DUTCH ELM DISEASE THERAPY

by James L. Sherald and Garold F. Gregory

The virulence of Dutch elm disease (DED) has long precluded therapy as a practical, routine component of DED management programs. However, successful therapy has been achieved through pruning (May and Douglas 1944, Marsden 1952, Campana 1975, Himelick and Ceplecha 1976), and through fungicide injections (Gregory et al. 1973, Kondo et al. 1973). More recently, the combination of pruning and chemotherapy has been found to be more effective than either of the techniques used alone (Campana and Gregory 1976, Gregory and Allison 1979).

In 1975 the Ecological Services Laboratory of the National Capital Region (NCR) of the National Park Service, in cooperation with the USDA Forest Service, Forest Insect and Disease Laboratory, Delaware, Ohio, initiated a 3-year case study of DED therapy in NCR. The purpose of the study was to determine if integrated therapy, pruning plus fungicide injections, could be a reliable, practical procedure for reducing DED losses and saving high value elms.

Materials and Methods

The study was conducted in NCR-Central, which includes the National Mall, the White House, Lafayette Park, the Jefferson and Lincoln Memorials, as well as other parks, streets, and monument grounds within the federal enclave of Washington, D.C.

From 1975 through 1977 approximately 2,260 elms were examined for DED symptoms. Trees exhibiting symptoms were tagged and samples collected for culture and identification of *Ceratocystis ulmi.* Elms with 30%, or less, wilt received therapy.

Trunks were injected with MBC . HCl (methyl 2-benzimidazole carbamate hydrochloride) in 1975 and 1976, and with Lignasan BLP (methyl 2-benzimidazole carbamate phosphate) in 1977: Trunk injections were made at 3 grams/liter, 2 liters/2.54 cm dbh, which is approximately 7.5 times the labeled rate of most commercial formulations of Lignasan BLP. Injections were made at 70 p.s.i. with a Spartan Power Sprayer (FMC Corporation, Model 3320(33-C) equipped with a 49 liter translucent polyethylene carboy as the fungicide reservoir (Fig. 1). To facilitate dosage preparation, the carboy was calibrated in liters/cm dbh. When necessary, additional fungicide could be added to the carboy without stopping the injection. Injector heads, hoses, and manifolds were the same as those developed by the USDA Forest Service (Gregory and Jones 1975). Injector heads were placed at ground level at approximately 15 cm intervals around the base of the trunk. Whenever possible, heads were inserted into root-flares.

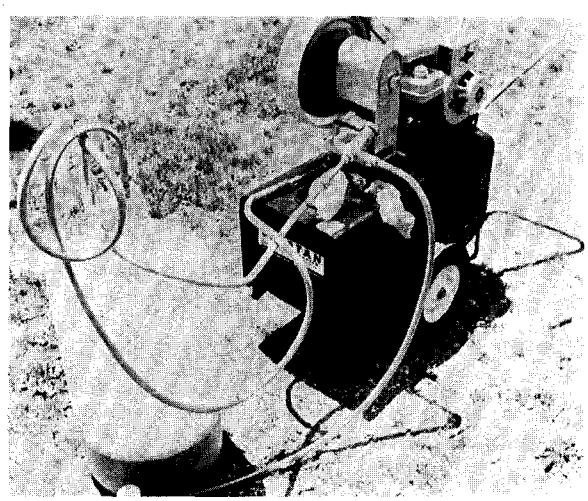

Fig. 1. Spartan sprayer injection apparatus.

Frequently, when wilt was localized in one or two limbs, limb injections were performed (Fig. 2). Injector heads were placed at 10 cm intervals around the circumference of the infected limb at a major notch well below the wilted segment. Limb injections were made at 6 grams/liter, 1 liter/2.54 cm limb diameter in 1975 and 1977, and at 12 grams/liter in 1976. Whenever possible, limb injections were made prior to pruning; however, when pruning occurred first, limbs were injected

at the next major crotch below the pruning cut. Although an attempt was made to prune all diseased limbs beyond discolored sapwood, this was not always possible.

All treated trees were examined for DED symptoms through 1979.

