

1974

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FRUIT SPRAYING CALENDAR

Extension Bulletin 154 Farm Science Series February 1974

For Commercial Fruit Growers



Apple Scab Ascospores, magnified (arrows)



Apple Scab

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY

SPECIAL WARNING

PESTICIDE DRIFT AND CONTAMINATION OF FOOD AND FEED CROPS

There is always a possibility of drift and injury to neighboring crops and premises from both aircraft and conventional ground spray and dust applications. Hay and pasture crops, for example, grown near orchards treated with pesticides may contain illegal chemical residues, particularly chlorinated hydrocarbons. Since few chemicals have a tolerance established for hay crops and there is a **ZERO TOLERANCE** for any pesticide in milk, extreme caution must be exercised to avoid pesticide contamination of forage and pasture crops. Chlorinated hydrocarbons are particularly hazardous since they are stored in animal fat and are secreted in the milk. Chlorinated hydrocarbon insecticides include: dieldrin, kelthane, methoxychlor and thiodan.

Where the possibility of pesticide drift is present, growers should use phosphate or carbamate insecticides in their spray program but only those registered for use on forage and pasture crops.

PROTECT THE BEES

The transfer of pollen from one flower to another by bees is a basic requirement for the production of practically all fruit. It is to the fruit grower's benefit to use sprays in such a way that the least possible number of bees are killed. This is a good policy of cooperation with the beekeepers and it also conserves the bumble bee and other wild bee populations that serve you free of charge.

"Do not spray plants in bloom" is the basic rule in protecting bees. This applies not only to the fruit bloom but also to dandelions and clovers that may be reached by the spray. Mowing dandelions, yellow rocket and clovers in the fruit area helps. Also, do not let puddles of spray accumulate on the ground where bees might drink it. If beekeepers supply fresh water near the bee hives, this hazard is reduced. Where there is a choice, use insecticides least harmful to bees.

The pest control schedules in this publication are merely guides to aid each grower in preparing his own pest control program. The same insects and diseases are not always present or economically important in all orchards and small fruit plantings. Thus, during any single season, each grower has to adjust his pest control program to fit his specific conditions.

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no indorsement by the Cooperative Extension Service is implied. Note that chemicals are not necessarily listed in order of preference in the Spraying Schedule.

1974 FRUIT SPRAYING CALENDAR

PREPARED BY A. L. JONES¹, DON RAMSDELL¹, W. W. THOMPSON²,
A. J. HOWITT², JEROME HULL³

MUCH GOES INTO THE PLANNING of an economical and effective spraying program. In fruit growing, a successful pest control schedule must be based on a knowledge of:

- (1) the life history of the important insects and diseases likely to be encountered;
- (2) the various kinds of pesticide chemicals available, and their proper use; and
- (3) susceptibility of the different kinds and varieties of fruit to insect, disease and spray injury.

In order to provide more complete reference information, publications dealing with fruit pests have been written by members of the Departments of Entomology, Botany and Plant Pathology and Horticulture at Michigan State University. These are:

1. *Diseases of Tree Fruits in Michigan* by A. L. Jones, Extension Bulletin E-714.
2. *Chemical Weed Control for Horticultural Crops* by A. R. Putnam, Extension Bulletin E-433.
3. *Postharvest Fungicide and Heat Treatment for Brown Rot Control on Stone Fruits* by A. L. Jones, C. L. Burton and B. R. Tennes, MSU Agr. Expt. Sta., Research Report 209.
4. *Nematodes and Their Control* by C. W. Laughlin, Extension Bulletin E-701.

The chemicals included in each fruit pesticide schedule in this publication have been suggested only at the times they may be used without danger of excessive residues (not to exceed established tolerances) on harvested fruit. The allowable chemical residue and required waiting period between last application and harvest are given for each chemical in Table 1 on page 58 as well as at the end of each spray schedule section.

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The authors express their appreciation for the valuable help and suggestions received from district horticultural agents, county agricultural agents, and Extension and Research personnel in the Departments of Horticulture, Entomology, and Botany and Plant Pathology.

