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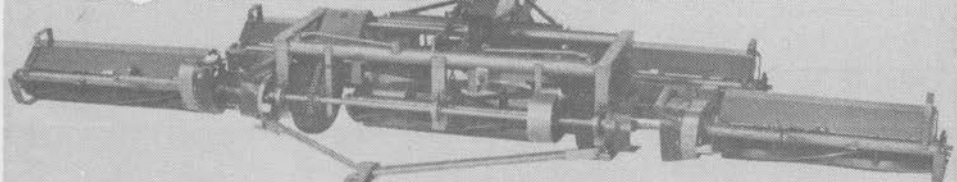
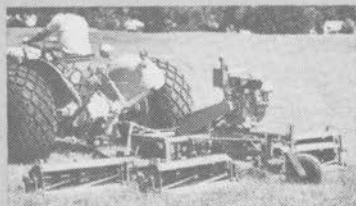
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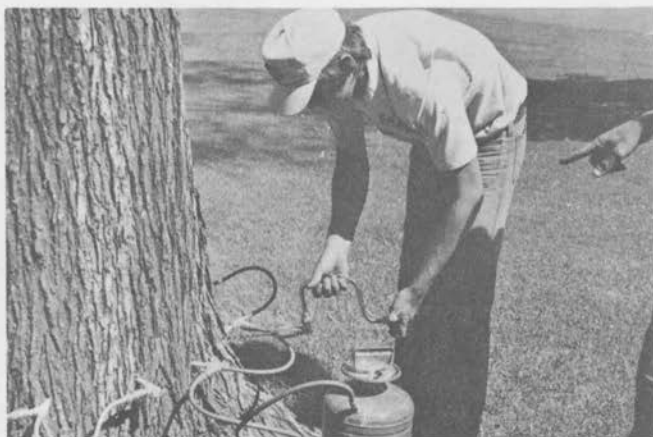
Dutch elm update

Discussions continue about the merits of the chemicals used for DED control and their rates and methods of application.

A great deal of work is being done in several Mid West states including Michigan. Controversy continues around the chemical that some feel is a botanical Laetrile. Yet, we keep reading about success stories involving this chemical when injected at heavier than recommended rates.

Several local golf courses have embarked on a program to save their critical Elms. The American Elm is an important tree to many golf courses and without them many fine golf holes would be rendered "weak" and defenseless.

The following article is reproduced from the Minnesota Chapter Newsletter called "Hole Notes", August, 1978.



Drilling $\frac{1}{2}$ " hole into tree, attaching injection equipment.

NOTE: It is recommended that these holes be drilled in the root flares and not in the main trunk as shown in these photographs.

Systemic fungicides for control of Dutch elm disease

by Mark Stennes and D.W. French

The primary control measure for Dutch elm disease is sanitation which includes early detection, elimination of dead and dying elms and disruption of common root systems (Agricultural Extension Bulletin #211). Systemic fungicides, if properly applied, can provide additional protection against Dutch elm disease for elms of high value.

Although the fungitoxic properties of the two commercially available systemic fungicides ("Arbotect" 20-S=TBZ and "Correx" Lignasan BLP=MBC-P) have been known for some time, some unanswered questions remain. The objective of the study reported here was to demonstrate a technique of application and an amount of properly diluted chemical (dosage rate) which together will have

the following attributes: (1) Maximum distribution of the chemical to all susceptible parts of the tree; (2) Optimal migration of the chemical into new apical and radial wood; (3) Effectiveness as a cure for mature American elms which are in an early state of infection by the Dutch elm disease fungus, *Ceratocystis ulmi*.

The overall objective is to provide the users of these systemic fungicides with dependable information on how to best use them.

EXPERIMENTATION. Three injection techniques, truck, ground level and exposed root flare, and a range of dosage rates were tested in various combinations on groups of healthy, mature, even-aged American elms. Label rates as well as rates exceeding those suggested on the label were evaluated. Most of the trees injected are located on the Minnesota State Fairgrounds and have an average DBH (diameter at 4.5 feet above the ground) of 22.3 inches.

To access the distribution and relative strength of the treatments being tested, a sampling and bioassay technique was used to detect and determine the percent distribution of the chemical in the crowns of the treated trees. There were five trees in each group and 16 samples from each tree for a total of 80 samples for each treatment.

