

## ASSESSMENT OF PESTICIDE USAGES BY COMMERCIAL AND MUNICIPAL ARBORISTS<sup>1</sup>

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**Abstract.** Questionnaires on fungicide and insecticide usage were mailed to 529 commercial and 40 municipal arborists in Illinois in 1982; 156 arborists responded. Of these respondents, 37 were also personally interviewed. Responding arborists combined purchased 9,200 pounds of fungicide and 225,000 pounds of insecticide in 1982. Benomyl, maneb, and zineb were the most frequently used fungicides; carbaryl, dimethoate, malathion, and dormant oil were the most frequently used insecticides. Scab and rust were the most prevalent diseases; scales, aphids, and bagworms were the most prevalent insects. Cost of pesticide purchased by the average Illinois arborist was \$8,500. Of this, 15% was for fungicides and 85% for insecticides.

One major desire of the U.S. Environmental Protection Agency is to assess the impact of pesticides in the environment. Federal funds are distributed for research to determine the benefit-cost ratio of these pesticides, especially those that have been targeted as possibly hazardous to human health. Extensive data have been accumulated on the quantity and types of pesticides used in agriculture, industry, and structural pest control. However, the use of pesticides by arborists in the urban environment has not been definitively researched prior to this study. We obtained data from licensed Illinois arborists as a representative sample of pesticide use by American arborists.

Seventy-four percent of the people in the USA reside in urban areas, which contain 200 million trees and 800 million shrubs. These plants serve not only horticultural, aesthetic, and environmental functions but societal ones as well. Citizens are increasingly aware of the value of trees, and homeowners, institutions, industries, and municipalities are willing to spend large sums of money to protect and keep these plants healthy.

The specialist in the care of trees is the arborist. Commercial arboriculture is a \$1 billion per year

industry involving expenditures for pruning (37%), spraying (18%), and removing (16%) trees. Small, highly competitive businesses constitute the primary portion of the industry. Most larger municipalities employ one or more professionally trained arborists to protect the trees and shrubs in parkways and parks.

Urban pest-control technology is years behind that of commercial agriculture. Many Integrated Pest Management (IPM) strategies have been developed for field, fruit, and vegetable crops, but IPM for urban areas is just beginning. Extensive protective sprays are still the rule rather than the exception. The goal of this project was to determine the extent of spraying by commercial and municipal arborists. The objectives were to determine: 1) pests being controlled, 2) pesticides used in control, 3) kinds of plants being treated, 4) quantity and cost of pesticides applied, 5) time of application, 6) kinds of equipment used to apply the pesticides, and 7) the relative economic importance of pesticide application to the total value of services offered by commercial arborists.

### Methods and Procedures

Data for this research project were obtained through questionnaires and personal interviews. Separate questionnaires were prepared for the commercial and municipal arborists to represent their differing interests, and goals. Those arborists who consented were asked for an additional 30-45 minutes of time for a personal interview to obtain more detailed information.

The 529 arborists in Illinois licensed as tree experts in 1982 were mailed questionnaires on July 9. Of the 156 arborists who returned questionnaires, 16 were employed by municipalities, 29 performed no diagnostic or spray services, and 34 performed no spray services. Data from the re-

1. This study was financed in part by Project 168 of the Environmental Protection Agency Pesticide Impact Assessment Program, North Central Regional Office, Columbus, Ohio.

maining 77 commercial arborists were used in the following summary. Not all arborists answered all questions.

College-trained arborists employed by municipalities were not required to be licensed. Of the 40 questionnaires mailed to this group, 20 were returned. These 20 plus the 16 arborists previously mentioned supplied the data sample for municipalities. Thirty commercial and seven municipal arborists were personally interviewed in July, August, or September of 1982.

### Commercial Arborist Questionnaire

The commercial arborists who responded were employed by firms that varied from one-man operations to 110-man units (Fig. 1). Approximately one-half of the employees were part-time, one-half of the firms hired no part-time technicians, and two-thirds of the firms had been in business for less than 15 years.

The gross income for individual arboricultural firms varied widely: 6 reported annual income of less than \$15,000, whereas one firm reported income of \$1,000,000. Nineteen percent of the firms earned \$36,000 to \$75,000, 20% earned \$76,000 to \$150,000, and 25% earned \$160,000 to \$350,000 (Fig. 2).

