TREE PRESERVATION BULLETIN 6

Spraying and other controls for diseases and insects that attack trees and shrubs

TREE PRESERVATION BULLETIN SIX

Spraying and other controls for diseases and insects that attack trees and shrubs

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U.S. DEPARTMENT OF THE INTERIOR

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NATIONAL PARK SERVICE

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Spraying and Other Controls for Diseases and Insects That Attack Trees and Shrubs[1]

Importance of Controlling Diseases and Insect Pests

Trees and shrubs represent an important part of the wealth and beauty of this country. They constitute our forests and beautify our parks, residential areas, city streets, highways, estates, and cemeteries. In many parks, forest and cultivated plantings are the most attractive features.

To keep trees and shrubs healthy and attractive, special measures are often necessary to protect them against diseases and insect pests—the most important causes of plant decline and failure. In forests, losses are usually offset by the regeneration of new plants; but, under cultivation, failures of trees and shrubs can only be remedied by replanting, which may be costly. To safeguard high investment values in cultivated trees and shrubs, it is often wise to use special controls which would be impractical under most forest conditions.

The recommendations in this bulletin are more applicable to urban than forest conditions and deal mainly with the use of sprays for control of diseases and insect pests that damage trees and shrubs. The treatments are intended only for forest and oranmental plants and not for plants in food production. The control recommendations apply particularly to the Eastern States, but they may also apply to the Midwest. Pesticide treatments are recommended only when nonchemical treatments are not

[1] Valuable assistance was received from plant pathologists and entomologists of the U.S. Department of Agriculture in the preparation of this bulletin.

suitable or adequate. Control of Ginkgo fruit by chloro-IPC spray is included with the pesticide treatments. Safety precautions are presented for the protection of the public, spray crew, plants, birds, fish, and other animals.

Growing Threat of Diseases and Insects

More effort than ever before is required to control introduced and native tree diseases and insect pests in the Eastern and Midwestern States because of their rapid increase since the early 1930's. Following are some of the more significant diseases and insect pests of trees in these areas.

The Dutch elm disease, of European origin and first discovered in this country in 1930, has since become well-established throughout the Eastern and Midwestern States, where it has destroyed countless American elms. The fungus that causes the disease, *Ceratocystis ulmi*, is transmitted in this country by two species of elm bark beetles—the smaller European elm bark beetle, *Scolytus multistriatus*, and the native elm bark beetle, *Hylurgopinus rufipes*. The European elm bark beetle is by far the more important in spreading the disease in the United States; in Canada, however, both species of bark beetles are equally important as carriers. In addition to insect transmission, the disease is readily transmitted by root grafts.

Phloem necrosis, apparently a native disease caused by a virus, primarily affects the American and cork elms. Since the 1930's this disease has greatly reduced the elm population in many Midwestern towns and cities. The disease is threatening these species in the Southern States, from Mississippi to Georgia and, in time, it is expected to become even more widespread.

The high susceptibility of the American and cork elms to the very destructive Dutch elm and phloem necrosis diseases makes it seem unwise to continue the wholesale planting of these species in the United States.

However, the European and Asiatic elms usually have been found much less susceptible to the Dutch elm disease and apparently immune to phloem necrosis. This indicates that these species have sufficient disease resistance to warrant their use in preference to the highly susceptible American species. The exotics are represented by a wide variety of attractive forms, including arching forms similar to the American and cork elms. Similar crown forms also appear in the Zelkovas and sugar hackberry. The latter species are relatively free of disease and insect problems. Diversification of American and cork elm plantings with proper clones of the above species therefore appears well warranted as a long-range control program for combating the Dutch elm and phloem necrosis diseases in this country. These recommendations appear in Table III.

Elm scorch, followed by dieback, is a common decline condition of the American elm in the Washington, D.C., area; field observations indicate the disease also occurs in the Southeastern States. The disease often turns American elms so unsightly that removal is required 4 to 6 years after infection. Elms so affected are very susceptible to the Dutch elm disease, probably because of attempted breeding attacks on weakened trees by the smaller European elm bark beetle, which is the main vector of this disease in the United States. The disease has been transmitted by bud graft and root graft inoculations, indicating it may be caused by a virus.

Sycamore scorch is very similar in symptoms and distribution to elm scorch. It also has been transmitted by bud inoculations and the similarity of symptoms, means of transmission, and distribution of elm and sycamore scorch indicate both diseases may be caused by a common virus.

Oak wilt, caused by *Ceratocystis fagacearum*, has been known in Wisconsin and neighboring States for many years. Beginning in the mid-1940's the disease has been reported in other Midwestern and many Eastern States, causing heavy oak losses in some sections. Oak wilt is one of the more serious diseases of forest trees, but it has not seriously threatened municipal oak plantings. The disease is transmitted by insects and root grafts. Fortunately, insects, in comparison to root grafts, play a lesser role in spreading the disease.

Study of mimosas in North Carolina led to the discovery in 1935 of mimosa wilt, caused by *Fusarium perniciosum*. The disease now has spread as far north as New Jersey. Infection first occurs in the roots and then spreads into the crown, producing dark-brown discoloration in the sapwood.

The mimosa webworm, *Homadaula albizziae*, is a major introduced pest of the mimosa and honey locust. It was first observed in the vicinity of Washington, D.C., in 1940 and has since been widely disseminated in the Eastern and Midwestern States.

Sycamore canker stain, caused by *Endoconidiophora fimbriata f. platani*, was first observed about 1935 in Philadelphia and has since been reported in the Eastern States as far south as Mississippi. The disease is readily transmitted by implements such as pruning tools.

The wax scale, *Ceroplastes ceriferus* introduced from Japan, is now a serious pest of various woody plants in the Southeastern States as far north as Maryland. It was first observed in Washington, D.C., about 1955, where it has become a major pest of Chinese holly and Japanese quince.

Mist Blowers and Hydraulic Sprayers

The mist blower is adapted for applying relatively concentrated sprays, and the hydraulic sprayer relatively diluted sprays. Both types of spray equipment are manufactured in a range of sizes. The smaller are suitable for spraying shrubs and small trees, while the larger sizes may be used for spraying large trees.

In the mist blower, the pesticide is sprayed into a strong airstream that propels and disperses the chemical. The larger mist blowers are capable of spraying trees satisfactorily to heights of about 70 feet.

In the hydraulic sprayer, the pesticide is compressed and forced through a hose and spray gun which disperses the spray mixture. The larger hydraulic sprayers can be used for trees to heights of about 50 feet, although waste is excessive at these heights.

The hydraulic sprayer and mist blower each have their particular advantages in pesticide application. The hydraulic sprayer is much more maneuverable and is therefore better suited for spraying in areas inaccessible to heavy equipment but within reach of a spray hose. The mist blower, however, is more suitable for spraying along streets, parkways,

and open areas where maneuverability is high. In these places, the mist blower sprays large trees more rapidly and at lower cost than the hydraulic sprayer.

Wind hinders mist blower spraying more than it does the hydraulic spray. Wind velocities are usually lower at night than during the day; therefore, to lessen wind interference, mist blower spray applications may be made more effectively at night. The tops of 50- to 70-foot elms can be sprayed satisfactorily with the mist blower only when there is light or no wind. Also, more skill is required to obtain proper spray coverage with the mist blower.

The hydraulic sprayer is particularly well adapted for applying drench-spray coverage. This type of spray treatment is necessary for control of most diseases and some insect pests, such as scale. The mist blower, however, is more effective where light coverage is adequate, as in control of leaf-eating insects or the European elm bark beetle. If the hydraulic sprayer is recommended for operational conditions that normally would suggest use of the mist blower, it is usually because drench-spray coverage is required in the given situation.

Precautions

Pesticide Hazards

Pesticides are applied for the control of insect pests, plant diseases, weeds, and rodents. The toxic characteristics of some pesticides are so great that trace amounts can be lethal to many forms of wildlife. Oysters, fish, ducks, eagles, quail, pheasants, songbirds, and beneficial insects are among the many forms of wildlife that may be seriously affected. Pesticides that are a threat to wildlife also may be hazardous to humans under some conditions.