USE CHEMICALS SAFELY

Phosphate Insecticides

Growers using phosphate-type insecticides should obtain a doctor's prescription for 1/100 of a grain of atropine tablets and keep a supply of these for emergency use in treating poison symptoms. Early symptoms include weakness, headache, nausea, vomiting, and tightness in the chest. Atropine tablets should not be taken routinely, but only when necessary and under a doctor's direction.

Never take atropine before symptoms occur. It is not safe to give tablets by mouth to an unconscious person.

A new antidote, specific for phosphate chemicals, has recently been released for use by doctors for emergency treatment of phosphate poisoning. This antidote, protopam chloride or pralidoxime called PAM, can be injected intravenously by doctors or prescribed in tablet form. In several instances, persons poisoned by phosphate chemicals, have responded to treatment with PAM when atropine failed to give the desired results.

All Agricultural Chemicals

The National Agricultural Chemical Association has published a 12-point safety code for insecticides and other agricultural chemicals. *Study these 12 rules repeatedly until each is adopted and becomes a habit with you:*

1. Always read the label before using any pesticide. Note warnings and cautions each time before opening the container.
2. Keep pesticides out of the reach of children, pets and irresponsible people. Pesticides should be stored outside the home and away from food and feed.
3. Always store pesticides in original containers and keep them tightly closed. Never keep them in anything but the original container.
4. Never smoke while working with pesticides.
5. Avoid inhaling sprays or dusts. When directed on the label, wear protective clothing and masks.
6. Do not spill pesticides, sprays or dusts on the skin or clothing. If they are spilled, remove contaminated clothing immediately and wash thoroughly.
7. Wash hands and face and change to clean

clothing after spraying or dusting. Also wash clothing each day before reuse.

8. Cover food and water containers when treating around livestock or pet areas. Do not contaminate fishponds.

9. Use separate equipment for applying hormone-type herbicides in order to avoid accidental injury to susceptible plants.

10. Always dispose of empty containers so that they cannot harm humans, animals or valuable plants.

11. Observe label directions and cautions to keep residues on edible portions of plants within the limits permitted by law.

12. If symptoms of illness occur during or shortly after spraying or dusting, call a physician or get the patient to a hospital immediately.

In Case of Poisoning

1. **Call your physician:** Note to Physician: The table below lists Poison Control Centers in Michigan which can furnish specific information including antidotes, for various trade named poisons. Services of the Centers are intended mainly for Medical Doctors. However, offices remain open 24 hours a day and can give emergency poison treatment advice over the

phone. If information is not available at your local Poison Control Center, call the University Hospital, Ann Arbor.

2. **For poisons spilled on the skin:** Wash thoroughly with large amounts of soap and warm water. Particles in the eyes may be removed by thorough flushing with plain water. For phosphate materials absorbed through the skin, give atropine by injection or in tablet form.

3. **For poisons that have been inhaled:** Place the patient in the open air. Give atropine as directed above if a phosphate material was inhaled. Administer artificial respiration when necessary.

4. **For poisons that have been swallowed,** induce vomiting as soon as possible: Gently stroke the inside of the throat and/or give an emetic such as warm salt water (1 tablespoon in a glass of water). Repeat until the vomit fluid is clear. After the stomach has been emptied, give a demulcent, such as raw egg white mixed with water.

5. Physician may inject 1/30 to 1/60 of a grain of atropine sulfate at hourly intervals for phosphate materials, or phenobarbital for chlorinated hydrocarbon chemicals.

POISON INFORMATION CENTER

DETROIT

Detroit City Health Department
1151 Taylor Avenue 48202
TR2-1540

POISON TREATMENT CENTERS (Information and Treatment)