Most of the firms performed tree maintenance services other than pest control. Three of 63 firms

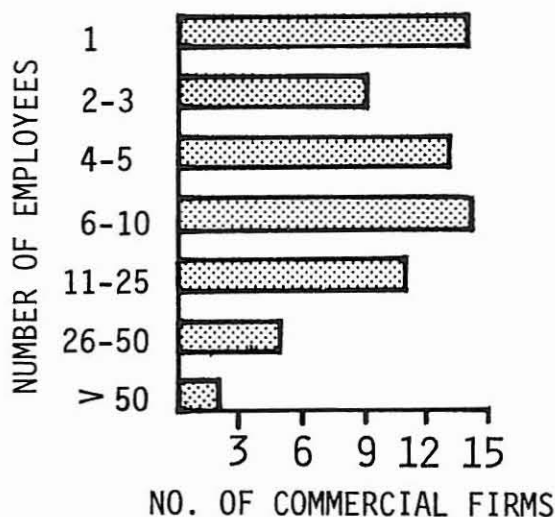


Figure 1. Comparative size of 68 commercial firms in Illinois based on number of employees.

reported that income from tree pest control was less than 1% of their gross and another 21 stated that it was less than 15% (Fig. 3). Many of these are firms that sell nursery stock or gardening supplies. Twenty of the firms primarily offer tree-pest-control services and receive 40 to 100% of their gross income from these activities. Fifty-one of 69 arborists stated that over 80% of their work

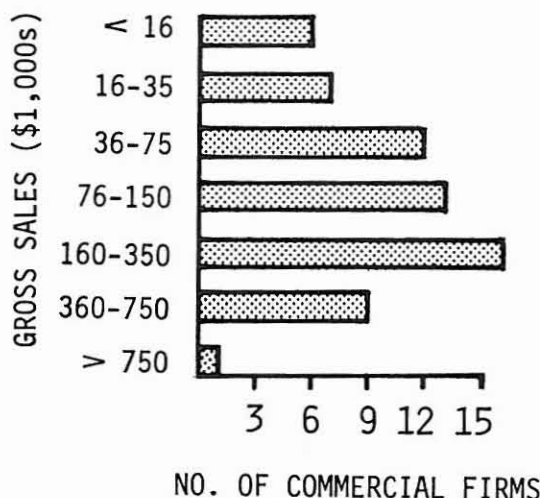


Figure 2. Comparative gross sales in thousands of dollars of 64 firms in Illinois engaged in commercial arboriculture.

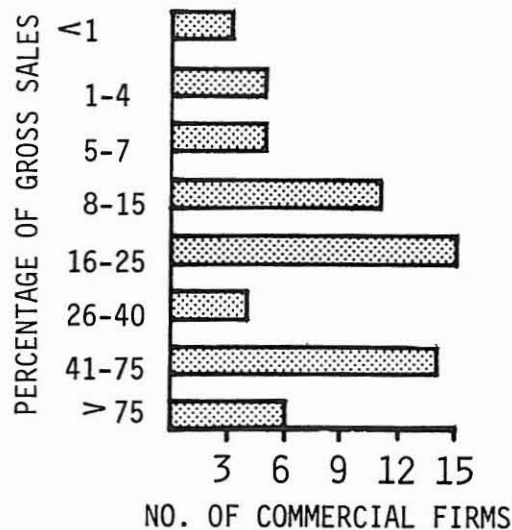


Figure 3. Comparative percentage of gross sales derived from pest control services by 63 Illinois commercial arborists.

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was for residential homeowners.

The responding commercial arborists reported that most of their spraying was done with hydraulic sprayers. Only five reported use of mist-blower sprayers in 1982. Applying the pesticide at the proper time seemed to be the most difficult pesticide-related problem faced by the arborists. The second most difficult to solve was diagnosis of pest problems. Pesticide storage and disposal of empty containers or surplus pesticides were not considered serious management problems.

Fungicides were used by fewer commercial arborists and in much smaller quantities than insecticides (includes miticides). Fifty-eight respondents used fungicides whereas 68 used insecticides. Benomyl was the fungicide most often used and the only fungicide stocked by more than half the arborists (Table 1). The arborists combined purchased 1,500 pounds of three fungicides (benomyl, maneb, and zineb). Carbaryl, diazinon, dimethoate, malathion, and dormant oil were the insecticides used by more than half of the arborists (Table 1); acephate, BT, chlorpyrifos, dicofol, and methoxychlor were also frequently used. The 68 arborists combined purchased 9,000 gallons of dormant oil, 6,500 gallons of methoxychlor, 3,000 gallons of each of malathion and dicofol, 2,000 gallons of diazinon, 6,000 pounds of carbaryl, 4,000 pounds of chlordane, and 2,200 pounds of acephate.