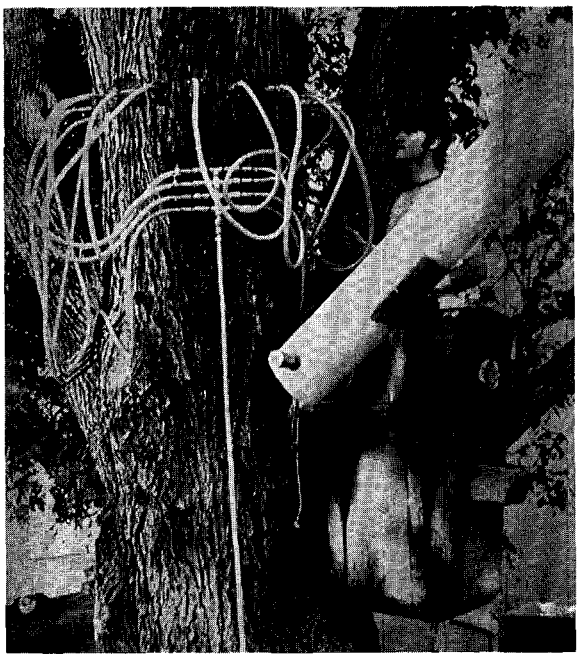

Fig. 2. Elm limb prepared for pressure injection.

Results and Discussion

Within the study area the DED incidence for 1975, 1976 and 1977 was 2.6, 2.2 and 3.2% respectively. Of the 185 elms infected during the study, 86 (47%) exhibited over 30% wilt and were removed. Thus, slightly more than half of the trees infected each year exhibited 30% or less wilt and received therapy (Table 1). Therapy was provided to 98 trees, mean dhb 88.9 cm, during the 3 year program. Average injection time for trunks and limbs was 60 and 40 minutes respectively.

In 1979, 57 (55.1%) of the treated trees were free of wilt and apparently recovered from DED. Forty-four had to be removed following a recurrence of DED (Table 1). Symptoms were arrested in most trees for the remainder of the season following treatment. However, recurrences were noted in treated trees as late as 4 years following therapy. Although recurring infections were not traced, it is likely that the original infection remained latent following treatment. Later recurrences could reflect the fungistatic nature of MBC (Janutolo and Stipes 1976), the varying sensitivity of *C. ulmi* to MBC, the inability of some trees to completely and permanently wall-off the pathogen, or a combination of these possibilities. When initial therapy has not been successful, yet the residual infection has not reached the bole of the tree, repeated therapy may be successful. Repeated injection could effect more nearly complete distribution of fungicide in the outer sapwood. Of 11 trees treated in 1975 and retreated in 1976 following a recurrence of the disease, 5 were still free of wilt in 1979.

Limb, as well as trunk, injections were given to 62 of the 98 trees treated. Sixty percent of these trees were saved compared with 47% of those receiving only a trunk injection. Limb injections increase the likelihood of fungicide being present in the vicinity of any residual infection which remains following pruning. This could account for the greater success with combined trunk and limb injections.

Table 1. Summary of Dutch Elm Disease in the National Capital Region, Washington, D.C.

				Treated and lost[a]					*Total treated & lost*	*Total treated & remaining*	*% Treated remaining*
Year	*No. infected*	*No. treated*[b]	*% Treated*	*1975*	*1976*	*1977*	*1978*	*1979*			
1975	60	29 (30)[c]	50.0	0	8	4	4	1	17	12	41.4
1976	51	27	52.9	—	2	3	2	4	11	16	59.2
1977	74	42	56.7	—	—	8	6	2	16	26	61.9
Total:	185	98 (99)[c]	Ave. 53.5			Total:			44	54	Avg. 55.1

[a]Removed after severe recurrence of Dutch elm disease.

[b]*Tree exhibiting 30% or less wilt received treatment.*

[c]One tree lost because of storm damage, 1975.

Sixty-six of the treated trees had 10%, or less, wilt at the time of treatment. Twenty-three had 20%, and only 9 were judged to have 30% (Table 2). Therapy was most successful on trees in the 10%, or less, category, with 39 free of disease 2-4 years after treatment. However, even 5 of the 9 trees with 30% wilt were cured (Table 2).

Table 2. Status of Elms with 10%, 20%, and 30% Wilt Receiving Dutch Elm Disease Therapy.

	Number of elms			
% Wilt	treated	lost	remaining	% remaining
10	66	27	39	59.1
20	23	13	10	43.5
30	9	4	5	55.6

Therapy treatment during the 3-year study reduced DED losses by 29% and saved 55% of the trees treated. Although the total number of trees saved is not great, (Fig. 3) the value of the individual specimens saved, is immeasurable (Fig. 4).

