm is dead. Our record of accomplishment over the past 10 years has been a loss rate of less than one percent over a three-year period.

We have found little or no necrosis around the injection wound as long as the chemical is properly diluted and the injection wound is no deeper than one inch. It is important to treat healthy trees only. The injection process can do great harm to trees with root diseases.

Thiabendazole, like any other treatment, must be used in an appropriate and technically accurate way. It prevents insect-transmitted infections, but not infections transmitted through root-grafts. I do not recommend injection as a cure for diseased elms. While there has been some success reported, I have personally never saved a tree by injection alone. I have caused the symptoms to disappear for as long as 2 years with Thiabendazole, but in every case, the disease came back.[1] However, I have found a method of saving elms that

[1] Note: In oak wilt infected White or Burr oaks, *Ceratocystis fagacearum*, I have stopped the disease, with no return infections after 5 years. In numerous trees, the disease was stopped and did not return in almost every case with 2 exceptions. The chemical used was Propiconizole (Alamo) at the 10-ml rate. We believe this success has to do with the strong ability of these types of oaks to compartmentalize infections. Unfortunately, diseased elms we have treated with Propiconizole failed in 23 out of 23 trees.

works. But only as long as the infection has not moved into the roots. Even if the trunk is infected. I will describe this process using a unique method of pruning later in this article.

Propiconizole *(Alamo)* – Was introduced in the early 1990's and has shown promise as a material that is easy to inject and profitable to use. The recommended dose was 5-ml per inch diameter in 1993. In 1995, they raised the dose to 10-ml per inch diameter; now I have heard that the label rate may be increased to 20-ml per inch diameter. Currently, research is being done on this higher rate in hopes that it works better than the 5-ml or 10-ml rates. We treated over 400 elms with the 10-ml rate in 1995. Our losses were zero in the first year. In the second and third year, our results were not very good, as the number of trees lost was nearly equal to the surrounding community losses. I am not sure this material has the capability of moving into new wood. We will wait to see the results of the newest research.

Copper Sulfate *(Phyton 27)* –is used as a flower preservative. My experience has shown that the material is not water-soluble and is very hard to inject. The manufacturer recommends trunk injection, claims it can save trees up to 30% diseased, and promotes it for many other tree diseases. We used this material on about 60 trees in 1986 as an informal test in a high disease area. There was little or no reduction in disease compared to surrounding trees at any point after treatment.

Lignasan – Is still used in parts of Canada and the East Coast. I used it for 3 years in the late 1970's. My experience was that it gave 1 year of protection. The chemical is very mobile and moves easily into the leaves.

Saving Diseased Elms

In my experience, none of these chemicals are useful for saving diseased elms. However, we get predictably good results by using an innovative technique that removes the disease through mechanical means. Basically, we physically isolate all the diseased tissue from the healthy part of the tree. This goes a major step beyond just removing the diseased limb; it involves understanding how the disease grows in the tree and then tracing around all of it. This works well because the person doing the tracing will know if they can get all the disease or not. When we know we have gotten all of the disease, we rarely lose a tree. However, if the disease has already grown into the root system, I know of nothing that works. There are complications in using this procedure when dealing with disease that has grown into a co-dominant stem of the elm. A co-dominant branch connection is different from a normal branch in that the vascular tissue is connected both at the top and the bottom. In a normal branch, the vascular tissue is only connected to the trunk at the bottom. Thus, if the disease grows directly into a co-dominant stem, it will move into the other co-dominant stem and grow back up the tree. When this situation happens, the disease can move fast and be very difficult to track down if not caught in time. This chainsaw procedure is not that difficult to learn, leaves shallow wounds on the tree (1" – 2" deep) and could save 1000's of large valuable elms that are removed unnecessarily each year.

Elm injection is a valuable tool for the arborist. However, its use should be limited to high value, irreplaceable elms. The most important aspect of Dutch elm disease control is the removal and disposal of diseased elms. Without sanitation, this disease can spread a very rapid path of destruction for elm trees.

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