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Pesticide use by the Department of the Interior

In recognition of the need to protect humans, other animals, and plants from harmful pesticides, all pesticide sprays used by the Department of the Interior are checked for safe usage as well as for effectiveness. The Department is opposed to mass use of persistent chlorinated hydrocarbons, such as aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, TDE and toxaphene, because of the hazard to fish and other forms of wildlife. The danger presented to wildlife by these pesticides is a result of slow breakdown in natural environments and their accumulation in food chains. Extremely toxic pesticides, such as some mercury compounds requiring "POISON" in bold red letters and the human skull and crossbones on the labels, are also restricted. Pesticides requiring such warning are restricted in use mainly for protection of the spray operator and the public, although there may be concern for other forms of life as well.

It has been questioned that use of the less toxic pesticides involves some sacrifice in effectiveness. Fortunately, however, the effectiveness of safer compounds usually compares quite favorably with that of the more hazardous chemicals.

Pesticide Toxicity

The toxicity of pesticides to man are indirectly indicated by their test effect on animals such as white rats. Of these tests, the LD50 oral toxicity test is usually the most significant. Oral toxicity figures of LD50 are formulated by the number of milligrams of pesticide per 1,000 grams of body weight required to kill 50 percent of test animals. The lethal dosage for rats does not necessarily apply to humans. Experience has shown, however, that the relative toxicity to both rats and humans is about equal. Toxicity figures for LD50 vary under different test conditions. Therefore, such figures should not be regarded as precise. Nevertheless, they fulfill an important need for an evaluation measure of pesticide toxicity. The pesticides herein recommenced with their LD50 figures are presented in Table 1. LD50 figures and amounts probably fatal to a human adult, from

the *Clinical Handbook on Economic Poisons of Public Health Service*, U.S. Department of Health, Education, and Welfare, are as follows:

Acute oral LD50 for any animal (mg./kg.)	*Probable lethal oral dose of technical material for a human adult*
Less than 5	A few drops
5 to 50	"A pinch" to 1 teaspoonful
50 to 500	1 teaspoonful to 2 tablespoonful
500 to 5,000	1 ounce to 1 pint (1 lb.)
5,000 to 15,000	1 pint to 1 quart (2 lb.)

Table I.—Pesticides and Mammalian Toxicity

Common name	Use	LD50 oral mammalian toxicity figures (mg. kg.)
Copper sulfate	Fungicide	300
Carbaryl (Sevin)	Insecticide	850
Chloro-IPC	Fruiticide	6, 000
Diazinon	Insecticide	108
Dicofol (Kelthane)	Miticide	1, 100
Dimethoate (Cygon)	Insecticide	215
Dinocap (Karathane)	Fungicide	1, 000
Ferbam	.....do.....	17, 000
Folpet (Phaltan)	.....do.....	10, 000
Lime sulfur 33° Baumé	Miticide Insecticide Fungicide	Low
Malathion	Insecticide	1, 375
Maneb	Fungicide	7, 500
Metham (Vapam)	Rooticide	6, 000

Toxicity of Sprays Reduced by Dilution

Dillution can greatly reduce the toxicity of pesticide sprays. In formulas for the hydraulic sprayer dilution is much greater than for the mist

blower; formulas for the mist blower in shade-tree spraying are usually six times as concentrated as those for the hydraulic sprayer. Because spray formulas for mist blowers are more concentrated, more atomized, and more subject to fallout than those for hydraulic sprayers, mist blower applications present a greater health hazard to man and wildlife from air pollution and direct contact. Consequently, less toxic pesticides are recommended for the mist blower than for the hydraulic sprayer.

Safety of Humans and Other Forms of Animal Life

Follow the manufacturer's instructions, noting all precautions.

Don't use extremely toxic pesticides that require a death warning on the label: "POISON" in red letters, skull and crossbones.

Don't use chlorinated hydrocarbons such as aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, TDE, and toxaphene.

For hydraulic sprayers, use only pesticides having LD50 ratings of 75 and above.

For mist blowers, use only pesticides having LD50 ratings of 450 and above.

Don't dispose of spray materials where they may pollute streams, lakes, and ponds.

Avoid spray drift to wildlife habitats, streams, fishponds, market produce, crops, domestic animals, and beehives.

Avoid spraying plants particularly favored by bees during their flowering period.

Spray crews should take the following protective measures:

Avoid prolonged inhalation of spray mist.

Avoid prolonged contact of pesticides on skin, particularly concentrates and mist blower formulations. If contact should occur, promptly wash freely with water.

Wear respirator in applying pesticides when specified on the label.

Wear waterproof outer garments, including headgear.

Wear clean clothes daily; wash after handling pesticides and before eating or smoking.

Don't carry food, candy, tobacco, or gum in work clothing.

Don't hold face over opening of spray tank when pouring pesticides.

Don't attempt to clear spray nozzles by blowing with mouth.

Safety of Plants

Don't apply winter-oil sprays in autumn. Apply this type spray from January 1 until buds begin to swell in spring.

Don't apply winter-oil sprays during sudden drops of temperature to below freezing; apply only when the temperature is above 40° F.

Don't apply winter-oil sprays on maples, beeches, walnuts, or oriental flowering cherry trees of Yoshino, Akebono, and weeping and higan varieties, which are sensitive to oil injury.

Don't spray under windy conditions as proper spray coverage is difficult to obtain and spray drift may damage plants sensitive to spray.

Don't apply oil sprays when the temperature is above 85° F., particularly during humid weather or droughts.

Don't overspray with mist blower applications.

Don't use 2,4-D in sprayers used for fungicides and insecticides.

Protection of Property

Whenever it is necessary to spray trees bordering streets or other parking areas, warning signs should be displayed 1 day prior to the spraying. This will give car owners ample time to park elsewhere during the spraying.

Lime sulfur is an effective fungicide, insecticide, and miticide, but has some objectional features that limit its use. The spray has an objectionable odor which may persist for about 1 week after application; therefore, it should not be applied extensively in the more populated areas. The spray also blemishes some painted surfaces, so it should not be applied near buildings or other painted structures

Disease and Insect Control

In Table 3, recommendations for controlling diseases and insect pests of trees and shrubs are compiled in alphabetical order under the common names of the host plant. Control treatments are listed for each disease and insect pest. Spray formulas are presented for both the hydraulic sprayer and mist blower for definite pesticide concentrations per 100 gallons of water. Modifications of these formulas would be required for different concentrations. Common or coined names of chemicals are usually used in preference to trade names. The few trade names of chemicals that appear are not intended to imply that other trade chemicals are not equally as effective for the purpose indicated. Many homeowners will be interested in converting the formulas recommended for 100-gallon mixtures to 3 gallons and 1 gallon. Table 2 shows how wettable powder and emulsifiable concentrates of pesticides may be converted from quantities per 100 gallons of water to quantities for 3 gallons and 1 gallon.

Table II.—Quantities for Wettable Powder and Emulsifiable Concentrate

Formula	Water		
	100 gals.	3 gals.	1 gal.
Wettable powder	5 lbs.	10 tbsps.	3 tbsps.
	4	8	8 teasps.
	3	6	6
	2	4	4
	1	2	2
Emulsifiable concentrate	5 gals.	1¼ pts.	13 tbsps.
	4	1	10
	3	¾	¼ pt.
	2	½	5 tbsps.
	1	8 tbsps.	3
	1 qt.	2	2 teasps.
	1 pt.	1	1

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
APPLE				
DISEASES:				
Cedar-apple rust (*Gymnosporangium juniperi virginianae*)	Ferbam 76% WP	2 lbs.	.....	If practical, destroy all cedar trees within 1/4 mile radius of apple trees or spray apples to prevent infection. Spray 3 or 4 times at 7 to 10-day intervals beginning at pink or petalfall stage of bloom.
Fire blight (*Erwinia amylovora*)				Prune out cankered branches, disinfecting tools with 10% Clorox solution between pruning operations. Destroy severely affected trees and avoid over-fertilization (nitrogen).
INSECTS:				
Brown-tail moth (*Nygmia phaeorrphoea*)	Malathion 25% WP	4 lbs.	.....	In Northeastern States, spray foliage in spring as soon as possible after larvae emerge from hibernation. Repeat during latter half of August.
	57% EC	1 qt.	1½ gals.	
Eastern tent caterpillar (*Malacosoma americanum*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear in early spring.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qt.	3 gals.	