ADRIAN

Emma L. Bixby Hospital
818 Riverside Ave. 49221
265-6161

FLINT

Hurley Hospital
6th Avenue & Begole 48502
Cedar 2-1161

MARQUETTE

St. Luke's Hospital
West College Avenue 49855
Canal 6-3511

ANN ARBOR

University Hospital
1405 E. Ann Street 48104
764-5102

GRAND RAPIDS

Blodgett Memorial Hospital
1840 Wealthy, S.E. 49506
456-5301

MIDLAND

Midland Hospital
4005 Orchard Drive 48640
TE 5-6711

BATTLE CREEK

Community Hospital
200 Tomkins St. 49016
963-5521

Butterworth Hospital
100 Michigan, N.E. 49503
451-3591

MONROE

Memorial Hospital of Monroe
700 Stewart Road 48161
CH 1-6500

BAY CITY

Mercy Hospital
100 Fifteenth St. 48706
Twinbrook 5-8511

St. Mary's Hospital
201 Lafayette, S.E. 49503
459-3131

PETOSKEY

Little Traverse Hospital
416 Connable 49770
Diamond 7-2551

Grand Rapids Osteopathic
Hospital
1919 Boston St., S.E. 49506
452-5151

BERRIEN CENTER

Berrien General Hospital
Dean's Hill Road 49102
471-7761

HANCOCK

St. Joseph's Hospital
200 Michigan Avenue 49930
482-1122

PONTIAC

St. Joseph Mercy Hospital
900 Woodward Avenue 48053
338-9111

COLDWATER

Community Health Center
of Branch County
274 E. Chicago Street 49036
278-7361

HOLLAND

Holland City Hospital
602 Michigan Avenue 49423
396-4661

PORT HURON

Mercy Hospital
2601 Electric Avenue 48060
Yukon 5-9531

DETROIT

Children's Hospital of Michigan
3901 Beaubien 48201
494-5711
Mount Carmel Mercy Hospital
6071 W. Outer Drive 48235
864-5400

KALAMAZOO

Bronson Methodist Hospital
252 E. Lovell Street 49006
342-9821

SAGINAW

Saginaw General Hospital
1447 N. Harrison Road 48602
753-3411

ELOISE

Wayne County General Hospital
30712 Michigan Avenue 48132
722-2500 ext. 6230 or 6231

LANSING

St. Lawrence Hospital
1210 W. Saginaw Street 48914
372-3610

TRAVERSE CITY

Munson Medical Center
Sixth Street 49684
947-6140

NEMATODE CONTROL FOR FRUIT CROPS

By George W. Bird

Department of Entomology and Department
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Plant parasitic nematodes cause extensive injury to fruit crops. Research has shown that many fruit crops respond to nematicides. Fumigation of soil prior to planting tree fruits on old fruit sites is essential to produce a vigorous and healthy stand of young trees. Likewise, strawberries and grapes to be planted in soil infested with root-knot or root-lesion nematodes will respond to soil fumigation practices. Dagger nematodes are capable of transmitting viruses to several fruit crops including blueberries, grapes and raspberries.

Proper soil preparation prior to nematicide appli-

cation is essential for maximum effectiveness. The soil should be cultivated to promote thorough decomposition of previous crop debris. Undecayed roots harbor nematodes, protect them from nematicide contact and interfere with fumigant application. The soil should be in excellent tilth and soil moisture should approach that desirable for seeding. Dry soil allows too rapid escape of fumigants. Dispersion of nematicide in excessively wet soil is poor. At soil temperatures below 45° F., soil fumigants do not volatilize and spread properly. Above 80° F., the materials escape too rapidly from the soil. Late summer or early autumn is usually best for the application of soil fumigants in Michigan.

Where the need for plant parasitic nematodes has been established, the following materials are recommended:

