THE DED PICTURE AS I SEE IT[1]

by Spencer H. Davis, Jr.

Let's start out by saying I believe the American elm is the most beautiful shade tree the Good Lord has given us and I fervently wish that someone could develop a strain resistant to Dutch elm disease (DED). But since breeding and selection for resistance takes many years, and we don't have that long to wait at the speed DED is knocking off our elms, I also wish that a chemical could be developed to do the job until the plant breeders have the answer.

Those who know me will know that I am usually an extreme optimist. Almost invariably I look at the happy side of things and believe that all will work out well in the end. Unfortunately, I do not have that conviction when it comes to saving the American elms. My hopes have been raised too many times in the past and I have lived through so many 'good news' stories on saving the American elm that I am very skeptical regarding its future.

During the summer of 1940, I worked under Dr. Curtis May, who at that time was heading up DED work out of the Morristown, New Jersey headquarters. Some of you may have worked under Curtis and some of you may go back to the DED eradication programs carried out by the CCC during the 1930's. As I recall, something like three million dollars in preinflation money was spent in an effort to eradicate every DED tree that could be found. That program was then abandoned as being a failure.

Plant breeding and selection for resistance to disease has developed many varieties of plants that did the job of growing in the presence of the causal fungus. But fungi mutate or change too, and so often the newly developed resistant variety of plant later falls prey to the new strain of the fungus.

Breeding work to develop strains of elm resistant to DED has been going on in the Netherlands since 1928. In 1975 these plant breeders released 30,000 grafts of three strains of elm that are (now) resistant to DED. But even as we read that good news we also learn of a new and highly virulent strain of the DED fungus which is ravaging the elms in Great Britain and on the continent. What happens when these (and later) super virulent strains of the fungus hit the new elms?

Let's look at previous experiences with other plants, their diseases, and what happened to resistant strains of those plants. The Rutgers tomato became famous many years ago as the most popular tomato in the country. It was resistant to Fusarium wilt of tomato. It is no longer resistant because the *Fusarium* fungus has developed new strains that can knock off not only Rutgers variety but also some of the more recently developed tomato varieties.

The red stele disease of strawberry is caused by a fungus called *Phytophthora*. Through the years as plant breeders developed new lines of strawberries which were resistant to red stele, the fungus also developed new strains which overcame the resistance in the strawberry.

Some years ago, two new lines of mimosa were released which were resistant to Fusarium wilt. Those varieties, 'Charlotte' and 'Tryon' were sold quite widely but I doubt that you can find nurseries which still grow them today because *Fusarium* has found a way to beat the plant breeder once again.

These examples do not mean that plant breeders should stop their efforts to find resistant plant lines. If they had given up years ago, we might have no tomatoes, strawberries, wheat, mimosa, etc.

Now let's look at chemicals for insect control, since DED is spread by insects. The following quotation does not refer to elm bark beetles, but it does authenticate work done in 1977 and reported in *The Monthly Magazine* and *American Review* of that year. I quote, "Within these few years, an insect, before unknown in this country, has made its appearance in the British orchards, which if means are not taken to root it out will in a short time destroy every apple tree in the

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Kingdom." "We are happy in having in our power the recipe of a cheap composition, discovered by William Forsyth, his majesty's gardener at Kensington, which has found effectually to answer the purpose: To 100 gallons of human urine add as much cow dung as will bring the whole to the consistence of paint, with which anoint the infected trees about the end of March."

This is the early work on insect control and fortunately for us much more refined work has followed. We used to DDT and it did a respectable although not complete job of stopping the beetles. Now that DDT is gone, we are left with methoxychlor, which is recognized as being inferior to DDT. Still we read in one recent scientific publication that "(1) fall spraying with methoxychlor is effective, (2) residues accumulate from successive yearly sprays; and (3) heavy doses of methoxychlor are not necessary to control the disease." We know that methoxychlor does a respectable job of controlling the beetles but can we keep ahead of them and the disease they spread?

And then along came *Bidrin.* I am sure that the majority of arborists in business today know of this chemical and perhaps most of them have used it "to control DED." When it came along the scientific evidence presented with it was most impressive. I was personally so impressed that I set up a two-day meeting of some 200 men in New Jersey to learn how to inject this chemical into the trees to control DED. I believe the chemical is still available today for other uses, but I know of no arborist who is using it for DED. Do you?

And now let's quickly run through some of the chemicals and methods which have been touted for chemotherapeutic control (injection of fungicides into the trunk) of DED.

In 1947, in a paper presented to the National Shade Tree Conference, Drs. Dimond, Horsfall, and Stoddard reported on the use of oxyquinoline benzoate, which "exerted definite beneficial action in suppressing symptoms of DED in the sick tree." This chemical was sold for a number of years by Andrew Wilson Company under the name of *Bioquin.* It is no longer used.

In 1948, Dr. Skolnick received his Ph.D. degree from Rutgers University, having worked on a Bartlett Tree Fellowship on DED. The chemical he found to be very effective was called lauryl pyridinium chloride and produced by the Hooker Chemical Company. To my knowledge it never did make the commercial market.