European red mite (*Panonychus ulmi*)	Dicofol 18.5% WP	2 lbs.	.....	Spray foliage as mites appear in spring.
	18.5% EC	1 qt.	1½ gals.	
Fall webworm (*Hyphantria cunea*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage in May as first generation larvae appear and again for second generation in August.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Gypsy moth (*Porthetria dispar*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear in early spring in Northeastern States.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Japanese beetle (*Popillia japonica*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as beetles appear (about 3d week in June in Washington, D.C.). If necessary, repeat about 3 weeks later.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Oyster shell scale (*Lepidosaphes ulmi*)	Oil, superior dormant	2 gals.	.....	Spray in early spring before buds open.
Periodical cicadas (*Magicicada* spp.)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray branches as adults appear in early summer.
	4 F	1 qt.	1½ gals.	
San José scale (*Aspidiotus perniciosus*)	Oil, superior dormant	2 gals.	.....	Spray during dormant season.
Scurfy scale (*Chionaspis furfura*)	do	2 gals.	.....	Do.

Footnotes at end of table.

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Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
ARBORVITAE				
DISEASE:				
Arborvitae blight (*Cercospora thujina*)	Bordeaux 8–8–100	16 lbs.	.....	Apply 3 sprays at monthly intervals (beginning about June 1 in the South).
INSECTS:				
Arborvitae leaf-miner (*Argyresthia thuiella*)	Malathion 25% WP	4 lbs.	.....	Spray foliage about mid-May to June 1 as larvae appear. Repeat about 2 weeks later.
	57% EC	1 qt.	.....	
Bagworm (*Thyridopteryx ephemeraeformis*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear in May or June.
	Carbaryl[1] 4 F	1 qt.	.....	
Juniper scale (*Diaspis carueli*)	Malathion 25% WP	4 lbs.	.....	Spray as crawlers appear in June.
	57% EC	1 qt.	.....	
Two-spotted spider mite (*Tetranychus urticae*)	Dicofol 18.5% WP	2 lbs.	.....	Spray foliage in spring as mites appear.
	18.5% EC	1 qt.	.....	
ASH				
DISEASE:				
Ash anthracnose (*Gloeosporium aridum*)	Bordeaux 8–8–100	16 lbs.	.....	Spray in spring when buds are ready to open. Repeat immediately after buds have opened.
	Ziram 76% WP	2 lbs.	.....	
INSECTS:				
Ash borer (*Podosesia syringae fraxini*)	Dimethoate 30.5% EC	1½ pts.	.....	Spray trunk and larger branches in July and August to kill young borers.

Fall webworm (*Hyphantria cunea*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage for first generation larvae in May and second generation in August.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Lilac borer (*Podosesia syringae*)	Dimethoate 30.5% EC	1½ pts.	.....	Spray trunk and larger branches in July and August to kill young borers.

AZALEA

Diseases:				
Azalea flower blight (*Ovulinia azaleae*)	Zineb 65% WP	1½ lbs.	.....	Spray flowers at 2- to 3-day intervals, especially Indian and Kurume varieties.
Azalea leaf and flower gall (*Exobasidium vaccinii*)	Ferbam 76% WP	1½ lbs.	.....	Spray plants before buds open and immediately following flowering.
Insects:				
Azalea bark scale (*Eriococcus azaleae*)	Malathion 25% WP	4 lbs.	.....	Spray as crawlers appear in early summer.
	57% EC	1 qt.	.....	
Azalea lacebug (*Stephanitis pyrioides*)	Dimethoate 30.5% EC	1 pt.	.....	Spray underside of foliage as nymphs appear in spring and again 3 weeks later.
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	.....	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	.....	
Azalea leaf-miner (*Gracilaria azaleella*)	Diazinon 25% EC	½ pt.	.....	Spray foliage in May or June as mines appear.
	Malathion 57% EC	1 qt.	.....	
Azalea white fly (*Aleyrodes azaleae*)	Dimethoate 30.5% EC	1½ pts.	.....	Spray underside of foliage for larvae in spring.
Mealy bug (*Ferrisiana virgata*)	Malathion 57% EC	1 qt.	.....	Spray as mealy bug appears in summer.
Mulberry whitefly (*Tetraleurodes mori*)	Dimethoate 30.5% EC	1½ pts.	.....	Spray underside of foliage for larvae in autumn before frost and, if necessary, the following spring.
	Malathion 57% EC	1 qt.	.....	

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
BEECH				
DISEASES:				
Leaf scorch (*Physiogenic*)				Provide good cultural conditions.
Nectria beech bark canker (*Nectria coccinea* var. *faginata*)				See beech scale, the disease carrier.
INSECTS:				
Beech scale (*Cryptococcus fagi* Carrier of beech Nectria)	Lime sulfur 33 Baumé	12 gals.	.....	Spray trunk and lower limbs in dormant season.
Giant aphid (*Longistigma caryae*)	Malathion 25% WP	4 lbs.	.....	Spray limbs and twig growth as aphids appear.
	57% EC	1 qt.	.....	
Woolly beech aphid (*Phyllaphis fagi*)	Malathion 25% WP	4 lbs.	.....	Spray foliage and branches as aphids appear in spring.
	57% EC	1 qt.	.....	
BIRCH				
DISEASES:				
Birch anthracnose (*Gloeosporium betularum*)	Bordeaux 8–8–100	16 lbs.	.....	Spray foliage as disease becomes evident. If necessary repeat 10 days later.

Brown leaf-spot (*Cylindrosporium betulae*)	Bordeaux 8–8–100	16 lbs.	.....	Do.
INSECTS:				
Birch casebearer (*Coleophora salmani*)	Lime sulfur 33° Baumé	12 gals.	.....	Spray in spring with lime sulfur before buds open. Spray in July or August with malathion.
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	.....	
Birch leaf-miner (*Fenusa pusila*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage about May 15 for 1st brood and July 12 for 2d brood as adults begin appearing in the Northeastern States.
	Carbaryl [1] 4 F	1 qt.	.....	
	Dimethoate 30.5% EC	1 pt.	.....	
Birch skeletonizer *Bucculatrix canadensisella*)	Malathion 25% WP	4 lbs.	.....	Spray foliage as larvae appear in July and August.
	57% EC	1 qt.	.....	
Bronze birch-borer (*Agrilus anxius*)	Carbaryl [1] 85% WP	10 lbs.	.....	Spray foliage and bark as adults appear in May or June. Wrap trunks of newly planted trees with 3 to 4 inch bands of tree-wrapping paper. Maintain good tree vigor by watering and feeding.
BOXWOOD				
DISEASES:				
Meadow nematode (*Pratylenchus vulnus*)	Nemagon 10% granules	.....		Punch holes 6 to 9 inches deep at 12 inch intervals in root zone of plants. Pour 1 tsp. (3 grams) of Nemagon 10% granules in each hole and cover with soil. Apply treatment during growing season when soil temperature is 50° F or above. Benefits of treatment not apparent until about 1 year later.
Nectria canker (*Nectria roussellianа*)	.....			Prune and burn infected branches. Remove dead leaves that lodge in branch crotches.

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
BOXWOOD—Continued				
INSECTS:				
Boxwood leaf-miner (*Monarthropalpus buxi*)	Dimethoate 30.5% EC	1 pt.	.....	Spray foliage as flies begin emerging usually during the 1st week in May in Washington, D.C. Repeat as necessary in June or July for control of young miners.
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	.....	
Boxwood mite (*Eotetranychus buxi*)	Dicofol 18.5% WP	2 lbs.	.....	Spray foliage thoroughly in spring as mites appear. Repeat 1 month later if necessary.
	18.5% EC	1 qt.	.....	
Boxwood psyllid (*Psylla buxi*)	Dimethoate 30.5% EC	1 pt.	.....	Spray foliage thoroughly within 1 month after psyllids mature (about the end of May in Washington, D.C.).
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	.....	
CATALPA				
DISEASE:				
Leaf spot (*Phyllosticta catalpae*)	Ferbam 76% WP	1½ lbs.	.....	Spray foliage in spring 2 or 3 times at about 10-day intervals while foliage is developing.
INSECTS:				
Catalpa sphinx (*Ceratomia catalpae*)	Malathion 25% WP	4 lbs.	.....	Spray foliage in spring or early summer as larvae appear.
	57% EC	1 qt.	.....	
Comstock mealy bug (*Pseudococcus comstocki*)	Dimethoate 30.5% EC	1 pt.	.....	Spray for crawler stage which appears soon after leaves unfold.
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	

CHERRY

INSECTS:

Eastern tent caterpillar (*Malacosoma americanum*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear in early spring.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
European red mite (*Panonychus ulmi*)	Dicofol 18.5% WP	2 lbs.	.....	Spray foliage as mites appear in spring.
	18.5% EC	1 qt.	1½ gals.	