Most of the tree species common in residential or urban areas were sprayed for one or more pest problems. Fifty of the 68 commercial arborists had clients with birch trees; 40 or more arborists sprayed each of the following: ash, crabapple, elm, euonymus, hawthorn, honeylocust, juniper, maple, oak, or pine (Table 2). Hawthorn and sycamore were the only trees sprayed more often for disease than for insect problems, and even then most arborists used a fungicide and insecticide combination on these two species.

The number of commercial arborists who reported spraying for a specific disease or insect problem is given in Table 3. If the relative importance ranking by arborists is weighed (3 = 1st, 2 = 2nd, 1 = 3rd), the disease most important to arborists in Illinois is scab (58 points), followed by rust (39 points), and anthracnose (37 points). The most important insect problem is scale (52

**Table 1. The number of commercial arborists (out of 68 who responded) that reported use of a particular pesticide in 1982.**

Fungicide	Use frequency	Insecticide	Use frequency
Arbotect	16	Acephate	31
Benomyl	43	BT	26
Bordeaux	13	Carbaryl	53
Captafol	2	Chlordane	9
Captan	16	Chlorpyrifos	23
Chlorothalonil	7	Diazinon	38
Copper	3	Dicofol	32
Cycloheximide	6	Dimethoate	42
Dinocap	2	Disulfoton	1
Dodine	2	Ethion	1
Ferbam	9	Lindane	9
Folpet	3	Malathion	57
Mancozeb	10	Methoxychlor	18
Maneb	15	Oil (dormant)	46
Streptomycin	9	Oxydemeton methyl	2
Sulfur	2	Trichlorofon	1
Thiram	10		
Zineb	24		

**Table 2. The reported frequency of spray use by commercial arborists to trees of a fungicide, insecticide, or a combination of both in 1982.**

Host	Total No. that sprayed	Insecticide	Fungicide	Combination
Arbor-vitae	39	30	0	9
Ash	47	35	1	11
Birch	50	45	1	4
Boxwood	18	15	0	3
Cherry	35	20	1	14
Crabapple	49	8	4	37
Currant, alpine	22	11	4	7
Dogwood	26	21	1	4
Elm	46	29	2	15
Euonymus	45	40	0	5
Fir, spruce, yew	47	36	0	11
Hawthorn	42	4	9	29
Honeylocust	46	41	0	5
Horsechestnut	29	16	3	10
Juniper	48	25	1	22
Maple	49	37	1	11
Mountain ash	34	18	2	14
Oak	45	29	0	16
Pine	47	33	1	13
Rhododendron	24	16	1	7
Sycamore	39	8	10	21
Tulip tree	33	26	0	7

**Table 3.** The reported use of sprays by commercial arborists in 1982 to control insects or diseases, and the ranking of relative importance within each.

Problem	Use frequency (no. arborists)	Relative importance <sup>a</sup>		
		First	Second	Third
<b>Diseases</b>				
Anthraxnose	11	6	5	9
Blight	14	5	3	3
Canker or dieback	7	2	1	3
Galls	14	1	3	0
Leaf spots	19	2	5	4
Powdery mildew	14	2	2	4
Rust	13	4	11	5
Scab	11	14	5	6
DED	12	4	3	2
<b>Insects</b>				
Aphids	28	5	10	7
Bagworms	22	10	3	3
Borers	34	7	6	4
Caterpillars	35	5	4	4
Elm bark beetles	24	1	2	3
Gallmakers	20	0	1	0
Leaf beetles	26	0	1	2
Leafminers	32	1	1	0
Leafhoppers	24	1	2	1
Mites	31	4	4	8
Moths (gypsy or tussock)	16	1	0	0
Plant bugs	19	0	0	0
Scale insects	23	10	8	6
Webworms	29	1	2	6

<sup>a</sup> The number of arborists who rated this disease (or insect pest) as first, second, or third in importance in his area.

points), followed by aphids (42 points), and bagworm (39 points).

#### Municipal Arborist Questionnaire

Dutch elm disease has been a major problem for Illinois cities since the mid-1950s. Many cities began control programs at that time and hired one or more tree specialists to coordinate the disease program with other arboricultural practices. Municipal arborists usually had small budgets for pest control; three stated that they had no funds, another 3 of the 12 responding to this question had over \$20,000 in the 1982 budget. The average for the 12 cities was \$15,000 in 1982 for protection of city trees.

In nine of 11 reporting cities pest control was

accomplished only or primarily by municipal employees. Two cities contracted all tree-pest-control activities with commercial arborists. In nine of 13 reporting cities, pesticides were wholly or partially applied with a mist-blower sprayer. Almost all of these cities applied methoxychlor to healthy parkway elms to control Dutch elm disease. Municipal arborists agreed with commercial arborists that application of sprays at the proper time is a difficult problem.