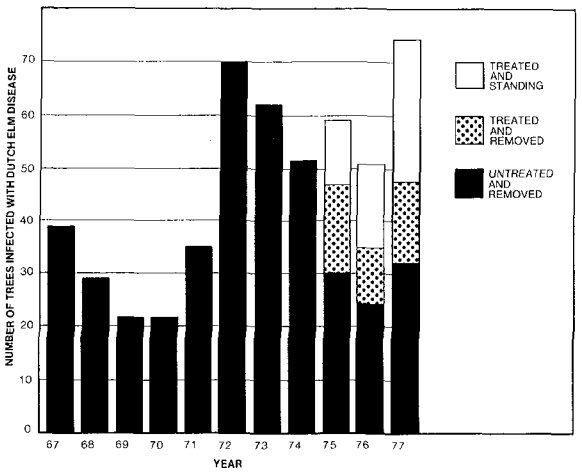

Fig. 3. Dutch elm disease incidence in the study area, 1967-1977. DED therapy was performed from 1975 through 1977.

Therapy is by no means a substitute for sanitation and methoxychlor sprays. However, therapy can be a valuable tool for communities, college campuses, and park authorities where arborists are responsible for managing small, high value elm populations where infections can be detected early and where special attention can be given to individual trees. Table 3 lists some guidelines which can be used in managing a therapy program.

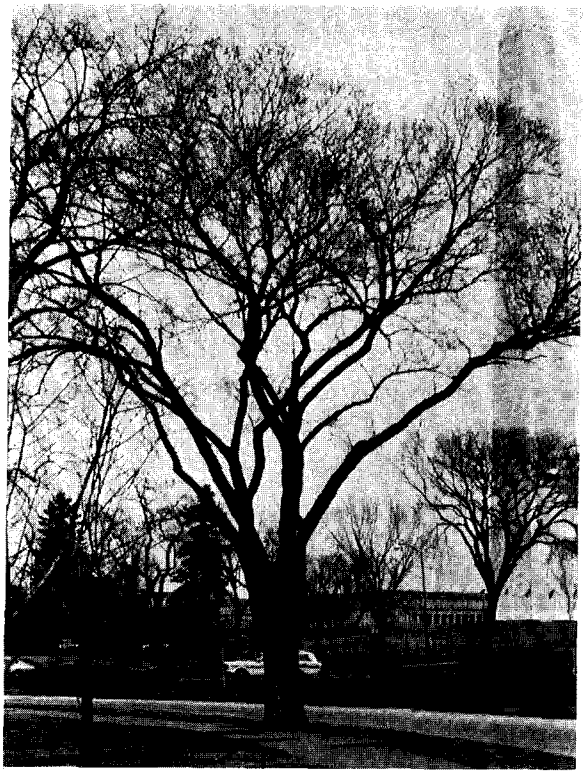

Fig. 4. American elm near the Washington Monument which received Dutch elm disease therapy in 1977 and has shown no further symptom progression.

Table 3. Guidelines for Dutch Elm Disease Therapy.

1. Thoroughly examine elms for DED symptoms from May through September.

2. Immediately evaluate infected elms for therapy.

   a. Reserve therapy for high value elms with 10% or less wilt. Poor risk trees, those with greater than 10% wilt, and older trees with deteriorating crowns and generally poor vigor, should be removed immediately.

      Poorly shaped specimens, trees aesthetically unacceptable after radical pruning, or trees located in insignificant locations, should be removed and treatment reserved for more valuable specimens.

b. Therapy should not be performed when vascular discoloration extends into the main trunk.

Small "windows" cut in the bark of the limb and in the trunk below the wilted segment help determine the extent of sapwood discoloration.

3. Immediately provide therapy to selected elms.

a. Inject fungicide into the trunk and the infected limb.

b. Prune the infected limb 1-3 days after injection.

(1) There should be at least 5' and preferably 10' between the last visible sapwood discoloration and the pruning cut.

(2) If discoloration extends into the main trunk, the tree should be removed.

4. Closely examine treated elms for symptom recurrence.

5. Elms with recurring infections should be evaluated for further treatment or removed.

6. Maintain complete records on each therapy case.

Records should include: Tree location, dbh, percent and location of symptoms, date of treatment, amount of fungicide injected, and time required for treatment. A photographic record for each tree can be very useful.

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