CHERRY (Oriental)

INSECTS:

Fall webworm (*Hyphantria cunea*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage in May for 1st generation larvae and in August for 2d generation.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Japanese beetle (*Popillia japonica*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage about 3d week in June. If necessary repeat about 3 weeks later.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
San José scale (*Aspidiotus perniciosus*)				Measures applied for West Indian peach scale will control this scale.
Shot hole borer (*Scolytus rugulosus*)	Methoxychlor 24% EC	4 gals.	.....	Spraying with methoxychlor before leaves emerge in spring will probably control pest.

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
CHERRY (Oriental)—Con.				
INSECTS—Con.				
West Indian peach scale..... (*Aulacaspis pentagona*)	Oil, superior dormant	2 gals.	.....	Spray during dormant season, applying superior oil, except to Japanese flowering cherry varieties, Yoshino, Akebono, higan and weeping, which are susceptible to injury from winter spray oil. On these exceptions, spray for crawler stage of the scale applying indicated combination of methoxychlor and summer spray-oil. Crawler stage of scale appears in 3 generations in Washington, D.C. These occur about May 15, July 4, and August 21. The combination spray sometimes may cause some yellowing and dropping of foliage.
	Methoxychlor 24% EC	2 qts.	.....	
	plus summer spray-oil	1 gal.	.....	
CHESTNUT				
Disease:				
Chestnut blight..... (*Endothia parasitica*)				Disease impractical to control on the highly susceptible American chestnut. Plant Chinese chestnut or blight resistant hybrids.

COTONEASTER

Diseases:				
Fire-blight (*Bacillus amylovorus*)				Prune out cankered branches; disinfect tools with 10% Clorox solution between pruning operations. Destroy severely affected plants and avoid over-fertilization (nitrogen).
Leaf spot (*Phyllosticta sanguinea*)	Ferbam 76% WP	1½ lbs.		Ferbam spray applied to foliage should be effective.
Insect:				
Hawthorn lace bug (*Corythucha cydoniae*)	Dimethoate 30.5% EC	1 pt.		Spray undersurface of foliage as nymphs appear and again within 2 to 3 weeks.
	Malathion 25% WP	4 lbs.		
	57% EC	1 qt.		
	Methoxychlor 50% WP	2 lbs.		
	24% EC	2 qts.		

CRAPEMYRTLE

Disease:				
Powdery mildew (*Erysiphe lagerstroemia*)	Lime sulfur 33° Baumé	12 gals.		Spray with lime sulfur spray in spring when buds are swelling and Dinocap when plant is in full leaf.
	Dinocap 25% WP	½ lb.		
Insects:				
Crapemyrtle aphid (*Myzocallis kahawaluockalani*)	Malathion 25% WP	4 lbs.		Spray as aphids appear.
	57% EC	1 qt.		
Japanese beetle (*Popillia japonica*)	Carbaryl [1] 50% WP	2 lbs.		Spray foliage as beetles appear, about 3d week in June in Washington, D.C. If necessary, repeat 3 weeks later.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.		
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.		
	24% EC	2 qts.	3 gals.	

Footnotes at end of table.

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Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
DOGWOOD				
DISEASES:				
Crown canker (*Phytopthora cactorum*)				Avoid basal trunk injuries. Remove severely affected trees. Before replanting, replace diseased soil with healthy soil. Grafting or budding near groundline appears to predispose trees to infection. Therefore, avoid planting trees having propagating defects of this kind.
Flower and leaf blight (*Botrytis cinerea*)	Zineb 65% WP	1 lb.	.....	Spray just before bracts fall.
Spot anthracnose (*Elsinoe corni*)	Ferbam 76% WP	2 lbs.	.....	Spray flower buds just before opening. Repeat 1 to 2 weeks later.
INSECTS:				
Dogwood borer (*Thamnosphecia scitula*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray at monthly intervals from May 15 to September 15 in Washington, D.C. area.
	Dimethoate 30.5%	1 pt.	.....	
Dogwood scale (*Chionaspis corni*)	Oil, superior dormant.	2 gals.	.....	Spray in early spring before buds open.
White-marked tussock moth (*Hemerocampa leucostigma*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear in spring. If necessary, repeat for later generations.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	

ELM

DISEASES:				
Dutch elm disease (*Ceratocystis ulmi*)	Methoxychlor 24% EC	4 gals.	24 gals.	*Spray:* February-April for Washington, D.C. area (includes partially developed foliage in April). Spray night and day as necessary. *Scout:* June-September, referring disease suspect samples to State Agricultural Experiment Station as required. NPS Laboratory provides culture diagnosis for Washington, D.C. *Sanitation:* Destroy by burning all likely breeding sources of elm bark beetles. These sources include dying, cut, or dead elm wood, regardless of known infection by Dutch elm disease fungus. Destroy all such elm bark beetle breeding sources prior to new growth in the spring and promptly as found during growing season. Destroy promptly Dutch elm disease cases detected in growing season, except mild symptom cases in European and Asiatic elms, which usually recover.

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water		Control
		Hydraulic sprayer	Mist blower	
ELM—Con.				
DISEASES—Con.				Continued
Dutch elm disease—Con.				*Prevention of transmission from breeding attacks of beetle vector:* Avoid trimming elms mid-June to mid-September, as wound healing appears to render the trunk bark highly susceptible to breeding attacks of the beetle vector. Infections of this origin are often very virulent, even with disease tolerant and resistant elms. DDT and methoxychlor sprays are not effective against this type of beetle attack and disease transmission. *Prevention of root graft transmission:* Where elms of trunk diameters of 12 inches and more are growing within 40 feet of each other, possible root grafts between trees should be disconnected by trenching or chemical treatment. Lines of disconnection should be at about the crown limits. The trenching method consists of severing all roots within the trench to a depth of about 18 inches. The

			chemical treatment involves drilling ¾ inch holes in ground about 15 inches deep at 6 inch intervals in line of treatment. Pour 125 cc of Metham (Vapam) diluted 1:5 in water in each hole. Close hole with shoe heal. Plant elms preferably 60 feet or more apart unless on disease resistant root stock. *Diversified planting program:* For replacement of American and cork elms, diversify with better comparable clones of European and Asiatic elms, Zelkovas and sugar hackberry. Grow European and Asiatic elms on disease-resistant root stock.
Elm black leaf-spot (*Gnomonia ulmea*)	Ferbam 76% WP	1½ lbs.	Spray 2 or 3 times in spring at 10-day intervals while foliage is developing.
Elm dieback (*Deuterophoma ulmi*) (*Cephalosporium ulmi*)			Prune out disease, whenever practical.
Elm leaf spot (*Cercospora microsora*)	Ferbam 76% WP	1½ lbs.	Spray as buds open in spring. Repeat about 10 days later.
Elm mosaic (virus)			Remove American elms which have been greatly weakened by disease.
Elm scorch (probably virus)			Remove unsightly affected American elms.
Phloem necrosis (*Morsus ulmi*)			Scout for symptoms in American and cork elms from June to September. Remove and burn infected trees. For areas threatened by disease, plant European and Asiatic elms, which seem to be resistant.

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
ELM—Con.				
DISEASES—Con.				
Verticillium wilt (*Verticillium albo-atrum*)				Scout for symptoms from May to September. Send suspect samples to State Agricultural Experiment Station for cultural diagnosis. Remove and burn severely affected trees. Before replanting, replace diseased soil with healthy soil.
Wetwood (slimeflux) (*Erwinia nimipressuralis*) and (*Bacterium* spp.)				Avoid leader pinching in crotches by proper pruning. Do not plant elms with trunk injuries below the groundline. Installation of drain tubes to prevent bark damage may be desirable.
INSECTS:				
Black carpenter ant (*Componotus herculeanus*)				Inject 2 percent chlordane emulsion into insect holes.
Elm borer (*Saperda tridentata*)	Carbaryl [1] 85% WP	10 lbs.	.....	Spraying of trunks and leaders at monthy intervals from May to September may be beneficial. Remove and burn dead leaders and branches.
Elm leaf beetle (*Galerucella xanthomelaena*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray undersurface of foliage as larvae and beetles appear from April to September.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	

Elm scurfy scale (*Chionaspis americana*)	Oil, superior dormant.	2 gals.	.....	Spray in early spring before buds open.
Elm spanworm (*Ennomos subsignarius*)	Malathion 25% WP	4 lbs.	.....	Spray new foliage as larvae appear.
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
European elm scale (*Gossyparia spuria*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray in July during crawler stage.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
European red mite (*Paratetranychus pilosus*)	Dicofol 18.5% WP	2 lbs.	.....	Spray foliage in spring as mites appear.
	18.5% EC	1 qt.	1½ gals.	
Fall cankerworm (*Alsophila pometaria*)	Methoxychlor 50% WP	2 lbs.	.....	Spray foliage in spring as larvae appear.
	24% EC	2 qts.	3 gals.	
Fall webworm (*Hyphantria cunea*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage in May for 1st generation and in August for 2d generation.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	53% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Giant aphid (*Longistigma caryae*)	Malathion 25% WP	4 lbs.	.....	Spray branches as aphids appear.
	57% EC	1 qt.	1½ gals.	
Japanese beetle (*Popillia japonica*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as beetles appear (about 3d week in June in Washington, D.C.). If necessary, repeat about 3 weeks later.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Leopard moth (*Zeuzera pyrina*)				Prune and burn infested branches.

