

On June 30, 1972, the Bull Sheet editor attended a seminar on the subject of the dutch elm disease. I want to pass the information on to you.

## TECHNICAL INFORMATION CONCERNING BENOMYL (BENLATE)

### Nomenclature

Benomyl is the common or coined name for the commercial fungicide Benlate, which has the chemical name of Methyl 1-(butylcarbamoyl)-2-benzimidazole-carbamate. "Benlate" is a trademark of E. I. du Pont de Nemours & Co., and is available as a 50% wettable powder formulation. Benomyl is also registered as Tersan 1991 for commercial turf use.

### Dutch elm disease registration

Label registration for use as an aid in Dutch elm disease control programs was obtained on March 8, 1972, from the Environmental Protection Agency, registration number 352-354. The reader is referred to the sample label in the packet of information for the precise language of the label. This is a "supplemental label"; that is, only the person or firm buying Benlate Specifically for Dutch elm disease control will be provided this label by the chemical distributor.

### Other uses of benomyl

Benlate is now registered for control of certain diseases and certain methods of application on many ornamental and several food and feed crops. Benomyl is also registered as Tersan 1991 for commercial turf maintenance purposes. Since the product is relatively new, its crop and use registration is expected to expand considerably over the present status.

### Mammalian toxicology

The appropriate lethal dose for benomyl, by oral administration to male rats is greater than 9500 mg/kg (LD/50), the maximum feasible dose. **A common standard for comparison is aspirin, which has an LD/50 of 1200 mg/kg and is considered slightly toxic.** The smaller the number, the more toxic is the compound. In long term feeding trials with benomyl rates as high as 2500 ppm no nutritional, clinical, hematological, urinary, biochemical or pathological evidence of toxicity was noted.

Thus, benomyl is regarded as a chemical of low toxicity to man and warm blooded animals.

### Environmental toxicology.

The public is now very much concerned over the safety and effects of chemicals released into the environment. Such questions as their effects upon birds and other wildlife or serious contamination of water, soil and air are frequently asked. Products accepted for registration now must meet certain minimum standards regarding those questions before a label is granted.

On the basis of present information no deleterious effect is likely to occur to the environment when Benlate is used as directed for Dutch elm disease control. The user is implicitly advised, however, to avoid taking environmental chances with Benlate, as with any chemical. Lakes, streams or other bodies of water should not be sprayed; the operator should avoid preparing excess mixtures of chemicals that create disposal problems; no material should be poured down gutters or sewer lines, etc.; people and pets should not be sprayed; sprays should not be applied when winds will cause unnecessary or unacceptable drift, etc.

As with most modern-day chemicals, surveillance and research on environmental effects will continue in order to assure the protection of natural resources. Applicators of pesticides must also do their part in using chemicals selectively, properly and safely.

### Source of Benlate for Dutch elm disease control.

The Hopkins Agricultural Chemical Company, 537 Atlas Avenue, Madison, Wisconsin, is a distributor of Benlate (Tel. area code 608 222-0624). They will be provided a list of the people who participate in the training sessions, and will provide labels and chemical as it is ordered from them. The price is \$16.60 for two pound containers and will be shipped United Parcel Service prepaid.

**TCPA treatment** was developed because a simpler, less costly treatment than with Vapam was desired. TCPA (Na-2, 3, 6,-trichlorophenyl acetate or Fenac) is a chemical plant growth regulator that induces growth changes in the vascular system and apparently obstructs the movement of fungus in the tree. It has low mammalian toxicity and will cause no damage to vegetation or other wildlife when used as directed. Government approval for TCPA to prevent Dutch elm disease spread through root grafts will not be obtained for the 1972 season, but is mentioned for possible future use.

Before a diseased tree is treated, remove a slab of bark near the base of the trunk and check for discolored wood typical of the internal symptoms of the disease. If such coloration is found, the disease has already advanced too far for the treatment to be effective. The fungus has probably already entered the root system of the adjoining elm(s), though no external symptoms exist.

The chemical diluted 1 to 1 with water is injected into the newly detected diseased elm through aluminum injection sleeves inserted at 2 inch intervals around the circumference of the trunk at approximately breast high. The sleeves are injected into the sapwood just beneath the bark.

Opinions vary among municipal foresters regarding TCPA's comparative effectiveness with Vapam treatment. Because of its simplicity and economy, it probably will be used substantially in municipal control programs if government label approval is given.

### \* Benomyl (Benlate) Systemic Fungicide

Up to now control measures have emphasized prevention of the spread of Dutch elm disease — they have not attacked the disease-causing agent (fungus) directly. But intensive research the past four years with benomyl (Benlate) has demonstrated its effects upon the fungus and its ability to move in the vascular system of the tree. Though the full extent of its usefulness in helping control Dutch elm disease has not been determined, results appear to justify its release for use in specific situations in 1972 — Government registration has been granted, limiting its application to trained arborists. Benomyl has low mammalian toxicity and has demonstrated no damaging effects to wildlife or the environment in tests to determine these characteristics.

Benomyl appears reasonably effective in protecting elm against fungal invasion via European bark beetle feeding. It also has some curative power against these infections if treated immediately after symptoms occur. Results with curative treatment are better if elms have passed the springtime period of extreme susceptibility (after about June 20) before first symptoms appear.