FOR STRAWBERRIES

Nematicide	Application rate/acre	Limitations and/or Directions
DBCP (1, 2 dibromo-3-chloropropane) Fumazone Nemagon	Broadcast: 2.0-3.0 gallons Row: 0.75-1.50 gallons	Apply as pre-plant broadcast or pre-plant or post-plant row application to mineral soils. For pre-plant applications wait 7 to 14 days before planting. Space chisels 12 inches apart and apply chemical 10 inches deep. With row treatment use 2 chisels spaced 12 inches apart, per row injecting the material at a 10-inch depth. ALLOW 55 DAYS BETWEEN TREATMENT AND HARVEST.
1, 3-D (Dichloropropene and related chlorinated hydrocarbons) D-D	Broadcast: 40 gallons	Apply as a pre-plant treatment at least 21 days prior to planting when soil temperature is between 50° and 80° F. Space chisels 12 inches apart and inject at an 8-inch depth. Seal soil immediately after application. Allow additional time before planting if temperatures are below 60° F. or if soil is waterlogged.
Telone	Broadcast: 32 gallons	
1, 3-D and chloropicrin Dowfume W85 Soilbrom-85 Soilbrom-40	Broadcast: 9 gallons Broadcast: 27 gallons	
Terr-o-cide (EDB and chloropicrin)	Broadcast: 25 gallons	Same as 1, 3-D
Methyl Bromide (98% plus 2% chloropicrin) Brom-o-gas Dowfume MC-2	854 pounds per acre	Apply as a pre-plant treatment in plant beds for production of transplants only. Prepare plant bed as if for planting. Seal with airtight cover. Inject material treating when soil temperature above 50° F. Expose to fumigation for 48 hours. Aerate treated area for 2 days before planting.
Methyl Bromide and Chloropicrin (67 and 33%, respectively) Dowfume MC-33 Terr-o-gas 67	350 pounds per acre	Apply as pre-plant treatment. Inject material at 6- to 8-inch depth. Seal treated soil with airtight cover. Expose to fumigation for 48 hours. Aerate for 2 days before planting in transplant bed. Allow at least two weeks soil aeration between field fumigation and planting when transplants are for fruit production. Do not treat soil if temperature is below 45° F. at 5-inch level.
MIC (Methyl Isothiocyanate and chlorinated C ₈ hydrocarbons) Vorlex	7½ gallons per acre for beds, 15 gallons broadcast	Apply as pre-plant treatment. For broadcast application, use shanks spaced 6 to 8 inches apart injecting at a depth of 6 to 8 inches. For row application, use two chisels spaced 6 to 8 inches apart per row. Immediately after application seal soil. If soil is 70° F. or more at 6-inch depth, seal soil surface with plastic tarp. Keep soil moist and undisturbed for 4 to 7 days. Colder soils require longer fumigation periods. Cultivate soil and allow to aerate one week for each 10 gallons per acre of material.

FOR TREE FRUITS

Nematicide	Application rate/acre	Limitations and/or Directions
DBCP (1, 2 dibromo-3-chloropropane)		Pre-planting, at planting, or post-planting treatment to mineral soils when soil temperature is between 50° to 80° F. Inject at 12-inch depth with chisels spaced 12 inches apart. Seal soil surface immediately after application. If pre-planting application is made, wait 4 to 6 weeks before planting. Make post-planting application along rows only, not between trees in the same row. Do not apply within 30 days of harvest, nor more than once every 3 years.
Fumazone	Broadcast: 3-7 gallons	
Nemagon		
1, 3-D (Dichloropropene and related chlorinated hydrocarbons)		Apply as pre-plant fall treatment when the soil temperature is between 50° to 80° F. Space chisels 12 to 14 inches apart and inject at 12 to 16-inch depth. Seal soil immediately. Treat a 10-foot wide strip in which new trees are to be planted. Individual trees can be treated by injecting with a handgun in a 10-foot area. Inject 10 foot 12 inches deep with spacing 12 inches apart. Seal soil. Allow 3 to 6 months to lapse between treating and planting or longer if the odor remains in the soil.
D-D	Broadcast: 40 gallons	
Telone	Broadcast: 32 gallons	
Terr-o-cide D (1, 3-D and chloropicrin)	Broadcast: 25 gallons	Same as 1, 3-D
EDB (Ethylene dibromide)		Same as 1, 3-D
Dowfume W85	Broadcast: 15 gallons	
Soilbrom-85	Broadcast: 27 gallons	
Terr-o-cide (EDB and Chloropicrin)	Broadcast: 45 gallons	Same as 1, 3-D
MIC (Methyl isothiocyanate and chlorinated C ₈ hydrocarbons)		Apply as a pre-plant fall broadcast treatment. Space chisels 6 to 8 inches apart and inject at 10 to 12-inch depth. Seal with drag and smooth roller immediately after application. In soils 70° F. or higher at 6-inch depth. Special attention must be given to sealing soil surface: tarping gives best seal. Allow 3 to 6 months to lapse between treatment and planting.
Vorlex	Broadcast: 15 gallons	

SUPERIOR OIL

For the past several years "superior oil" has been recommended as one of the preventive European red mite control programs. This year only the 70-second viscosity "superior oil" will be recommended for use in Michigan. Based on research information from Michigan we feel the 70-second oil will give better European red mite control than some of the lighter viscosity oils recommended in the past.