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
ELM—Con.				
INSECTS—Con.				
Native elm bark beetle (*Hylurgopinus rufipes*) (Carrier of Dutch elm disease fungus).				Follow same measures as for control of smaller European elm bark beetle. See Elm: Dutch elm disease.
Oystershell scale (*Lepidosaphes ulmi*)	Oil, superior dormant.	2 gals.		Spray in early spring before buds open.
Smaller European elm bark beetle. (*Scolytus multistriatus*) (The most important carrier of the Dutch elm disease fungus in the United States)				See Elm: Dutch elm disease.
Spring cankerworm (*Paleacrita vernata*)	Carbaryl[1] 50% WP	2 lbs.		Spray foliage in spring as larvae appear.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
Two-spotted spider mite (*Tetranychus urticae*)	Dicofol 18.5% WP	2 lbs.		Spray foliage in spring as mites appear.
	18.5% EC	1 qt.	1½ gals.	
White-marked tussock moth (*Hemerocampa leucostigma*)	Carbaryl[1] 50% WP	2 lbs.		Spray foliage in spring as larvae appear. Repeat if later broods appear.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	

Woolly elm aphid (*Eriosoma americanum*)	Malathion 25% WP	4 lbs.		Spray foliage and branches in spring as aphids appear.
	57% EC	1 qt.	1½ gals.	

EUONYMUS

DISEASE:				
Crown gall (*Phytomonas tumefaciens*)				Plant gall-free stock.
INSECTS:				
Euonymus scale (*Unaspis euonymi*)	Dimethoate 30.5% EC	1 pt.		Spray with superior oil in late March or early April.
	Malathion 25% WP	4 lbs.		Apply malathion or dimethoate spray in June for crawlers.
	57% EC	1 qt.		
	Oil, superior dormant.	2 gals.		
Two-spotted spider mite (*Tetranychus urticae*)	Dicofol 18.5% WP	2 lbs.		Spray foliage in spring as mites appear.
	18.5% EC	1 qt.		

FIR

DISEASES:				
Gray mold twig blight (*Botrytis cinerea*)				Provide good ventilation; thin branches as necessary. Douglas-fir is the most susceptible host.
Spruce canker (*Cytospora kunzei*)				Prune out and burn cankered branches. Remove severely cankered trees. Sterilize pruning tools.
INSECTS:				
Bagworm (*Thyridopteryx ephemeraeformis*)	Carbaryl [1] 50% WP	2 lbs.		Spray foliage in May or June as larvae appear.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.		
	57% EC	1 qt.	1½ gals.	
Spruce budworm (*Archips fumiferana*)	Malathion 25% WP	4 lbs.		Spray foliage as growth starts in spring.
	57% EC	1 qt.	1½ gals.	

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
FIRETHORN				
DISEASES:				
Fire blight (*Erwinia amylovora*)				Prune out cankered branches.
Scab (*Venturia inaequalis*)	Ferbam 76% WP	1½ lbs.	.....	Spray 3 times at 10-day intervals, beginning as buds start to open.
INSECTS:				
San Jose' scale (*Aspidiotus perniciosus*)	Oil, superior dormant.	2 gals.	.....	Spray during dormant season.
Japanese scale (*Leucaspis japonica*)	Do.	2 gals.	.....	Spray during dormant season.
GINKGO				
Fruit control	Chloro-IPC 47% EC	⅓ pt.	1 qt.	Spray within 3 weeks following pollination when the young fruit is responsive. In Washington, D.C., pollination usually occurs 3d week of April. Spray with mist blower to near dripping point. Do not spray when temperature is above 80°F to avoid foliage burn. Spray sometimes causes foliage spotting to sensitive plants such as phlox.

				Mist blower is much more efficient than hydraulic sprayer. Hydraulic-sprayer applications are relatively ineffective above 40 feet.

HAWTHORN

DISEASES:				
Leaf blight (*Entomosporium thumeni*)	Zineb 65% WP	1 lb.		Apply 2 to 3 sprays at 10-day intervals as new foliage develops. Pauls Scarlet English hawthorn very susceptible.
Hawthorn leaf rust (*Gymnosporangium clavipes*)	Ferbam 76% WP	2 lbs.		Apply 3 sprays at 10-day intervals when tree comes into bloom.
INSECTS:				
Cherry hawthorn sawfly (*Profenusa canadensis*)	Diazinon 25% WP	2 lbs.		Spray developing foliage in spring.
	25% EC	1½ pts.		
Hawthorn lace bug (*Corythucha cydoniae*)	Dimethoate 30.5% EC	1 pt.		Spray undersurface of foliage as nymphs appear and 3 weeks later. Two generations in Washington, D.C.; the first appears in May to June and the second in July.
	Malathion 25% WP	4 lbs.		
	57% EC	1 qt.		
	Methoxychlor 50% WP	2 lbs.		
	24% EC	2 qts.	3 gals.	
Wooly aphid (*Sshizoneura lanigera*)	Methoxychlor 24% EC plus summer spray oil.	2 qts.		Spray as aphids appear.
		1 gal.		

HEMLOCK

INSECTS:				
Hemlock scale (*Fiorina externa*)	Dimethoate 30.5% EC	1 pt.		Spray for crawler stage during latter part of May in Washington, D.C.
Two-spotted spider mite (*Tetranychus bimaculatus*)	Dicofol 18.5% WP	2 lbs.		Spray foliage in spring as mite appear. If necessary repeat in 1 month.
	18.5% EC	1 qt.	1½ gals.	

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
HICKORY				
INSECT:				
Gall aphid (*Phylloxera* spp.)	Methoxychlor 24% EC	2 qts.	3 gals.	Spray as young crawlers emerge from galls (occurs in early June in Washington, D.C.). Pest occasionally causes severe defoliation.
	plus summer spray oil	1 gal.	6 gals.	
HOLLY				
DISEASES:				
Holly tar spot (*Phacidium cartisii*)	Ferbam 76% WP	1½ lbs.	.....	Spray foliage during May or June as symptoms appear. If necessary repeat in 6 weeks.
Winter injury				Avoid planting in cold windswept situations subject to temperatures below 15 F.
INSECTS:				
Holly leaf miner (*Phytomysa ilicis*)	Dimethoate 30.5% EC	1 pt.	.....	Pest may be controlled in adult (fly) and larva stages. In Washington, D.C., spray for adult stage about mid-May and for larva in July or early August.
Wax scale (*Ceroplastes ceriferus*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray for crawlers or young attached scale about mid-June in Washington, D.C. Repeat about 10 days later. Chinese holly is very susceptible.
	Carbaryl[1] 4 F	1 qt.	.....	
HONEY LOCUST				
DISEASE:				
Leaf spot (*Linospora gleditsiae*)	Ferbam 76% WP	1½ lbs.	.....	Spray in spring 2 or 3 times as foliage develops.