It has no protective or curative effects against infections occurring through the roots or trunk or against infections carried over from the previous season. Benomyl must be applied properly to assure uptake and distribution of the chemical. Thus, successful use of benomyl for Dutch elm disease control requires considerable understanding of the way the disease develops and the physiology of elms. Only competent, trained arborists will be allowed to use it.

**Preventive treatments** may be applied as foliage sprays or injected in the trunk. Initially municipalities may want to treat several blocks of trees with a known history of disease development and compare them with a similar nontreated area.

a. **Foliar application** in early June is the preferred time for limited preventive treatment. Losses in trees so treated in 1971 were less than one-third of those in comparable nontreated sites. Since the treatment has no effect on trees where root graft spread is occurring, root transmission must be prevented to obtain the maximum benefit of the systemic fungicide treatment.

Eight pounds of Benlate in 100 gallons of water is applied, using 2 to 3 gallons of this suspension per mature elm. John Bean Rotomist applicators provide the most complete coverage of the tree. Work with hydraulic sprayers has not been done, but these may provide adequate coverage.

Benomyl has low mammalian toxicity and apparently has no harmful effects on wildlife. Applicators should avoid drift of the chemical into nontarget areas, accidental spraying of people and pets, and contamination of water.

b. **Trunk injection** is an alternative preventive treatment which uses the injector sleeves mentioned in the TCPA root isolation treatment to get a benomyl suspension into the tree in early June (see figure 10). A suspension is prepared by adding 2 pounds of Benlate to 100 gallons of water and mixing vigorously. (Benomyl is essentially insoluble in water.) The suspension is then put in 65 ml. plastic capsules (vials) attached to the sleeves which are spaced at 2 inch intervals about the trunk of the tree. Uptake into the tree's vascular system is necessary for any possible effectiveness.

**Treatment of diseased elms** is probably the ideal approach toward Dutch elm disease control. Two factors are essential for success.

1. Select trees in which spread of the disease is apparently not rapid. Treatment is rarely successful if symptoms are evident before mid-June (such trees probably became infected the previous year) or if infection occurred through root graft. Therefore, trees which show first symptoms after June 20 and which are at least 50 feet away from where an elm has died during the previous two years have the best chance of recovery. Depending on the earliness of detection, perhaps one-fourth of all infected trees might be suitable for curative treatments

2. Start treatment immediately after symptoms appear — before laboratory confirmation of the disease. Chance of success drops substantially if more than 5 percent of the elm crown shows symptoms. Thus, close observation of elms is essential. Tree owners need to know what initial symptoms look like, and whom they can contact for prompt treatment, if they want to take advantage of this treatment which offers a 50-50 chance of success for

infected elms in this category. Laboratory confirmation should be obtained for accuracy of records. Treat as described for preventive benomyl trunk injection, as soon as possible after disease detection, but under conditions of good uptake (a sunny day with an adequate soil moisture supply available.) Pruning of diseased elm wood during the season of treatment is not recommended.

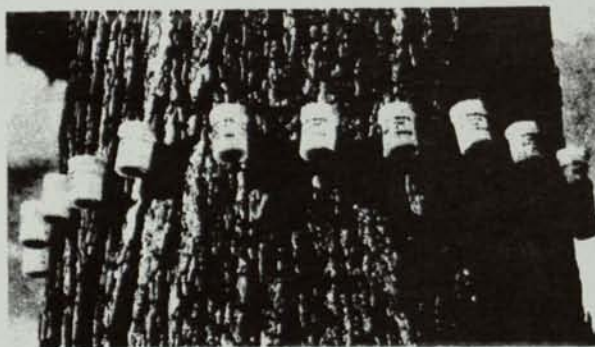
Treating properly selected diseased elms will not jeopardize municipal sanitation programs. However, all treatment should be made with the knowledge and approval of the city forester or other appropriate city official. Treated trees should be observed for evidence of continued spread of symptoms or invasion by bark beetles. If further deterioration is noted or beetle invasion occurs, remove the trees.

### THE FUTURE

The ultimate role of **systemic fungicides** such as benomyl is yet to be determined. Hopefully, application methods can be simplified, and techniques and timing improved to increase levels of control. Research is continuing with both preventive and therapeutic goals in mind.

**Dutch elm disease-resistant elms** with acceptable horticultural characteristics should be available at a future date. European releases have not been very acceptable for Wisconsin conditions, but two selections at the University of Wisconsin may be released soon and find use in some situations. Resistant elms would help urban forestry programs by increasing diversity in plantings, and providing a species that can tolerate salt damage, air pollution, soil compaction and other urban adversities.

**Better care of all trees**, not just elms, is also important. Greater appreciation of the role of municipal and commercial arborists and training programs that continue to increase their competency are essential. And private tree owners should learn the fundamental requirements of tree care, since many valuable trees are lost to homeowners each year through improper care or treatment.



The capsules attached to this tree contain benomyl, a systemic fungicide which shows promise in helping to control Dutch elm disease.

\* Excerpts from: "DUTCH ELM DISEASE IN WISCONSIN" by G. L. Worf, F. Koval, E. B. Smalley, Plant Pathologists — University of Wisconsin.

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