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These American elms, planted in a "tree monoculture," are dying from the combined forces of Dutch Elm disease and phloem necrosis, another disease. Photo courtesy of Illinois Natural History Survey.

### DED (from page 17)

elimination from the vascular conduits through which the infecting fungus moves. Time is critical here and its significance depends on whether the treatment is designed to be preventive or curative.

If preventive, the chemical must be applied in early spring (late May or early June in most places) and remain effective over a period of 4-6 weeks (into July in most places).

If curative, initial strength and rapid mobility might be decisive factors to achieve rapid and complete toxicity to the fungus. But in postinfection application, complete toxicity to all fungus elements of an established infection is unresolved.

5. *Is Benlate phytotoxic?* In concentrations necessary to be effectively fungicidal, does it cause side effects damaging to plant tissues into which it must move as a systemic?

All reports indicate little or no phytotoxicity at levels well above those required. However, some damage is reported at unusually high dosages in applications both of emulsified and solubilized forms. Probably because the initial evidence of lack of significant phytotoxicity is so encouraging, this point has not yet been evaluated critically.

To the extent that foliar application by spraying continues to show promise for preventive control, a critical study here to establish threshold levels of phytotoxicity is essential. Also, in flushing of Benlate emulsions into drilled holes in bark and wood, with resulting encrustation of exposed tissue surface by precipitated particulate matter, there is some possibility of localized toxicity.

However, it may be difficult, to separate apparent toxicity from wound-tissue reactions and subsequent microbial colonization. Many such wounds in 1972 healed quickly; thus, localized tissue damage by chemical toxicity or trauma is not considered serious. In effect, Benlate appears to satisfy the requirement for relative non-phytotoxicity.

### USE AND RESULTS

One of the most hopeful signs that a satisfactory systemic chemical may now be at hand, is the wide variety of research being done. Many pathologists are testing new techniques to put Benlate into vessels of elm, the main sites of initial infections and ultimate spread of the causal fungus throughout the tree.

When first used against Dutch elm disease, Benlate was incorporated into the soil to be absorbed by the root system of the tree. Its effectiveness by this method was based on sustained presence of the fungicide over long periods of time, in some cases exceeding a year, as well as on uniformity of distribution throughout the vascular systems of the trees. However, soil application is disadvantageous for many practical and economic reasons.

Foliar spray by mist blower at the rate of 8 pounds per hundred gallons of water was effective in preventing new infections both in Wisconsin and Michigan,<sup>4,5</sup> but is not considered to have value against established infections.

Systemic fungicides applied to foliage have limited ability to move downward in woody tissues, where the causal pathogen becomes deeply established. Therefore it is not likely that infection could be arrested, unless the

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fungus were limited in its distribution to relatively small twigs when the chemical spray was applied. Thus, in spite of its promise, spraying is limited to prevention of infection, and has potential for environmental damage.

Stem injection of Benlate poses no environmental hazard. In addition, it is more promising against established infections than any other method. In most cases methods involve direct stem or root application of water emulsions of particulate matter, encapsulated "pills," or water-acid solubilized chemical; injections are by pressure, or gravity flow. In all cases, the chemical is introduced by mechanical devices directly to xylem vessels exposed by drilled holes or incisions.

The earliest successful stem injection technique involved the use of the Maujet injector. Thin metal tubes hammered into tree trunks to a precise depth, are designed to allow liquid flow directly to vessels exposed in the wood of the current season. With this method, success depends largely on precision of timing and positioning of tubes. Much success and many failures are reported.

From personal observations, certain disadvantages seem apparent. The method is time consuming and thus expensive; it delivers a limited amount of chemical; the emulsified chemical clogs the openings and prevents or delays absorption; feeding cups in place are subject to vandalism; and the method requires a degree of patience, understanding and precision not conducive to treatment of large numbers of trees.

In spite of this, many elms have been saved because of it, and modifications may bring enhanced efficacy. In practice, the method is most effective in prevention, but has limited success against established infections.

Perhaps the most exciting development in stem injection of Benlate was the recent use of solubilized material applied under pressure. Several laboratories have developed similar methods. In our cooperative research with the U. S. Forest Service, acid-solubilized Benlate is forced under pressure by nitrogen gas (40-70 psi) through tubing and metal feeder pipes into small incisions made by chisel in the outer one or two rings of the xylem. The fluid chemical, whose volume is based on tree diameter, moves into the tree in 20-30 minutes.