The 70-second viscosity oil is not a dormant-type oil. It is lighter and more volatile than the original "superior oil" which was used as a dormant spray. The principal advantage of the lighter 70-second oil is the reduced possibility of plant injury. It is safer because it is more volatile, resulting in less persistence on the tree. It remains on the tree long enough to kill the mites but not so long as to interfere with vital plant processes or oil-incompatible pesticides which may be applied later.

Because of this safety factor, the 70-second oil can be applied between *Green-Tip* and *Pre-Pink* stages of

tree development. European red mite eggs are most susceptible to control by oil when they are about to hatch. Under Michigan conditions, the period of egg hatch starts about the time the trees are in the *Pre-Pink* to *Pink* stage. Thus, the closer the application to *Pre-Pink*, the greater the kill of mite eggs. Oil applied earlier than *Green-Tip* is not as effective as later applications. The addition of a phosphate insecticide does not increase the miticidal value of oil.

Preventive European red mite control programs are designed to control the mites at an early stage in their development to prevent any build-up through the season. Supplemental measures are usually required in mid- to late-season. Eradicative mite control programs, on the other hand, attempt to control mites after they have increased sufficiently in numbers to damage the crop. During the past few seasons the eradication programs have been expensive but not very successful in controlling established mite populations. *Oil applications have no value in controlling the two-spotted mite.*

Recent research indicates that spraying all four

sides of the tree with the oil mixture provides better control of red mites than spraying only two sides. Two oil sprays, the first applied during green tip—delayed dormant followed by a second spray in the pre-pink, have given better red mite control than a single pre-bloom spray.

The *minimum* specifications for the 70-second viscosity “superior oil” are as follows:

Property ^a	70-second Superior Oil
Saybolt Universal Viscosity at 100° F., Seconds ¹	66-74
Gravity ² API (minimum)	33
Unsulfonated residue ³ (minimum)	92
Pour Point ⁴ , °F. (maximum)	20
Distillation at 10 mm. Hg. 10° F. 50% point	425 ± 12
10%–90% range (maximum)	95

^a The following ASTM methods are to be used:

¹ D445-61 and D446-53; ² D287-55; ³ D483-61T;

⁴ D97-57 and ⁵ D1160-61.

EFFECTIVE DILUTE AND CONCENTRATE PESTICIDE APPLICATIONS

Effective pest control is dependent upon (1) proper timing and (2) the correct amount of pesticide per tree or per acre equally distributed throughout all parts of the tree. This applies regardless of the method of application and the concentration of mixture used. In order to achieve coverage of leaves and fruits in the top-center of large trees 18 to 20 feet high, two-thirds of the discharge *must* be directed into the upper one-third of the tree.

One way to set up a sprayer is to assume that the tree to be sprayed is 20 feet high with a 30-foot spread. A tree of this size will require 10 to 12 gallons of dilute mixture, 5 to 6 gallons applied to each of two sides to give effective pest control. This amount of pesticide mixture should be applied per tree with the first application and continued throughout the season.

When spraying smaller trees, one merely cuts off the top nozzles until the desired spray height is achieved. After doing this, if the machine still puts out more material per tree or per acre than desired, increase the rate of travel accordingly.

Concentrate spraying is accomplished by adding to the water in the spray tank 2, 3, 6, 10 or 30 times the amount of pesticide used in dilute application and applying a correspondently less amount per tree or per acre, 1/2, 1/3, 1/6, 1/10 or 1/30. Thus a tree requiring 12 gallons of spray mixture of dilute concentration for complete coverage will require only 2 gallons of 6x concentration or 0.4 of a gallon of 30x concentration.

For concentrate as for dilute spraying, two-thirds of the mixture should be discharged into the upper one-third of a tree 20 feet high with a 30-foot spread. And, when spraying smaller trees, it is necessary only to shut off top nozzles of the sprayer until the desired height of spray is reached. If the quantity of spray should be reduced beyond the amount accomplished by shutting off the top nozzles, the rate of travel while spraying can be increased.