The bioassay technique consisted of placing small sections of the branch samples on agar plates which had been covered with spores of *Ceratocystis ulmi* (Smally, 1973). The development of the fungus on the branch sections was a relative measure of the amount of chemical present in that part of the tree.

Between June and September, 1976, 11 naturally infected American elms

were treated with TBZ at the triple therapy rate. Percent foliar symptoms of Dutch elm disease in the crowns of these trees at the time of injection varied between 5 and 15%. Six of the trees were injected at ground level and five were injected through exposed root flares. In most cases, the branches with symptoms of the disease were removed about two weeks after injection, but no effort was made to remove all of the infected branches if they were not wilting.

RESULTS. The bioassays indicated that three high dose, exposed root flare injection treatments, one MBC-P treatment and two TBZ treatments, provided detectable quantities of the fungicide to practically all parts of the treated trees (Table I).



Tree injection process for treating Dutch elm disease.

Some data reported here, as well as work by others, indicated that MBC-P does not remain in the tree very long, regardless of the dosage used. It will not protect the tree the year following treatment. Bioassays in 1978 of trees injected in 1977

will undoubtedly confirm this conclusion.

The two highest TBZ dosages rates (2 X Th. and 3 X Th.) can provide detectable fungicide activity to the most recent annual ring at least into a second growing season. The double therapy rate (2 X Th.) will result in detectable amounts of chemical more than a year after treatment, but the fungicide will not be as well distributed or at levels as high as with the triple therapy rate. Repeated bioassays during the 1977 growing season indicated that the general quality of the triple therapy rate (3 X Th.), measured in terms of % distribution and relative levels of activity, will remain relatively high

Continued on next page

TABLE I
% DISTRIBUTION AND RELATIVE AMOUNT OF MBC-P AND TBZ IN TREATED ELMS

CHEMICAL	DOSAGE	CONC. (PPM)	RATE (QTS/INCH)	ELAPSED TIME (DAYS)	DISTRIBUTION (%)	AMOUNT
MBC-P ¹	Th. ⁴	438	2	14	0	
MBC-P	3 x Th.	438	6	22	72.4	low
MBC-P	6 x Th.	875	6	23	100.0	medium
TBZ ²	Pr. ⁵	5000	0.5	29	14.5	
TBZ	Th.	1000	5.0	27	55.8	low
TBZ	2 x Th.	2000	5.0	27	95.4	medium
				53 weeks	63.7%	low-med
TBZ	3 x Th.	3000	5.0	26	97.4	high
TBZ ³	3 x Th.	5000	3.0	41-50 weeks	27-100	med-high

¹MBC-P = "Correx" Lignasan BLP

²TBZ = "Arbotect" 20-S

³Diseased trees treated therapeutically in 1976

⁴Th. = Maximum therapy label rate

⁵Pr. = Maximum preventive label rate

throughout the second growing season. If the apparent trend continues, appreciable chemical activity may extend into a third growing season after injection. Bioassays in 1978 will determine whether or not these trends are confirmed.

During the 1977 growing season, 2 of 11 diseased elms treated therapeutically with TBZ in 1976 died, and one developed symptoms in one additional branch. Symptoms of Dutch elm disease did not reappear in any of the other eight trees. The only trees which wilted completely or developed new symptoms of Dutch elm disease had been injected at ground level and all five of the trees that were injected through exposed root flares survived through the 1977 growing season without retreatment or recurrence of symptoms. On the basis of bioassay and cultural examinations of the trees that

died, *incomplete* and *uneven* chemical distribution was the most probable reason for the failure of the fungicide to save them. Even these elms may have survived if the exposed root flare injection technique had been used.

SUMMARY. Most effective injection technique: EXPOSED ROOT FLARE. Most promising chemical: "Arbotect" 20-S. Most promising dosage rate: 3 X MAXIMUM THERAPY RATE. Chemical concentration: 3000 PPM (1.92 fluid oz. Arbotect/gallon of solution). Rate of application: 1.25 gallons of solution/ inch DBH.

Although our research results are incomplete and some important questions remain unanswered, we can draw some preliminary conclusions on the basis of what we do know! The data from those treatments evaluated all seem to indicate that exposed root flare

Continued on page 15

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This will be on a first come basis, therefore if you are interested, please get your check in the mail to G.C.S.A.A. Headquarters, 1617 St. Andrews Drive, Lawrence, Kansas 66044. If you have any questions, their telephone number is 913-841-2240.

