ECONOMIC EFFECTIVENESS OF OPERATIONAL THERAPEUTIC PRUNING FOR CONTROL OF DUTCH ELM DISEASE[1]

by F. A. Baker and D. W. French

Abstract. Therapeutic pruning for Dutch elm disease control has not been widely used in Minnesota because of fear of low success, operational difficulties, and difficulty in obtaining funds for such a program. We report a study in which trees were identified for pruning during routine tree inspections, and pruned by contractors. Of 32 pruned trees, 8 have died. Had trees not been pruned, removal costs would have been $5351. The pruning and removal of trees which died subsequently cost $1856. The pruning program reduced the Dutch elm disease program budget in participating communities, and prolonged the life of the pruned elms.

Dutch elm disease, caused by the fungus *Ceratocystis ulmi,* is causing serious mortality of American elms *(Ulmus americana)* and red elms (*U. rubra)* in Minnesota. Many communities have maintained Dutch elm disease control programs, even when state funding decreased and was finally eliminated. The primary objective of most disease management programs is sanitation: removal of diseased trees and bark intact elm wood. Root graft disruption, elm injection and therapeutic pruning are considered secondary control measures. Hart (1970) reported that therapeutic pruning was costly and had only a 23% success rate. Several more recent studies have related the degree of symptoms and of vascular discoloration to the likelihood of survival after pruning (Campana, 1975, and Gregory and Allison, 1979). We now know that pruning can save more than 60% of pruned elms if more than 5 feet of wood can be removed between the main stem and the last detectable vascular discoloration. Himelick and Ceplecha (1976), reported that operational therapeutic pruning saved 62% of pruned trees, resulting in considerable cost savings. They attributed success to prompt pruning. In spite of these results, few Dutch elm disease programs include pruning as a component. Urban foresters in Minnesota have considered pruning ineffective, too expensive, or too difficult to administer. This study was done to evaluate the effectiveness of therapeutic pruning under operational constraints, in terms of dollar cost and the number of trees saved.

Materials and Methods

The communities participating in these studies were Falcon Heights, and Inver Grove Heights, Minnesota. In 1983 Falcon Heights lost 68 of its 840 elms to Dutch elm disease; Inver Grove Heights lost 56 of its 2600 elms. Candidate trees were identified during routine biweekly inspections for Dutch elm disease. Trees were considered pruneable if, based on foliar symptoms, the fungus was not yet thought to be in the main stem of the tree. The locations of candidate trees were given to tree removal firms under contract to the appropriate city. Contractors were selected by lowest bids for a projected number of hours of pruning, and a projected number of trees to be removed. Trees were pruned as soon as possible after detection, often within 24 hours. Contractors were instructed to remove the diseased branch at the main stem of the tree. When possible, a sample was collected for confirmation of the presence of the Dutch elm disease fungus, and the distance between the main stem and the vascular discoloration was measured. All samples processed were positive for Dutch elm disease.

Pruning cost was determined from contractor billing for pruning. Removal cost was determined from the contractors bid price, based on tree diameter at 1.4m (dbh).

Pruned trees were examined during routine inspections, and at least once annually for the purpose of this study.

Results

During this study, 32 trees were pruned (Table 1). Of these, 25 are still alive. Pruning costs averaged $33.60 per tree, and removal cost for

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the 7 trees that died after pruning was $781 (Table 2). The removal cost of the trees that had been pruned would have been $5351. The average distance between the main stem and the last detectable stain was 8.5 feet. One tree with 5 feet of stain-free wood did not survive.

Discussion

This study reports the effectiveness of a pruning component within an operational Dutch elm disease control program. The trees pruned were selected during routine inspections for Dutch elm disease. Pruning was done by commercial contractors, at competitively bid prices. Under these constraints, it was usually possible to prune trees within 24 hours of detection. By pruning trees, 25 trees were saved, and $3495 that would have been spent on tree removal was saved. Although several more trees may die, with an average removal cost of $167 each, and savings may decrease somewhat, pruning will still provide substantial savings. Our study, and the results are quite similar to those reported by Himelick and Ceplecha (1976).

Several urban foresters have suggested that administrative costs of a pruning program are much greater. This is in fact the opposite. By securing contractor services based on hourly rates for pruning and dbh class for tree removal, there is only one bidding process per year, and only one contractor to deal with. This greatly reduces the response time for pruning, and also for tree removal. On numerous occasions, root graft barriers were not necessary, because trees were removed before the fungus colonized the root systems of the diseased tree. Contractors were notified by phone when trees were to be pruned, and would often do the pruning first thing the next morning, and then work elsewhere. This rapid response is essential for a pruning program.

Others have raised the issue that pruning trees only delays the inevitable removal of the tree. They ask "Why spend money to prune a tree, when it will have to be removed anyway? Better to spend the money now to remove it and be done with it." This argument really doesn't really hold. Based on an average pruning cost of $33.60 per tree, a removal cost of $167 per tree, if the difference between pruning cost and removal cost were invested at 10% interest, it would take less than 3 years to recover the pruning cost. Thus, if trees did not become infected during the next 3 years, the community would be making money in addition to having the trees to enjoy. This illustrates the importance of an effective sanitation program. Good sanitation is the most important component of a Dutch elm disease program. If the infection rates are high, secondary opportunities such as pruning and injection are of very limited value.

Thoughout this discussion, the effectiveness of pruning has been discussed in terms of dollars saved. Trees were saved, incidental to reducing costs. For many citizens, saving trees is of primary importance. Trees increase property values, reduce heating costs, and can add greatly to the aesthetic appeal of the community. Homeowners are willing to pay for these benefits, as indicated by a survey which found 61-82% of homeowners willing to pay $10 or more in increased taxes for a shade tree program (Reynolds et al. 1981). Once a community has established an effective sanitation program, pruning is a viable and feasible control measure which can protect both financial and elm resources.

Table 1. Effectiveness of pruning to remove Dutch elm disease from American elms.

Year	*Number of trees pruned*	*Number alive in 1984*
1981	2	2
1982	14	9
1983	11	9
1984	5	5
Total	32	25

Table 2. Costs of pruning program.

Item	*Cost*
Pruning cost	$1075
Removal cost, actual	$ 781
Total cost	$1856

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depth of infection following excision of infected branches. Proceedings of the American Phytopathological Society 2:95 (Abstr.).
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SPECIES ADAPTED FOR STREET-TREE ENVIRONMENTS IN IOWA[1]

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Abstract. From condition classification of more than 39,000 street trees in Iowa, an analysis is presented of which species seem to be best adapted for street-tree types of environments. Species were also analyzed for change in condition with increasing size and for differences in adaption between the northwestern and southeastern halves of the state.
Keywords: *Street trees, suitability, street-tree environment, selection, street-tree size, street-tree condition.*

The concept of total system management of urban forests, developed by Jorgensen (1970), is not one of individual tree management, rather it considers tree management on an area basis with respect to how woody vegetation is influenced by the urban environment and utilized by the urban population. An important component of total system management is the selection of suitable tree species. Not all climatically adapted species are good candidates for use in street or similar environments. The environment to which street plantings are subjected goes beyond the climate of a region. In fact, street-tree planting environments are among the most severe encountered in a region. The soils may be compacted, modified, or in some cases almost nonexistent, and, as a result, root growth, as well as water and nutrient uptake, may be severely retarded. The soil may also be modified chemically with salt or snow-control chemicals, excessive fertilizer, or many other soil contaminants. The air quality may be reduced by vehicle and industrial emissions.

The stressful environment in which city trees grow affects tree populations. Tree species that

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