Most of the airblast sprayers currently being used in Michigan can be adapted to apply mixtures of 2x to 10x. However, it usually requires specially adapted machines for concentrations above 10x. All airblast sprayers will perform equally well using 2x–1/2 gallonage as using dilute mixtures. And, refill down time is cut in half.

When using mixtures of 2x, 3x or 4x successfully, one can usually go to a higher concentration without difficulty. Using your present concentration and rate of spray discharge as a base, *reduce* the discharge of each nozzle the amount you *increase* the concentration. For example, using 2x concentration and 1/2 gallonage, to change to 4x concentration and 1/4 gallonage, it is only necessary to reduce the discharge of each nozzle by one-half and use 4 times the amount of pesticide per 100 gallons, as suggested for dilute spraying or twice the amount used for 2x.

It should be remembered that when using concentrated mixtures, the wind must be under 10 miles per hour. And, the larger the airblast capacity of the sprayer the faster one may travel spraying. Concentrate spraying may be used successfully in Michigan and very advantageously, but the sprayer must be set up properly to give the *right* gallons per tree and uniform coverage *throughout* the tree. Using this method of application, it is necessary to do night spraying when there is little to no wind. There is no greater danger from chemical injury when spraying at night than during the day. However, respect the possible hazards with chemicals and do not take unnecessary chances by spraying alone.

PESTICIDE CHEMICALS AND THEIR USE

Pesticide chemicals may be classified into three groups: (1) Fungicides—materials to control fungus diseases; (2) Insecticides—materials to control insects; and (3) Accessory Materials—materials included as correctives, stickers, spreaders, activators, flocculators and emulsifiers.

FUNGICIDES

Benomyl [*methyl 1-(butylcarbamoyl)-2-benzimidazole carbamate*] has been cleared for the control of scab on apples, and powdery mildew, sooty blotch, flyspeck, and postharvest fruit rots caused by *Botrytis*

(gray mold), *Penicillium* (blue mold or soft rot), and *Gloeosporium* (Bull's-eye rot) on apples and pears. It is formulated as a 50% wettable powder under the trade name Benlate. On both apples and pears it is used at 4 to 6 ounces per 100 gallons of water and on apples only, it may also be used at 2 to 3 ounces plus 1 quart of non-phytotoxic superior type spray oil (60 to 70 sec. viscosity) per 100 gallons of water. For control of postharvest fruit rots on apples and pears it may be used (without oil) as a preharvest spray at 6 ounces or as a postharvest dip or spray at 8 ounces.

On stone fruits, it is used on peaches, nectarines, apricots, cherries, prunes, and plums for the control of brown rot, powdery mildew, peach scab, and cherry leaf spot. It is not effective for control of peach leaf curl. Benomyl is particularly effective for the control of brown rot when used at ½ lb. per 100 gallons of water in preharvest sprays or as a postharvest dip or spray. It will not control fruit rots caused by *Rhizopus* spp. or *Alternaria* spp.

In tests at East Lansing and in areas of western Michigan, Benomyl has given good control of leaf spot. When disease pressure was heavy, the ½ lb. and ¾ lb. rates performed best. The ¼ lb. rate was adequate under light to moderate infection conditions and where a post-harvest spray was used.

On strawberries, Benomyl effectively controls leaf diseases and fruit rots caused by *Botrytis*, *Dendrophoma* and *Rhizoctonia* spp. fungi.

Bordeaux mixture is a combination of soluble copper sulfate (bluestone), hydrated lime, and water. It is used for the control of fire blight on apples and pears, for peach leaf curl on peaches, and for brown rot blossom blight on sweet cherries. In a 2-6-100 Bordeaux, for example, the first figure of the formula is copper sulfate in pounds, the second figure is spray lime in pounds, and the third figure is water in gallons. Homemade Bordeaux is superior to prepared dry mixtures.

Bordeaux has many compatibility problems. Before combining with other pesticides, check the compatibility chart and read the label on the can carefully.

Captan (*N-trichloromethylthio-4-cyclohexene-1, 2-dicarboximide*) is used for control of apple scab, brown rot, and cherry leaf spot. It is also fairly effective against several minor diseases including: black rot, *Botrytis* blossom-end rot, Brooks fruit rot, *Botryosphaeria* rot, bitter rot, sooty blotch, and fly speck. It will not control apple rust, powdery mildew or fire blight. Recommendations are based on a 50% wettable powder formulation. Several dust formulations and an 80% wettable powder formulation are available and should be used at equivalent rates.