Wastewater Conference – November 13 & 14

On November 13 and 14, 1978, a conference sponsored by the American Society of Golf Course Architects Foundation, the National Golf Foundation and the Green Section of the United States Golf Association will be held at the Arlington Park Hilton, Euclid Avenue & Rohlwing Road, Arlington Heights, Ill. 60006. The theme of the 2-day conference is "Wastewater Irrigation of Recreational Turf Areas." The conference's objectives are (1) to produce "State of the Art" information and to document what is now known as it applies to recreational turf; (2) to generate additional information on wastewater uses; (3) to produce "Guide Line"

information for publication.

Everyone interested in land disposal of wastewater (effluent and other) is cordially invited. A monumental bit of work has been done in this area. Interest in wastewater has quietly mushroomed due to concern for possible future limits on fresh, potable water for recreational purposes. Representatives of all recreation turf installations - golf, park and recreation, industrial, military, government, irrigation, landscape and water works are invited.

Mark these dates on your calendar now - plan to attend! Would you indicate your interest by detaching and mailing the following.

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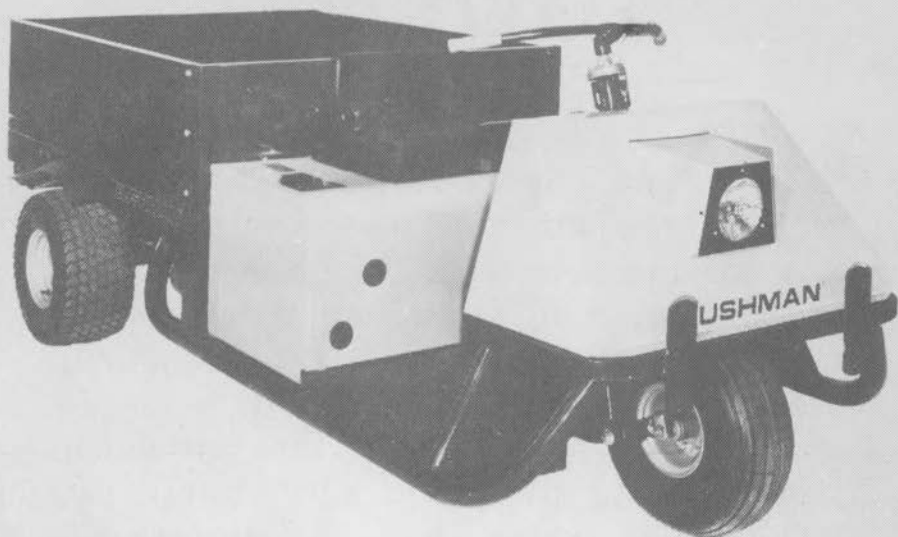
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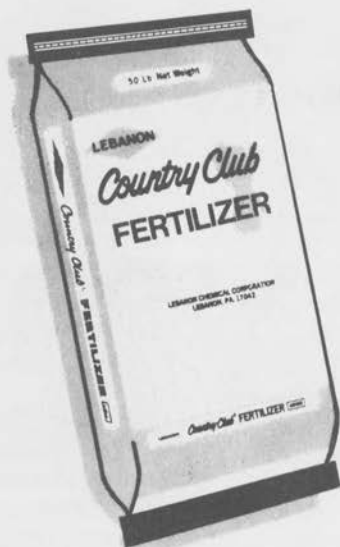
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Nominating Committee selects slate

The nominating committee, consisting of George Prieskorn, Jerry Gill, Ted Woehrle, and Ward Swanson submit the following slate for our annual election October 3, 1978.

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For Vice-President:

James Timmerman

For Secretary-Treasurer:

Bruce Wolf from

For Director:

Richard Bell

Michael Edgerton

Harold Fiebelkorn

Charles Gaige

Fritz McMullen

Chris Myers

The candidates have been notified in writing of their nomination and all have accepted.

Many thanks to everyone for the plants and flowers and all the beautiful cards sent to me during my illness.

Your thoughtfulness is greatly appreciated.

— Mrs. Clarence Wolf from

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Prior to joining FDS, Stanley served the W. A. Cleary Corporation as Technical Sales Representative where he succeeded in boosting sales to a record high throughout the southeastern portion of the States.

