

Literature Cited

- Flemer, William III. 1976. Container trees for use in landscaping. In F.S. Santamour, Jr., et al., Eds. Better Trees for Metropolitan Landscapes, USDA Forest Serv. Gen. Tech. Rpt. NE-22, p. 185-193.
- Gouin, Francis R. 1976. Winter injury to container-grown plants. In F.S. Santamour, Jr., et al., Eds. Better Trees for Metropolitan Landscapes. USDA Forest Serv. Gen. Tech. Rpt. NE-22. p. 179-184.
- Havis, John R. 1976. Root hardiness of woody ornamentals. HortScience 11: 385-386.
- Studer, Elaine J., Peter L. Steponkus, George L. Good, and Steven C. Weist. 1978. Root hardiness of container-grown ornamentals. HortScience 13:172-174.
- Wiest, Steven C., George L. Good, and Peter L. Steponkus. 1976. Analysis of thermal environments in polyethylene overwintering structures. J. Amer. Soc. Hort. Sci. 101: 687-692.

MBC-P INJECTION OF ELMS AT COLORADO STATE UNIVERSITY

by Lawrence B. Helburg

During 1977 and 1978, 187 elms, most of them apparently healthy, were treated on the Colorado State University campus with a 424 ppm solution of MBC-P fungicide (Lignasan BLP® or Correx®), using the Canadian dosage recommendation. All injections were made at or below the root collar. The species complement consisted of 153 American elms, *Ulmus americana*, averaging 68 cm (27 inches) diameter at breast height (dbh); and 34 rock elms, *Ulmus thomasi*, averaging 66 cm (26 inches) dbh. Chemical uptake under 143-426 gms per cm² (2-6 pounds per square inch) pressure varied from 1.3 to 86 liters per hour (0.35-22.7 gallons per hour) in American elms and averaged 20 liters per hour (5.3 gallons per hour). Rock elms took the chemical much more slowly, averaging 2.5 liters per hour (0.66 gallons per hour) and ranging from 0.5 to 18 liters per hour (0.13-4.8 gallons per hour). The only variable that noticeably affected uptake within a given species was soil moisture. If the lawn sprinklers had been operating within 24 hours before injection was attempted, uptake was noticeably slower. Windspeed, cloud cover or temperature did not have an appreciable affect on uptake.

The type of injector head also did not seem to affect uptake. Two types of heads were utilized: wooden dowel injectors (Kondo, 1975) and Lamb plastic "T" injectors supplied with the injection apparatus purchased from PicArbor of Sault Ste. Marie, Canada. The wooden injectors were easier

and faster to use and did not leak as badly as the Lamb injectors, although they had to be reworked or replaced periodically. Three sets of wooden injectors were used in rotation, with two sets drying while the third was in use.

Ten to 14 days after treatment branch samples were taken from four sides of each tree crown to determine if the chemical was present in a high enough concentration to prevent *Ceratocystis ulmi* from becoming established. Care was taken during the process to select a terminal sample from each of the major branch systems. The samples were surface sterilized, peeled and cut into discs which were aseptically transferred to *C. ulmi* seeded plates. The fungus was allowed to grow for 3 or 4 days before the culture was analyzed. Inhibition of the fungus (little or no mycelial growth) on the discs or culture medium was noted. A tree was classified as having "good" distribution when 75-100% of the discs showed inhibition. A classification of "fair" was awarded trees with 50-75% inhibition zones, and "poor" with less than 50% inhibition.

1977 Results

Seventy-seven American elms were treated in 1977, 32 of which were bioassayed. Nine trees showed "good" distribution, 14 "fair," and 9 "poor." Fourteen of the "fair" or "good" trees were resampled in April, 1978 and only four had retained enough chemical to maintain a "fair" distribution status. The other ten had lost the abili-

ty to inhibit the fungus.

Three American elms that were found to contain *C. ulmi* in 1977 were treated curatively, and the symptomatic portions were pruned two days later. All three of these trees were lost in 1978. The first was 86.5 cm (27 inches) dbh and received 142 liters (37.5 gallons) of Lignasan BLP® injected through 16 injection sites (including 3 excised roots). Nine hours were required to get this volume into the tree at 143 gm per cm². Bioassay indicated poor distribution throughout the crown even though symptoms were only 10% of the crown. The symptoms continued to progress and the tree was removed during the summer of 1977.

The second, a 79 cm (31 inches) dbh American elm, received 71 liters (45 gallons) of Correx® through 41 injection sites (including four excised roots) at 143 gm per cm². Bioassay indicated excellent distribution on the "healthy" side of the tree, while the "diseased" side had very poor distribution even though symptoms were noted in less than 10% of the crown. Symptoms continued to spread in the spring of 1978. Stain was traced to the root collar by mid-summer and the elm was removed.

The third was a 66 cm (26 inches) American elm and was treated by Dr. Wayne Nishijima, a CSU pathologist, with Correx® using root-flare injection under 716 gm per cm² pressure and the U.S. label rate. This tree was pruned after injection but the visible stain had already entered the main bole. This tree was also removed in 1978.

1978 Results

Of the 110 elms treated in 1978, only 10 (9

percent) had "good" distribution, 17 (15.5 percent) rated "fair," and an overwhelming 83 (75.5 percent) showed "poor" distribution. No elms were treated curatively and none of the 1977 treated trees was retreated.

Five elms were lost on campus in 1978, two of which were preventatively treated in 1977. The other three had never been treated. Each of these trees was isolated from previously diseased trees which indicated that they were not "root graft transmissions." One of the two treated elms showed "fair" distribution in 1977 and "poor" in April, 1978. It received 171 liters (45 gallons) of Correx® and had 32 root-flare injection sites. The solution was taken up in two hours with 143 gm per cm² pressure.

The other treated elm lost in 1978 received 129 liters (34 gallons) of Lignasan BLP®. The chemical was taken up in three hours through 18 root-flare injection sites. No bioassay was run on this tree, so distribution is unknown.

Results of this work indicate that injections with MBC-P may not be justified in the Ft. Collins area, and no further injections were planned by CSFS. We will, however, continue to monitor those elms already treated. Bioassays will be conducted on 10 percent of the 1978 treated elms to determine if the chemical is still active after the leaves come out in 1979.

*Insect and Disease Division
Colorado State Forest Service
Colorado State University
Fort Collins, Colorado*