This technique has both advantages and limitations. Since the chemical is forced into the tree in a liquid form, there is a high probability of fast action, high toxicity, and wide distribution. However, it is time-consuming and costly as with the Maujet technique. Also, speed of distribution could be a liability rather than an asset, if the chemical is swept out of the tree too fast. In spite of high expectations for uniform distribution, there is some evidence suggesting difficulties here. The method was first fieldtested in 1972. Preliminary results

indicate significant progress in arresting visible progress of disease, but final evaluations cannot be made until June or July in 1973.

A novel approach to stem injection was initiated in 1972 by the Elm Research Institute with which the writer is working cooperatively. Holes (1/2 in. diam., 2 inches deep) are drilled around the tree 6 inches apart. Iron fittings with hose nozzle attachments are screwed tightly into holes to a depth of 1-1/2 inches. Hosing connecting all of the fittings is connected to a two-gallon, hand-pump garden-type spray can, then the injection is made under pressure up to 40 psi.

As with the Maujet treatment, the use of emulsified material results in conspicuous clogging of holes and vessels. Also, the bulk of the suspension is fed too deeply into the wood for maximum distribution into vessels of the current season, and most may be deposited in wood spaces of no significance for disease control. However, with solubilized Benlate, and improvement of the injection delivery, this method has much promise for the homeowner.

**CURRENT RECOMMENDATIONS**

But what is the commercial arborist, the municipal forester and the tree owner to make of all these new developments? How can the new information on chemical control be used to advantage? The evidence is clear that Benlate poses bright prospects for control, but caution is urged. It should be used experimentally within the provisions specified by the EPA in its approval: i.e., by trained and licensed arborists, as a productive spray or by stem injection through any method allowed by EPA. The following guidelines are suggested for maximum protection of elms not known to be diseased.

(It should be clear that all use of Benlate is still essentially experimental; these suggestions are based on limited but promising, data. Further critical research is essential before firm recommendations are warranted.)

1. Continue to practice thorough sanitation in areas of trees to be protected (i.e., eliminate dead, diseased or weakened elm wood in trees or on ground);

2. Apply dormant methoxychlor spray as recommended by USDA (i.e., at least before leaf emergence; before flower emergence is preferred);

3. Sever mechanically or treat chemically potential root graft connections between closely-spaced (50 feet) trees.

4. Apply Benlate by one of the following methods:

a. Apply foliage spray of Benlate as recommended by University of Wisconsin (8 lbs. of formulated Benlate per 100

(continued on page 74)



Is it a pigeon? Maybe it's a chicken? No, it's Lew Kolb in the alligator corral.



Mike Davenport, assistant curator of reptiles, ventures into the pit with Lew. "If I head for the wall," says Mike, "don't ask questions, just follow." "Ok," replied Lew. "Just don't be in my way."

## Beyond the Call of Duty . . . or Some People Will Do Anything for Money

Some tree men are called on to do the darndest things. Take Walt Money of Guardian Tree Experts, Inc., for instance.

Just last week he received a call from Jack Monday at the Washington National Zoo. Jack had a request for Walt to inject a few rubber trees with nutrients and insecticide using the Mauget injectors. Sounded simple enough, so Walt says "Sure, we'll do it."

One catch. The rubber trees were located on an island in the alligator pit. "You gotta be kidding!" cried Walt. Nope, came the reply.

Jack said there wasn't too much to

fear, except for "Biggie," a 15-foot 1,000 pound crocodile. The week before, in a lightning move, he had gobbled up an unsuspecting pigeon who had landed six feet away. Walt said, "Has he eaten since?" Jack replied, "We're not sure. Roll call is tomorrow."

To make the reptiles as docile as possible, several water tanks were drained. Then like a true executive, Walt delegated the injection job to Lew Kolb.

"Someone had to take the pictures," said Walt coyly, standing behind the glass spectator windows. "Who else would believe this story."



While visions of pigeons and female crocodiles dance through "Biggie's" head, Lew does the fastest injection job in treeman history.