INSECTS:				
Bagworm	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage in May or June as larvae appear.
(*Thyridopteryx ephemerae formis*)	Carbaryl[1] 4 F	1qt.	1½ gals.	
Honey locust mite	Dicofol 18.5% WP	2 lbs.	.....	Spray undersurface of foliage June or July.
(*Eotetranychus multidigituli*)	18.5% EC	1 qt.	1½ gals.	
Mimosa webworm	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as 1st generation larvae appear (about 3d week in June in Washington, D.C.). Repeat in July and August as 2d and 3d generation larvae appear.
(*Homadaula albizziae*)	Carbaryl[1] 4 F	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
HORSE CHESTNUT				
DISEASES:				
Leaf blotch	Ferbam 76% WP	1½ lbs.	.....	Beginning late spring or early summer, apply 2 to 3 sprays at 10-day intervals.
(*Guignardia aesculi*)				
INSECTS:				
Bagworm	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear in May or June.
(*Thyridopteryx ephemeraeformis*)	Carbaryl[1] 4 F	1 qt.	1½ gals.	
Japanese beetle	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as beetles appear (about 3d week in June in Washington, D.C.).
(*Popillia japonica*)	Carbaryl[1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
JAPANESE FLOWERING QUINCE				
INSECTS:				
Wax scale	Carbaryl[1] 50% WP	2 lbs.	.....	See Holly.
(*Ceroplastes cereferus*)	Carbaryl[1] 4F	1 qt.		

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
JUNIPER				
DISEASES:				
Cedar blight (*Phomopsis juniperovora*)	Bordeaux 8–8–100	16 lbs.	.....	Prune out and burn localized branch infections. Sterilize tools as necessary. Remove and burn infected trees. Spray valuable trees at 2-week intervals during growing season.
Cedar-apple rust (*Gymnosporangium juniperi virginianae*)				See Apple.
INSECTS:				
Bagworm (*Thyridopteryx ephemeraeformis*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage May and June as larvae appear.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
Juniper scale (*Diaspis carueli*)	Malathion 25% WP	4 lbs.	.....	Spray in June as crawler stage appear.
	57% EC	1 qt.	1½ gals.	
Juniper webworm (*Dichomeris marginella*)	Malathion 25% WP	4 lbs.	.....	Spray early in July for new larva generation or early in spring for over-wintered infestation.
	57% EC	1 qt.	1½ gals.	
Two-spotted spider mite (*Tetranychus urticae*)	Dicofol 18.5% WP	2 lbs.	.....	Spray foliage in spring as mites appear. If necessary repeat 1 month later.
	18.5% EC	1 qt.	1½ gals.	

LARCH

Disease:				
Cedar blight (*Phomopsis juniperovora*)	Bordeaux 8–8–100	16 lbs.	.....	Prune and burn local branch infections. Sterilize tools as necessary. Remove and burn heavily infected trees. Spray valuable trees at 2-week intervals as necessary.
Insects:				
Gypsy moth (*Porthetria dispar*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear (from April to June 10 in the Northeastern States).
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
Japanese beetle (*Popillia japonica*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as beetles appear (about 3d week in June in Washington, D.C.). If necessary, repeat about 3 weeks later.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Larch casebearer (*Coleophora laricella*)	Lime sulfur 33° Baume.	12 gals.	.....	Spray during dormant season.
White-marked tussock moth (*Hemerocampa leucostigma*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear in the spring. If necessary, repeat treatment for later broods.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	

LILAC

Diseases:				
Bacterial blight (*Phytomonas syringae*)	Ferbam 76% WP	1½ lbs.	.....	Prune and burn diseased shoots; sterilize tools. Spray foliage when symptoms first appear.
Powdery mildew (*Microsphaera alni*)	Dinocap 25% WP	½ lb.	.....	Spray foliage when symptoms first appear, at 2-week intervals, if necessary.
Insects:				
Lilac borer (*Podosesia syringae syringae*)	Dimethoate 30.5% EC	1½ pts.	.....	Spray lower stems to kill young borers from July to August.
Oystershell scale (*Lepidosaphes ulmi*)	Oil, superior dormant	2 gals.	.....	Spray in early spring before buds open.

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
LINDEN				
DISEASES:				
Linden anthracnose (*Gnomonia tiliae*)	Ferbam 76% WP	1½ lbs.	.....	Spray in spring 2 or 3 times at 10-day intervals when symptoms appear on foliage.
Linden canker (*Botryosphaeria ribis*)				Remove and burn cankered branches. The European and big leaf lindens are more resistant than American or Quebec lindens.
INSECTS:				
Gypsy moth (*Porthetria dispar*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear (from April 20 to June 10 in Northeastern States).
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
Japanese beetle (*Popillia japonica*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as beetles appear (about 3d week in June in Washington, D.C.). If necessary, repeat about 3 weeks later.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Two-spotted spider mite (*Tetranychus urticae*)	Dicofol 18.5% WP	2 lbs.	.....	Spray foliage in spring as mites appear. If necessary, repeat 1 month later.
	18.5% EC	1 qt.	1½ gals.	
White marked tussock moth (*Hemerocampa leucostigma*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear in spring. If necessary, repeat for later broods.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	

LOCUST

Disease:				
Brooming disease (*Chlorogenus robiniae*)				In areas where locust is important, remove and burn young infected trees, which are more susceptible than older trees.
Insects:				
Locust borer (*Megacyllene robinia*)				Maintain trees in good vigor.
Locust leaf miner (*Chalepus dorsalis*)	Carbaryl [1] 50% WP	2 lbs.		Apply 3 sprays at weekly intervals to prevent egg deposition beginning about May 15 for Washington, D.C.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	

MAGNOLIA

Insects:				
Magnolia scale (*Neolecanium cornuparvum*)	Dimethoate 30.5% EC	1 pt.		Spray as crawlers appear in August or as young attached scale (early April for Washington, D.C.).
	Malathion 25% WP	4 lbs.		
	57% EC	1 qt.		
Tulip tree scale (*Toumeyella liriodendri*)	Dimethoate 30.5% EC	1 pt.		Spray as crawlers appear in September (early April for Washington, D.C.).
	Malathion 25% WP	4 lbs.		
	56% EC	1 qt.		
Wax scale (*Ceroplastes ceriferus*)	Carbaryl [1] 50% WP	2 lbs.		Spray for crawlers or young attached scale about mid-June in Washington, D.C. Repeat about 10 days later.
	Carbaryl [1] 4 F	1 qt.		

MAPLE

Diseases:				
Bleeding canker (*Phytopthora cactorum*)				Remove and burn severely infected trees. Do not replant susceptible species in same soil for at least 3 years.
Maple anthracnose (*Gloeosporium apocryptum*)	Ferbam 76% WP	1½ lbs.		Spray 2 to 3 times in spring at 2-week intervals.

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
MAPLE—Continued				
DISEASES—Continued				
Sun scald				Avoid drought conditions and excessive crown thinning by pruning.
Tar spot (*Rhytisma acerinum*)	Ferbam 76% WP	1½ lbs.		Spray new foliage in spring. If necessary, repeat in 2 to 3 weeks.
Verticillium wilt (*Verticillium alboatrum*)				Observe for wilt symptoms from June to September. Send suspect samples to State Agricultural Experiment Station for diagnosis. Remove and burn trees severely infected. Before replanting, replace diseased soil with healthy soil.
INSECTS:				
Bagworm (*Thyridopteryx ephemeraeformis*)	Carbaryl [1] 50% WP	2 lbs.		Spray foliage in May and June as larvae appear.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
Black carpenter ant (*Camponotus heraculeanus pennsylvanicus*)				Inject 2 percent chlordane emulsion into holes.
Boxelder bug (*Leptocoris trivittatus*)	Methoxychlor 24% EC	1 gal.		Remove female boxelder trees, the favorite host. Spray congregations of pest on trunks of boxelder trees, structures, and ground as they appear during worm days in autumn, winter, and spring.

Forest tent caterpillar (*Malacosoma disstria*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear (latter part of March or early April in Washington, D.C.).
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
Leopard moth (*Zeuzera pyrina*)				Prune out and burn infested branches.
Cottony maple scale (*Pulvinaria inumerabilis*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage late in June or early in July as nymphs appear.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
Norway maple aphid (*Periphyllus lyropictus*)	Malathion 25% WP	4 lbs.	.....	Spray foliage several times in summer.
	57% EC	1 qt.	1½ gals.	

MIMOSA

Disease:

Mimosa wilt (*Fusarium oxysporum f. perniciosum*)				Remove and burn infected trees. Plant resistant varieties-Tyron and Charlotte.

Insect:

Mimosa webworm (*Homadaula albizziae*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as 1st generation larvae appear (about the 3d week of June in Washington, D.C.). Repeat in July and August to control 2d and 3d generation larvae.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	

OAK

Diseases:

Bleeding canker (*Phytopthora cactorum*)				Remove severely infected trees. Before replanting, replace diseased soil with healthy soil. Provide good drainage.
Chestnut blight (*Endothia parasitica*)				Post and live oak relatively susceptible. Remove and burn severely cankered trees. Sterilize tools.