For early season scab control, Captan is used at

2 lbs. per 100 gal. of dilute spray. Though primarily a protectant fungicide, it will eradicate scab if used within 18 hours after the beginning of an infection period at average temperatures above 50°F. It should be applied at relatively short intervals during critical scab periods, when growth is rapid, or when rains are frequent.

Captan is associated with good finish on russet-susceptible apple varieties like Golden Delicious. On Red Delicious, it has caused a leaf spotting when used at full strength early in the season, especially when used in combination with sulfur. On other varieties, it may be combined with sulfur or with Dinocap for powdery mildew control. It is incompatible with oil and should not be used in combination with oil or near oil applications.

On stone fruit crops, Captan is used for early season control of brown rot on apricots and for combined control of brown rot and cherry leaf spot on sweet cherries starting at petal fall. On prunes, plums, and peaches, it is used for control of brown rot on the maturing fruit.

On grapes, captan is used against downy mildew and dead arm diseases and has some effect against black rot disease.

Dichlone (2, 3-dichloro-1, 4-naphthoquinone) is sold as a 50% active wettable powder under the trade name Phygon. For scab control, it should be used at the 1/4 lb. rate with a protectant fungicide and should be used only from bud-break through the first-cover period. It is used mainly for the control of brown rot blossom blight on peaches, plums, prunes, tart cherries, and sweet cherries. For this purpose, it is applied during the bloom period at the 1/2 pound rate.

Difolatan (*cis-N-[(1, 1, 2, 2-tetrachloroethyl)thio]-4-cyclohexene-1, 2-dicarboximide*) is cleared for use on machine harvested tart cherries only to control cherry leaf spot and brown rot. It is formulated as an emulsifiable solution containing 4 lbs. of Difolatan per gallon.

In tests at East Lansing and in outstate areas of Michigan, Difolatan has consistently provided good results in seasonal schedules when used at 6 pints per acre. Control with 3 pints per acre has been good in light to moderate leaf spot years where proper timing and thorough spray coverage were practiced. For brown rot control, use the high rate.

Human skin sensitization has occurred in some instances where Difolatan was used. Only a small percentage of the population is sensitive. A few farm workers have developed a reaction to the product after exposure to residues of Difolatan on the twigs, leaves and fruit. People who may come in contact with it must be warned of the possibility of this allergic reaction. (Also see page 20).

Dikar is a coordinated product of zinc ion and manganese ethylene bisdithiocarbamate, dinitro(1-methyl heptyl)phenylcrotonate and certain other dinitro phenols and derivatives. These are the active ingredients of Dithane M-45 and Karathane. Dikar has provided combined control of powdery mildew and apple scab on mildew susceptible varieties when used routinely. For best mildew control, the addition of a spreader-sticker is suggested. European red mite suppression has been obtained when applied on a seasonal schedule and where superior oil was used before bloom. Best results have been obtained when used at the 2-lb. rate. Dikar is incompatible with oil. Good fruit finish has been obtained with Dikar except workers in other states have reported moderate fruit russet on McIntosh and Cortland where used at high spray concentrations. Before using this product, compare its cost with alternative programs for the control of the specific pest problems involved.

Dodine (*n-dodecylguanidine acetate*) is an excellent fungicide for apple scab and cherry leaf spot control. It is sold under the trade name Cyprex and is formulated as a 65% active wettable powder. Dust formulations are also available. Dodine is primarily used as a protectant against apple scab, but also has eradicant properties. During critical periods, for spore discharge and for longer back action, it is used at 1/2 lb. per 100 gal. of water. As a protectant, it is used at 1/4 to 3/8 lb. and has given good scab control at these rates with proper timing and coverage. The lower rate is used primarily during the cover sprays. This material is particularly effective in reducing secondary spread of scab where it has been applied at regular intervals. It will reduce the production of spores in established lesions and also reduce spore germination.

Dodine is commonly used with oil, but a physical incompatibility may occur when a hard water source is used. Furthermore, lime should not be used with Dodine since it reduces its effectiveness.