Lew's in the last alligator pit now and he feels pretty confident. Not that he's ready for a wrestling match. No, he says, "but I wonder how alligator tree climbing shoes would feel."



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DED (from page 72)

gals. of water; 2-3 gals. per tree; mist blower recommended); or

b. Use injector tubes (Maujet type) with cups of about 2 oz. capacity; use Benlate as recommended by Virginia Polytechnic Institute and State University (2 lbs. per hundred gallons of water); or

c. Use drilled holes with nozzles, tubing and pressure spray can as recommended by the Elm Research Institute (2 lbs. per 100 gals. of water).

For therapy of diseased elms in early stages (not more than 10 percent crown visibility wilted), the following guidelines may be of interest, but little hope is currently offered for cure of such trees with chemical treatment by itself:

1. Prune the diseased branch back to the main trunk as quickly as possible; removal within 24 hours is recommended (this treatment is recommended only for single branch infections);

2. Stem inject with Benlate as indicated above with heavy application, concentrating on that side of the tree affected. If using the Maujet injector, make new injections two or three times at 10 day intervals.

As a final note of caution, chemical treatment should not be used as a substitute for sanitation, spraying, root graft treatment, or pruning out a disease-

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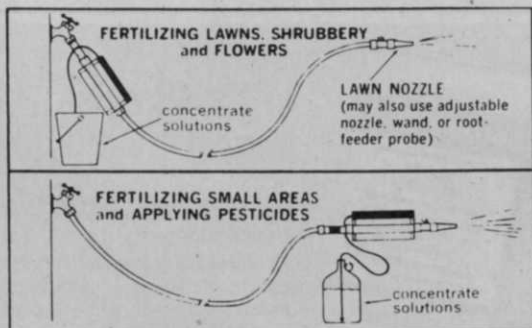
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## DED (from page 74)

ed branch, but as a supplement. Benlate and other systemic chemicals are on trial; prospects for control have never seemed better than at the present time, but only careful study and cautious evaluation can resolve the questions raised. In the final analysis, the record will speak for itself. □

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## trimmings

**LOOKING FOR A TREE JOB?** Contact Edgar Emrich of Graceham, Md. He's planning to chip 15 to 20 acres of pines in his 60 acre pine grove. Seems that his pines have a great affinity for birds. Thousands of them. Millions of grackles, redwing blackbirds, starlings. They've been holding a fly-in, feather preening, coo festival in the pines since December. One big problem, however. Emrich didn't set up any facilities. The ground is now covered with droppings. In fact, it's like a student with many degrees—B.S., M.S. (more of the same), and PhD, (pilled higher and deeper). In late March, farmer Emrich took action. He organized a major bombardment to scare the birds away, in spite of the cries of birdlovers. Included in the arsenal were fireworks, propane cannon fire, amplified bird distress calls, and more. As many as 110 county, state and Federal officials, neighbors and citizen volunteers were on hand to help. After three invasions, Dr. Kenneth L. Crawford, state veterinarian and director of the bird-ridding project, reported a marked reduction. Emrich said that wasn't good enough. He's decided to put an end to the bird concert by chopping down the trees.

**CANADIAN SCIENTISTS** are dialing CFS 1020 in hopes of finding a way to treat Dutch Elm Disease (DED). CFS 1020 is a water-soluble derivative of benomyl fungicide. It is being injected into a tree's sap system through the roots. The technique was developed over the past three years by the Canadian Forestry Service of Environment Canada with the aid of the faculty of forestry at the University of Toronto. The treatment is supplementary to sanitation measures. What does it do? According to D. N. Roy, a biochemist and associate professor of forestry at the University of Toronto, the compound would provide resistance against DED. Three years of tests on trees have proved the theory to be 100 percent true. It's still too early to make any predictions on how long the resistance will be exhibited.

**FINGER BLIGHT** has hit the Green Industry. There is no known environmental protection chemical to control it. Nor is there any mechanical device that is 100 percent effective. It occurs in nearly every place of business. It affects employers and employees alike, although employees are the most susceptible. Likewise, those outside your employ have no immunity. Best known control to the disease—better known as pilfering or stealing—is outsmarting the victim. When on the job, keep your eyes open and your property within easy

reach. When off the job, keep equipment and supplies in secured storage areas. Until more severe penalties can be enacted by lawmakers, finger blight will continue on its carousing, contagious course.