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
OAK—Continued				
DISEASES—Continued				
Leaf blister of oak (*Taphrina coerulescens*)	Zineb 65% WP	1½ lbs.	.....	Spray as buds become swollen. Serious in South.
Oak wilt (*Ceratocystis fagacearum*)				Observe for wilt symptoms from May to September. Send suspect samples to State Agricultural Experiment Station for diagnosis. Sever root connections between oaks to prevent spread through natural root grafts. Remove and burn infected oaks promptly, especially during growing season.
Shoestring root rot (*Armillaria mellea*)				Avoid injuries to base of trunk and roots. Removal of infected areas by tree surgery is sometimes advisable. Maintaining trees in good vigor by watering and feeding seems to be a beneficial preventative treatment.
Twig canker (*Diplodia longispora*)				Prune out and burn cankered twigs.
Ustulina butt rot (*Ustulina vulgaris*)				Avoid bark injuries, particularly near base of trunk. Keep pruning wounds covered with tree paint to prevent entrance of fungus.
Wetwood (slimeflux) (*Bacterium* spp.)				Species of black oak group more susceptible than white oak group. Avoid leader pinching by proper thinning during training period of tree.

				Do not plant oaks with trunk injuries below groundline. Drain tubes installed in trunk may be beneficial.
INSECTS:				
Black carpenter ant (*Camponotus herculeanus pennsylvanicus*)				Inject 2-percent chlordane emulsion into the holes. Small pump-type oil-can is satisfactory for this purpose.
Blotch oak leaf-miner (*Cameraria hamadryadella*)	Carbaryl [1] 50% WP	2 lbs.		Spray foliage in May for first generation. Repeat in summer for later generations.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
Carpenterworm (*Prionoxystus robiniae*)				Inject 2-percent chlordane emulsion into holes which occur primarily in the lower trunk. Species of the white oak group most susceptible.
Fall canker worm (*Alsophila pometaria*)	Methoxychlor 50% WP	2 lbs.		Spray foliage as larvae appear in spring.
	24% EC	2 qts.	3 gals.	
Forest tent caterpillar (*Malacosoma disstria*)	Carbaryl [1] 50% WP	2 lbs.		Spray foliage as larvae appear in spring.
	Carbaryl [1] 4 F	1 qt.	1½ gal.	
	Malathion 25% WP	4 lbs.		
	57% EC	1 qt.	1½ gal.	
Giant aphid (*Longistigma caryae*)	Malathion 25% WP	4 lbs.		Spray branch and twig growth as aphids appear.
	57% EC	1 qt.	1½ gals.	
Golden oak scale (*Asterolecanium variolosum*)	Oil, superior dormant.	2 gals.		Spray during dormant season.
Gregarious oak leaf-miner (*Cameraria cincinnatiella*)	Carbaryl [1] 50% WP	2 lbs.		Spray foliage in May for first generation. Repeat in summer for later generations.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
Japanese beetle (*Popillia japonica*)	Carbaryl [1] 50% WP	2 lbs.		Spray foliage as beetles appear (about the 3d week in June in Washington, D.C.). If necessary, repeat about 3 weeks later.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.		
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.		
	24% EC	2 qts.	3 gals.	

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
OAK—Continued				
INSECTS—Continued				
Kermes scale (*Kermes pubescens*)	Oil, superior dormant.	2 gals.	.....	Spray during dormant season.
Leopard moth (*Zeuzera pyrina*)				Prune out and burn infested branches.
Oak lace bug (*Corythucha arcuata*)	Malathion 25% WP	4 lbs.	.....	Spray underside of foliage as nymphs appear in early summer. Repeat about 6 weeks later for 2d generation.
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Obscure scale (*Gossyparia spuria*)	Oil, superior dormant	2 gals.	.....	Spray in early spring before buds open.
Orange striped oakworm (*Anisota senatoria*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear from late June to early August.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
Spring cankerworm (*Paleacrita vernata*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear in spring.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
PEAR				
DISEASE:				
Fire blight (*Erwinia amylovorus*)				Prune out cankered branches; disinfect tools with 10% Clorox solution between pruning operations.

				Destroy severely affected trees and avoid over-fertilization (nitrogen).
INSECT:				
Pear leaf blister mite (*Eriophes pyri*)	Line sulfur 33° Baume,	12 gals.	.....	Spray trees during dormant season.

PINE

DISEASES:				
Pine tip blight (*Diplodia pinea*)	Bordeaux 8–8–100	16 lbs.	.....	Spray when buds are opening and 2 weeks later. Remove and burn blighted twigs. Blight affects mainly Austrian and Scotch pines.
White pine blister rust (*Cronartium ribicola*)			.....	Although all 5-needle pines are affected, white pine is most susceptible. Local infections confined to branches can be removed by pruning.
Bark scald			.....	Avoid drought conditions and crown thinning by pruning.
INSECTS:				
European pine shoot moth (*Rhyacionia buoliana*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray when needle growth is about half developed (about June 24 in Northeastern States). Repeat in 10 days.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
European pine sawfly (*Neodiprion sertifer*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray needles as larvae first appear (in New Jersey occurs latter part of April). Red, Jack, Swiss Mountain, and mugho pines are favored food plants.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
Introduced pine sawfly (*Diprion similis*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray needles as larvae first appear; 2 generations occur in New Jersey, which are in the latter parts of June and August. White pine and other 5-needle pines are favored food plants.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
Nantucket pine moth (*Rhyacionia frustrana*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray new foliage as larvae appear in spring.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
PINE—Continued				
INSECTS—Continued				
Pine needle scale (*Phenacaspis pinifoliae*)	Malathion 25% WP	4 lbs.	.....	Spray needles as crawler stage appears (about early May in Washington, D.C.).
	57% EC	1 qt.	.....	
Pine bark aphid (*Pineus strobi*)	Methoxychlor 24% EC plus summer spray oil.	2 qts.	.....	Spray trunk and branches as nymphs appear (the latter part of April in Washington, D.C.).
		1 gal.	.....	
Pine sawfly (*Neodiprion pratti pratti*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray needles as larvae first appear (latter part of April for Washington, D.C.).
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
POPLAR				
DISEASES:				
Poplar anthracnose (*Marssonina populea*)				Remove and burn severely infected trees.
Poplar bacterial canker (*Phytomonas rimaefaciens*)				Remove and burn severely infected trees.
Poplar canker and leaf spot (*Dothichiza populea*)				Remove and burn severely infected trees. Lombardy poplar is very susceptible.
INSECTS:				
Imported willow leaf beetle (*Plagiodera versicolora*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as beetles or larvae appear. There are 2 generations in Washington, D.C. in April and July.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
Oystershell scale (*Lepidesaphes ulmi*)	Oil, superior dormant.	2 gals.	.....	Spray in early spring before buds open.

PRIVET

Disease:				
Canker or twig blight (*Glomerella cingulata*)	Ferbam 76% WP	1½ lbs.	.....	Prune out affected growth. Spray at weekly intervals while disease is active.
Insects:				
Japanese scale (*Leucaspis japonica*)	Oil, superior dormant.	2 gals.	.....	Spray during dormant season.
Japanese weevil (*Pseudocneorhinus bifasciatus*)	Malathion 25% WP	4 lbs.	.....	Spray in spring and summer whenever adults appear.
	57% EC	1 qt.	.....	
Thrip (*Dendrothrips ornatus*)	Malathion 25% WP	4 lbs.	.....	Spray foliage in June as thrips appear.
	57% EC	1 qt.	.....	

RED-BUD

Disease:				
Red-bud canker (*Botryosphaeria ribis*)			.....	Prune out and burn cankered branches. Plant the resistant Chinese red-bud, whenever possible.

RHODODENDRON

Disease:				
Root rot (*Phytophthora cryptogea* *Phytophthora cinnamoni*)			.....	Young grafted plants most susceptible. Remove infected plants. Before replanting, replace diseased soil with healthy soil.
Insect:				
Rhododendron lace bug (*Stephanitis rhododendri*)	Dimethoate 30.5% EC	1 pt.	.....	Spray underside of foliage as nymphs appear in spring and again in 3 weeks. Further treatments may be necessary for later broods.
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	.....	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	.....	