#### Arborist Interviews

The mailed questionnaires were designed to determine what tree hosts were treated, what tree diseases and insect pests were most common, and what fungicides or insecticides were most frequently purchased. The personal interviews were designed to record the interactions between pest and host, pest and pesticide, and host and pesticide, and when and how often the pesticide was applied.

Nine disease problems and 14 insect problems were listed on the mailed questionnaire. The interviewed arborists gave widely divergent answers as to the number and types of problems that they felt were sufficiently serious to warrant control measures. Five of the seven municipal arborists named three or fewer problems for which they sprayed; the other two listed seven to 10 problems. The commercial arborist recommended and applied sprays to control more pest problems than did the municipal arborists. Seven of the 30 interviewed commercial arborists named six or fewer problems; 23 listed more than six problems.

Over 1.2 million trees were sprayed one or more times in 1982 by the 30 interviewed commercial arborists. Over 30,000 trees were sprayed for these insect pest problems: 1) aphids or mites on crabapple, 2) bark beetles on elm, 3) bagworms on juniper, 4) aphids or mites on maple, 5) scales on maple, and 6) aphids on oak.

The interviewed arborists often combined two insecticides in spraying the 1.2 million trees. This resulted in 2.2 million insecticide:tree interactions. Over 100,000 trees were sprayed to control either: 1) aphids with diazinon, 2) aphids with sevin, 3) caterpillars with diazinon, 4) caterpillars with pyrethrum, 5) caterpillars with sevin, 6) mites with diazinon, 7) mites with kelthane, 8) mites with

sevin, and 9) scale with dormant oil.

The interviewed arborists often sprayed the trees two or more times during the season. This increased the 2.2 million insecticide/tree spray treatments to 2.7 million total treatments during 1982. Almost one million insecticide spray treatments were applied in June, approximately 800,000 in July, and 500,000 in May; these three months accounted for 83% of the spraying activity. April and August combined accounted for another 13%. January and February were the only months void of insecticide spraying in Illinois.

The only fungicides used by seven or more of the personally interviewed arborists were benomyl, maneb, or zineb. Each of these fungicides was used on 1,000 or more trees to control rust or scab diseases. Most of the fungicides were applied in April or May, accounting for 52,000 of the total 54,000 fungicide treatments applied in 1982.

#### Interpolations and Projections

Of the 529 questionnaires mailed to licensed arborists, 156 (29%) were returned. Of the 156, 16 (10%) were employed by governmental agencies and 140 (90%) were privately employed. Of

the 140 commercial arborists, 22 (15.7%) do no diagnosing and do not spray, 7 (5%) have recently retired, 34 (24.3%) do not apply pesticides, and 77 (55%) do apply pesticides. If we project these percentages to the arborists not responding to the questionnaire, there are 261 licensed commercial arborists in Illinois applying pesticides. The average expenditure per arborist for pesticide purchase in 1982 was \$8,500. Projected total expenditure by all arborists approached \$100,000 for each of two fungicides, Arbotect and benomyl, and exceeded \$100,000 for each of the following insecticides: chlorpyrifos, diazinon, dicofol, malathion, methoxychlor, and dormant oil. If our assumptions and interpolations are correct, licensed Illinois arborists spent approximately \$2.2 million for pesticides in 1982 — 85% for insecticides and 15% for fungicides.

The complete pesticide assessment report has been published. Single copies are available free of charge upon request from the senior author.

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## ABSTRACT

GOUIN, F.R. 1983. **Over-mulching, a national plague.** *Weeds, Trees & Turf* 22(9): 22, 24.

Over-mulching of trees and shrubs can best be described as a plague that is slowly and methodically annihilating ornamental trees and shrubs in established landscapes. Over-mulching is a serious problem responsible for the decline and death of many shallow-rooted shrubs and large coniferous specimen trees. Heavy and repeated applications of mulch around shallow-rooted established species (azalea, rhododendron, mountain laurel, leucothoe, andromeda, boxwood, holly, yew, and camelia) can suffocate their roots. If the species has the ability to root readily, the plants will often initiate new roots from the stems into the mulch layer, but produce little top growth. Shallow-rooted plants growing on sandy, well aerated soils can tolerate more mulching than plants growing on heavy clay or silt loam soils. Death to plants from over-mulching is slow and agonizing for the owner. There is generally a gradual decline in the vigor of the plants affected. The annual rate of growth becomes less each year, the leaves do not grow to mature size, and the symptoms of iron chlorosis begin to appear.