Stanley attended the University of Maryland where he received an Associate Degree in Agronomy. He is well versed in the areas of Soil Science, Plant Pathology, Weed Control, and Soil Conservation. He brings to this organization a wealth of experience in sales and service in the turf industry.

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I set out to be a friend, and friends were everywhere!

Systemic Fungicides cont.

injection of "Arbotect" 20-S at the triple therapy rate will provide the most fungicide for the longest time and will probably yield the most satisfactory results. Interpretation of the data is tentative because the exact relationship between bioassay results and actual resistance to infection in the tree has



Putting a wooden peg into hole where chemical was injected so healing will be quicker.

not been established. Specific conclusions about the significance of bioassay results will be possible only after artificial inoculation-bioassay experiments have been completed.

To consistently effect a cure for established Dutch elm disease infections in mature elms, *all parts* of the diseased tree must receive *enough chemical* to both suppress and inactivate the fungus and subsequently provide the tree with the opportunity it needs to compartmentalize the infection and leave it buried harmlessly in new wood. Exposed root flare injection appears to be the only practical method of attaining satisfactory chemical distribution. There is also some evidence to indicate that the resulting injury to the tree will be less severe and the wounds will close more quickly in the main stem.

Our research results are corroborating some reports from the University of Wisconsin which indicate that TBZ, the active ingredient in "Arbotect" 20-S, has some physical and chemical properties that are highly desirable in a systemic fungicide. The chemical will move into the crown of the tree where

Continued on next page

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Dosage Schedule for

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Chemical concentration: 3000 PPM = 1.92 fluid oz Arbotect/gallon

Rate of Application: 1.25 gallons (5 qts)/inch DBH

Circumference (Inches)	DBH (Inches)	Gallons of solution	Fluid ounces "Arbotect" 20-S
31.4	10	12.5	24.0
34.6	11	13.75	26.4
37.7	12	15.0	28.8
40.8	13	16.25	31.2
44.0	14	17.5	33.6
47.1	15	18.75	36.0
50.3	16	20.0	38.4
53.4	17	21.25	40.8
56.6	18	22.5	43.2
59.7	19	23.75	45.6
62.8	20	25.0	48.0
66.0	21	26.25	50.4
69.1	22	27.5	52.8
72.3	23	28.75	55.2
75.4	24	30.0	57.6
78.5	25	31.25	60.0
81.7	26	32.5	62.4
84.8	27	33.75	64.8
88.0	28	35.0	67.2
91.1	29	36.25	69.6
94.3	30	37.5	72.0
97.4	31	38.75	74.4
100.5	32	40.0	76.8
103.7	33	41.25	79.2
106.8	34	42.5	81.6
110.0	35	43.75	84.0
113.1	36	45.0	86.4
116.2	37	46.25	88.8
119.4	38	47.5	91.2
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Systemic Fungicides cont.

it is needed to combat the Dutch elm disease fungus but it will not move into the leaves in appreciable quantities (Nishijima, 1977). In addition, the chemical is quite stable and will move into new radial wood, provided the concentrations present initially are high enough. The research results indicate that the ability of this fungicide to move into new wood as the trees grow is a function of the total dose initially injected. The more fungicide injected initially, the longer the chemical activity will continue to exist in the newest formed wood. Of the dosage rates tested so far, the triple therapy rate appears to maximize this attribute of TBZ.

The most important advantages of a long-lasting treatment relate to cost and the need to minimize the injury to trees from wounds made in the injection process. Shigo has clearly established that the multiple injuries which result from tree injection are serious wounds from which the tree can never completely recover and that yearly injections to prevent Dutch elm disease are unacceptable to the well-being of the tree (Shigo, 1977). Accordingly, although the initial expense of the triple therapy rate will be the most costly (two 27" elms can be treated with one gallon of "Arbotect" 20-S), both the cost of and the additional injury caused by subsequent injections will be avoided.

In contrast to the above research results it is necessary to indicate to

Continued on next page

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Systemic Fungicides cont.

all concerned that the label is the law and that the data presented here do not change the law. They do, indicate, however, that the label rates which have been apporved may not provide adequate levels of fungicide to the treated tree.