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
ROSE				
DISEASES:				
Black spot (*Diplocarpon rosae*)	Folpet 75% WP plus	1 lb.	.....	Spray foliage from May to September at 1 to 2 week intervals. Burn fallen foliage.
	Dicofol 18.5% WP	2 lbs.	.....	
Brown canker (*Diaporthe umbrina*)	Lime sulfur 33° Baumé	12 gals.	.....	Prune out cankered canes in late winter and spray. Do not mound earth around plants in winter.
Powdery mildew (*Sphaerotheca pannosa*)				Spray program for black spot will control this disease.
Rose anthracnose (*Sphaceloma rosarium*)				Prune out cankered canes in spring. Control measures for black spot should control summer infections.
INSECTS:				
Flower thrips (*Frankliniella tritici*)	Dimethoate 30.5% EC	1 pt.	.....	Spray in spring at weekly intervals as flowerbuds are developing.
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	.....	
Japanese beetle (*Popillia japonica*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as beetles appear (about 3d week in June in Washington, D.C.). If necessary, repeat 3 weeks later.
	Carbaryl [1] 4 F	1 qt.	.....	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	.....	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	.....	
Rose chafer	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage and flowers in early June as beetles

(*Macrodactylus subspinosus*)	Methoxychlor 50% WP	2 lbs.	.....	appear. If necessary, repeat 2 weeks later.
	24% EC	2 qts.	.....	

SNOWBERRY

DISEASE:				
Anthracnose (*Sphaceloma symphoricarpi*)	Lime sulfur 33° Baumé.	12 gals.	.....	Spray in early spring before buds open.

SPRUCE

DISEASE:				
Spruce canker (*Cytospora kunzei*)			.....	Prune out and burn cankered branches; sterilize tools. Remove and burn severely infected trees.
INSECTS:				
Bagworm (*Thyridopteryx ephemeraeformis*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage in May or June when larvae appear.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
Eastern spruce gall aphid (*Chermes abietis*)	Malathion 25% WP	4 lbs.	.....	Spray in autumn or early spring.
	57% EC	1 qt.	1½ gals.	
Spruce bud scale (*Physokermes piceae*)	Oil, superior dormant.	2 gals.	.....	Spray in April before development of new growth. Spray may be toxic to blue spruce.
Spruce budworm (*Choristoneura fumiferana*)	Malathion 25% WP	4 lbs.	.....	Spray foliage as growth starts in spring.
	57% EC	1 qt.	1½ gals.	
Spruce mite (*Paratetranychus ununguis*)	Dicofol 18.5% WP	2 lbs.	.....	Spray foliage as mites appear in spring.
	18.5% EC	1 qt.	1½ gals.	

SYCAMORE

DISEASES:				
Sycamore anthracnose (*Gnomonia veneta*)	Zineb 65% WP	2 lbs.	.....	Apply 2 or 3 sprays in spring at 10-day intervals. Plant clones of London plane recognized as resistant.

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
SYCAMORE—Continued				
DISEASES—Continued				
Sycamore canker stain (*Endoconidiophora fimbriata f. platani*)				Remove and burn infected trees. Since infection occurs through bark injuries and pruning cuts, disinfect tools between pruning operations with 10% Clorox solution.
Sycamore scorch (probably virus)				Plant clones of London plane recognized as resistant.
INSECTS:				
Bagworm (*Thyridopteryx ephemeraeformis*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage in May or June as larvae appear.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
Japanese beetle (*Popillia japonica*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray foliage as beetles appear (about 3d week in June in Washington, D.C.). Repeat in 3 weeks.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	

Sycamore lace bug (*Corythucha ciliata*)	Malathion 25% WP	4 lbs.	.....	Spray underside of young foliage as nymphs appear in spring.
	57% EC	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 lbs.	.....	
	24% EC	2 qts.	3 gals.	
Sycamore tussock moth (*Halisidota harrisii*)	Methoxychlor 50% WP	2 lbs.	.....	Spray foliage as larvae appear.
	24% EC	2 qts.	3 gals.	

TULIPTREE

INSECTS:

Tuliptree aphid (*Macrosiphum liriodendri*)	Malathion 25% WP	4 lbs.	.....	Spray foliage in early summer when aphids appear. If necessary, repeat 1 month later.
	57% EC	1 qt.	1½ gals.	
Tuliptree scale (*Toumeyelia liriodendri*)				See Magnolia.

WALNUT

DISEASES:

Anthracnose (*Marssonia juglandis*)	Zineb 65% WP	1 lb.	.....	Spray half-grown foliage in spring. Repeat in 2 or 3 weeks as necessary. Compost or burn fallen infected leaves.
Brooming disease (virus)				Remove affected Japanese walnut trees; they are very susceptible.
Brown leaf spot (*Gnomonia leptostyla*)	Ferbam 76% WP	1½ lbs.	.....	Spray half-grown foliage in spring. Repeat in 2 or 3 weeks as necessary. Compost or burn fallen infected leaves.
Dieback (*Melanconis juglandis*)				Remove and burn infected twigs; sterilize tools.

INSECT:

Walnut caterpillar (*Datana integerimma*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage when insects appear.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	

Footnotes at end of table.

Table III.—Control of Diseases and Insects Affecting Trees and Shrubs—Continued

Host and pest	Pesticide formula	Amount of formula per 100 gallons of water: Hydraulic sprayer	Amount of formula per 100 gallons of water: Mist blower	Control
WILLOW				
DISEASES:				
Botryosphaeria canker (*Botryosphaeria ribis*)				Prune out and burn cankered branches. Pussy willow is particularly susceptible.
Cytospora canker (*Cytospora chrysosperma*)				Prune out cankered branches; sterilize tools. Avoid bark injuries. Maintain favorable growing conditions with watering and fertilizing.
Willow scab (*Fusicladium saliciperdum*)	Bordeaux 8–8–100	16 lbs.	.....	Apply 4 or 5 sprayings at 10-day intervals, with the first application just before leaf buds open.
INSECTS:				
Brown-tail moth (*Nygmia phaeorrhoea*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage in spring immediately after larvae emerge from hibernation (in April in Northeastern States). Repeat treatment for newly hatched larvae during latter half of August.
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
Gypsy moth (*Porthetria dispar*)	Carbaryl[1] 50% WP	2 lbs.	.....	Spray foliage as larvae appear (from April 20 to June 10 in the Northeastern States).
	Carbaryl[1] 4 F	1 qt.	1½ gals.	
Imported willow leaf beetle (*Plagiodera versicolora*)	Methoxychlor 50% WP	2 lbs.	.....	Spray foliage as beetles appear (about 3d week in June in Washington, D.C.). If necessary, repeat about 3 weeks later.
	24% EC	2 qts.	3 gals.	
Oystershell scale (*Lepidosaphes ulmi*)	Oil, superior dormant.	2 gals.	.....	Spray in early spring before buds open.
Scurfy scale (*Chionaspis furfura*)	Do.	2 gals.	.....	Spray in early spring before buds open.

Willow cone-gall midge (*Rhadbdophaga strobiloides*)				Prune and burn galls during dormant season.

YEW

Diseases:				
Root rot (*Phytophthora* spp.)				Remove and burn diseased plants. Before replanting, place diseased soil with healthy soil. Provide good drainage.
Insects:				
Black vine weevil (*Otiorrhynchus sulcatus*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray as adults appear in June.
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.		
Wax scale (*Ceroplastes cereferus*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray for crawlers or young attached scale about mid-June in Washington, D.C. Repeat about 10 days later.
Yew mealy bug (*Pseudococcus cuspidatae*)	Diazinon 25% WP	2 lbs.	.....	Spray with force as crawler stage appears in May or June in Washington, D.C.
	25% BC	1½ pts.	.....	
	Malathion 25% WP	4 lbs.	.....	
	57% EC	1 qt.	.....	

ZELKOVA

Insect:				
Elm leaf beetle (*Galerucella xanthomelaena*)	Carbaryl [1] 50% WP	2 lbs.	.....	Spray undersurface of foliage as larvae and beetles appear from April to September.
	Carbaryl [1] 4 F	1 qt.	1½ gals.	
	Methoxychlor 50% WP	2 qts.	.....	
	24% EC	2 qts.	3 gals.	

1. Miticide such as Dicofol should be included with Carbaryl sprays for prevention of mite population build-up. For hydraulic sprayer, use 2 lbs. of 18.5% WP per 100 gals. For mist blower, use 1½ gals. of 18.5% EC per 100 gals.

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