In 1950 the F.A. Bartlett Tree Expert Company put out an advertising leaflet entitled, "New Hope in the Fight Against Dutch Elm Disease." Their use of the chemical called *Carolate,* "opens a new road of hope for suppression of this destructive and costly tree disease" so the leaflet said. I don't know of anyone still using it for DED.

In 1957 the Trelife Company from Chicago released a chemical called *Kemysol* and later *Trelife*. They reported that J.C. Carter and Noel Wysong had tested the chemical and were unable to inoculate trees with DED after the chemical was injected. Their advertising leaflet reads "Basic Science Finds the Cure for Dutch Elm Disease." They also said "Since the treatment is identical for both Dutch Elm and Phloem Necrosis, separate diagnosis is not necessary."

Through the years we all heard about zinc chloride, zinc nails, iodine compounds, and many others. Then we came to the era of Benlate and benomyl-related materials. In 1972, The DuPont Company came out with *Benlate,* used either as a foliar spray or a trunk injection, "as an aid in the control of DED." And the Elm Research Institute put out a leaflet for use of Benlate stating, "Now at long last we have the means to control this dread disease . . ."

In the March, 1974 issue of Plant Disease Reporter we read "Injection of benomyl into soil surrounding large nursery elm trees greatly reduced DED symptoms . . ." I don't know of anyone using it now.

In 1976, the University of California prepared a leaflet #2864, entitled "Dutch Elm Disease." The leaflet recommends: sanitation, methoxychlor sprays, use of Vapam to cut off root grafts, and foliar sprays and trunk injections of Benlate ". . . to be effective the fungicide must be applied to healthy trees."

In May of 1976 we received the DuPont label for *Lignasan BLP.* This new formulation of a benzimidazole material in the solubilized state was prepared to get away from the clogged tubes and vessels which users of the old (1972) Benlate

had experienced. This material which was "an aid for the control of DED" was to be used by "trained arborists, could be used anytime during the growing season, and uninfected trees are to be retreated annually."

In the December 1976 issue of the Journal of Arboriculture we see a letter from the Chairman of the International Society of Arboriculture Pesticide Committee to Russell Train of the federal E.P.A. in reference to Lignasan. In it he points out that "the original research, done in Canada, calls for a rate of application 4 to 5 times greater than that called for on the present label," and "the original research requires the material to be injected into roots rather than trunk," and, "we therefore ask for revision of the label by DuPont and E.P.A." .

The Progress Report in the fall of 1976 from Elm Research Institute states, "When healthy elms are treated every year, the prognosis for continued health is more than an optimistic dream, it is a complete reality." The report then presents data on survival of treated and untreated elms in 16 states in which it indicates outstanding results from treatments with Lignasan. There is no attempt, however, to use what the scientist refers to as "matched pairs" of treated and untreated trees when collecting data. And interesting too is the fact that the tests in one state showed that 24% of the Lignasan treated trees became diseased.

Also in the fall of 1976 came a report from the University of Maine that stated, "Recent cutting of 80 elm trunks injected for disease control over a period of one to four years by Shigo and Campana showed extensive discoloration and decay. This suggests the possibility of serious interference with normal growth of elms injected for disease prevention."And to this I would add my comment, What will happen to those elms injected annually for 10 or 20 years?

Following this we have a December 1976 newsletter from Michigan State University on the subject of Lignasan BLP injected into trees. The newsletter states, "The injection fo Lignasan BLP is physically harmful to the tree, hence, healthy trees should not be injected as such treatment can in time be as harmful to the tree as the disease itself." Do you remember an earlier quotation which recommended treating healthy trees?

In 1977 DuPont no longer sold Lignasan directly to the user, but five outlets merchandised the material under trade names of *Correx, Agway Elmosan, Pratt Elm Tree Noculate, Arboral Fungicide,* and *Ulmasan.* The respective companies now advertise their materials with such lines as, "Now Elms Can Be Saved."

And the last of the new products to come on the market (at least to my knowledge) was released in June of 1977 by Merck & Company, and is called *Arbotect 20-S.* Although it is slightly different than Lignasan and is recommended at a more concentrated solution in water, it too is benzimidazol material. It is available through 29 distributors throughout the country.

In a May 1977 publication from the University of Wisconsin, their recommendation regarding use of Lignasan stated, "When subsequent holes are drilled the next season, these can be placed 2 to 4 inches above or below and slightly to the side of holes made previously." In recommendations made recently, Shigo says, "If additional injection wounds are needed they should be separated by at least 18 inches above the first whorl of wounds." So if we treat elms annually as some suggest, we would be injecting 15 feet above the ground at the end of 10 years and some research indicates injections should be in the roots or root flares. Shigo goes on to recommend "waiting two years or three years would be better between injections."

I trust you can understand why I, an optimist as a general rule, have such a pessimistic outlook on the DED problem. I hope I am wrong, and in two years we have the chemical answer to DED, and in five years have resistant elms as a result of breeding programs. In the meantime I wish every success to those researchers who are working so diligently to find the answers to DED and I hope the future proves how wrong I am with my pessimistic outlook.

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