**VELOCIPEDES** are back. And the Federal government is finding new ways to cope with them. The Federal Highway Administration recently announced expenditures of Federal-aid highway funds for the construction of bikeways and pedestrian walkways outside the normal highway right-of-way along Federal-aid highways. This means we could easily see cyclists peddling along bikeways adjacent to interstates. Just think of the fun John Doe and his family can have. Four bikes and a Big Wheel tooling down a bike path bound for Chicago. Just think of the extra business this may generate in keeping encroaching vegetation in check.

**RULE OF REASON** must interplay into our rationale in dealing with our environmental idealism and our attitude toward risk, charges Agriculture Secretary Earl L. Butz. "If we are to continue to reap the benefits of technology in a time when the limits of our resources become more clear each day, we must first come to grips with just how we shall proceed . . . Man cannot have all he wants to consume—and at the same time maintain a super-pure environment and a completely risk-free society.

**BEWARE OF BLACK WALNUT** trees. They're highly prized for the nuts and the timber, but scorned in another way. According to Harold Davidson of Michigan State University, the roots of the black walnut contain a phytotoxin, Juglone. This compound is not secreted into the soil. But when susceptible plants touch the roots, injury occurs. The range of the toxic zone is the spread of the root system, he says. The average range is 50 to 60 feet, although it can be as large as 80 feet. Highly susceptible plants include many evergreens, azaleas, rhododendrons, as well as some vegetables. Landscape arborists should advise clients that this tree is not desirable on small lots.

**"I DON'T NEED** some bunch of dogooder nuts telling me what's good to breathe," says Rep. Billy Williamson. "And I don't want a bunch of environmentalists and Communists telling me what's good for my life and family." In a UPI story from Austin, Tex., Williamson urged a constitutional convention committee to reject a proposal that would allow citizens to sue state agencies and public officials that do not properly administer state environmental laws. "I think we are all willing to have a little bit of crud in our lungs and a full stomach

nothing to eat," he said.

**WEIRD ORDINANCES** continue to draw wry smiles. Seattle, Wash. has one which calls for 90 days in jail for anyone who lets a thistle grow on his land, according to United Press International. Like the law in Delaware and other eastern states which prohibits Johnson-grass, one of the biggest offenders would be the state, itself. State owned land including highway rights-of-ways would likely receive the first ticket.

**WHO'S HOGGING BEACH** property? The Commander-In-Chief of the Federal government discovered in 1970 that he was. In February of that year, President Nixon was barefooting it along the beach near his San Clemente home when he discovered that nobody was watching. Why? All the land up and down the beach, for miles, was Federal land, part of Camp Pendleton and owned by the Navy. No access. No trespassing. Forbidden to enter. The creative juices started to flow and the result is the Legacy of Parks. Today, 400 properties, covering 61,476 acres and valued at over \$165 million, have been made available in all 50 states, DC, Puerto Rico, Guam and the Virgin Islands. The Bureau of Outdoor Recreation estimates that over 70 percent of these properties are located in or near urban areas.

**LEARN FROM EACH OTHER** is one way to make an industry grow. Arborist Robert A. Bartlett passes along these tips for you to try with your customers. Remind them that repairs or replacements to trees damaged by unusual icing conditions can be included in income tax returns and insurance claims. Best evidence of the extent of damage is before and after photos. If before photos are not available, Bartlett says to photograph the best possible view of the damage. It is a good idea to exercise the camera before the leaves appear.

**SLEEPING AT THE WHEEL** accounted for the most common cause of accidents involving motor vehicles, says the Bureau of Motor Carrier Safety. Sixty-nine percent of all accidents were classed into this group. Next biggest class of accidents was due to driving while under the influence of alcohol. Other factors included heart attacks, blackouts, and drug usage.

**STRANGE AS IT SEEMS,** but the Texas Highway Department engineers plan to use plastic grass in shaded sections of a newly constructed, double-decked segment of the Interstate 35 freeway through Austin. They say there isn't sufficient sun for the real thing to grow. The fake green stuff will break the monotony of dull concrete, they say.

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