References: Nishijima, W. T. 1977. Systemic fungicides for Dutch elm disease control. Ph.D Thesis. University of Wisconsin. Shigo, A. L. and Richard Campana. 1977. Discolored and decayed wood associated with injection wounds in American elm. J. Arbor: 3: 230-235. Smally, E. B. C. J. Meyers, R. N. Johnson, B. C. Fluke and R. Vieau. 1973. Benomyl for practical control of Dutch elm disease. Phytopathology 63:1239-1252.



**Century Rain-Aid AG Division
moves to larger facility**

Century Rain-Aid has announced the moving of the Ag Division to larger and more efficient quarters in Coldwater, Michigan located at 325 West Chicago Road on US-12, just five miles west of downtown Coldwater.

The new location offers better parts storage and display of new farm irrigation equipment and water-moving supplies. CRA's president, Ernie Hodas said, "Recent trends and demands of farm irrigation necessitated the move."

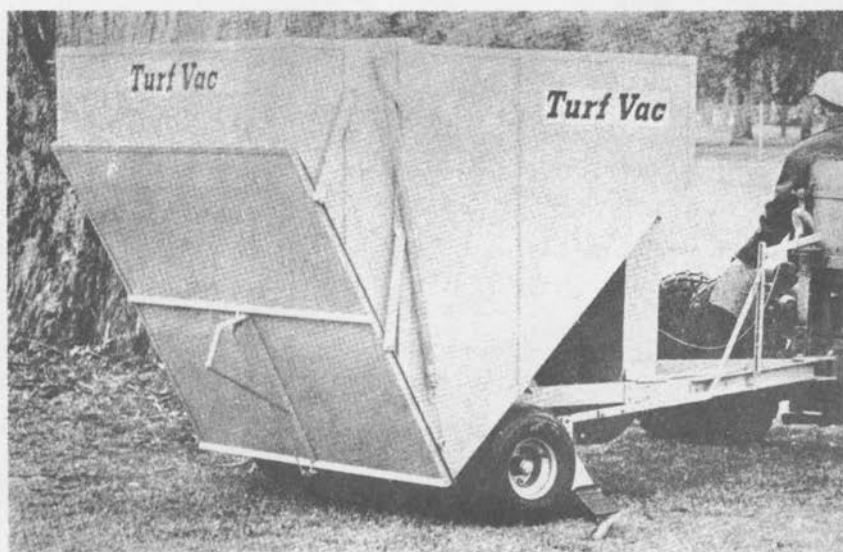
Additional management has joined CRA's new Ag Division with the appointment of Ken Kurtz as Sales Coordinator, and John Toth as Warehouse Manager.

Irrigation product lines including: Rainbow, Irromat, Pierce, Berkley, Rain Bird and Nelson are featured and displayed at the new Coldwater Division serving the Midwest.

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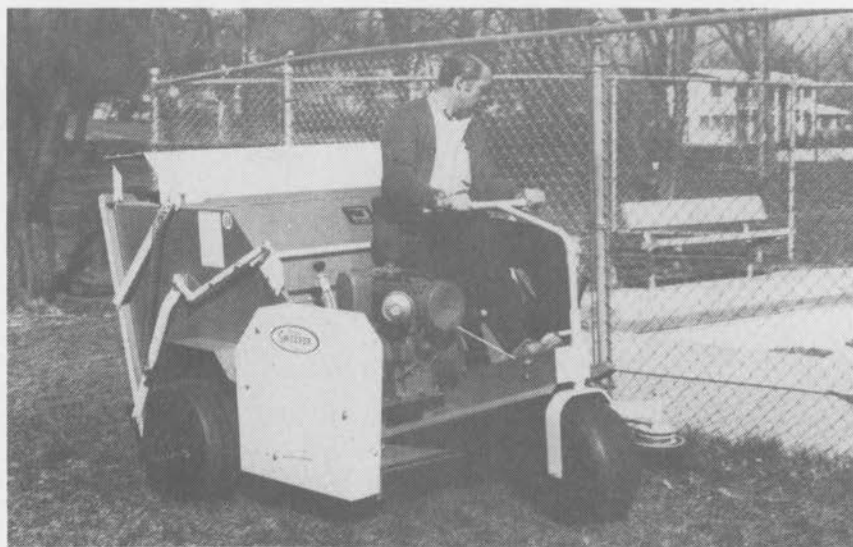
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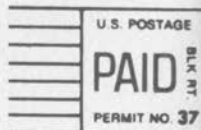
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