Dodine has given good cherry leaf spot control on tart cherries at 1/4 to 3/8 lb. under light to moderate conditions. Under severe conditions 1/2 lb. will be necessary. A post-harvest spray is a must for late season control. It is also used on sweet cherries where brown rot is not a problem.

Dinocap (*dinitro capryl phenyl crotonate*) is a 25% active wettable powder sold under the trade name *Karathane*. It is used primarily at the 1/2 lb. rate for the control of powdery mildew on susceptible apple varieties. A liquid formulation is also available. It is often used in the summer when high temperatures make the use of sulfur questionable on some varieties. This material may be combined with other fungicides used for scab control but should not be used with

oil or liquid insecticides having an organic solvent (kerosene or xylene) base.

Ferbam (*ferric dimethyl dithiocarbamate*) is formulated as a 76% wettable powder. It is used as a protectant for control of apple scab, pear scab, cedar-apple rust, peach leaf curl, and brown rot. Rates of use vary from 1-1/2 to 2 lbs. It is used in combination with wettable sulfur on plums, prunes, and sweet cherries for control of leaf spot. Ferbam can also be used as a lead arsenate safener at 1/2 to 3/4 lb. where lime cannot be used for this purpose. In some cases, yellow apple varieties have produced inferior finish when this material was used.

Ferbam is the most effective fungicide available for use against rot disease on grape.

Fixed Coppers are neutral, insoluble forms of copper compounds which usually require the addition of spray lime as a safener. Fixed coppers are sold under many trade names and differ in their metallic copper content. Recommendations of fixed coppers therefore are given in amount of actual copper to be used.

The main use for these compounds is on tart cherries for the control of leaf spot. For this purpose, they are used at the rate of 0.75 lb. of actual copper plus 3 lbs. of hydrated lime starting at second cover.

Folpet (*Phaltan*) (*n-trichloromethylthiophthalimide*) is formulated as a 50% WP. It is closely related to captan and is used effectively against black rot and dead-arm in grapes. It is also effective against grape powdery mildew and downy mildew.

Lime-Sulfur is used primarily as an eradicant in the silver tip to pre-pink period of bud development for the control of scab. It is available as a liquid and is used at the 2 gal. rate. Dry forms are also available. Lime-Sulfur is also used to some extent as a dormant spray on peach for peach leaf curl, on prunes and plums for black knot, and as a bloom spray on each of these crops for brown rot blossom blight. Although the use of lime-sulfur was once quite prevalent, it has generally been replaced by less phytotoxic or milder fungicides.

Streptomycin is a bactericide for use against fire blight on apples and pears. It is very effective against the blossom blight phase of this disease if sprays are well timed and thorough. Best results are obtained if sprays are applied when maximum temperatures above 65°F exist or are likely, and are accompanied by precipitation or following rainy days. Apply the first spray before or within 24 hours after favorable conditions. Apply a second spray if favorable conditions reappear, or if blossoms are opening rapidly and favorable conditions persist, 1 to 2 days after previous

spray. Repeat applications if warm, wet conditions prevail.

Recently, post-bloom sprays of Streptomycin have been approved on pears up to 30 days before harvest, on apples up to 50 days before harvest. Although sprays for the control of shoot blight need further study, the following is suggested for those who may wish to try this new procedure. In orchards with a history of severe fire blight, but where overwintering cankers have been removed and a well timed blossom blight program has been followed—use Streptomycin at 100 ppm. Follow a 7-day protective schedule starting at petal fall or 5 to 7 days after the last in-bloom spray. During periods of wet, humid weather, shorten intervals to 5 to 7 days. Continue program until terminal growth stops.

Sulfur is available as a wettable powder and as a paste. Because of their convenience, the wettable sulfur formulations are generally used. Recommendations are based on a 95% wettable sulfur formulation. Formulations containing less sulfur should be used at higher rates. Once used extensively as a protectant for scab, it has generally been replaced by organic materials of the protective-eradicant type.

Sulfur is effective against powdery mildew and is used at the 2 lb. rate with scab fungicides for the control of this disease on susceptible apple varieties. When sulfur is used at reduced rates in a mildew suppression program, applications should be initiated at silver tip and continued until cessation of terminal growth. Omit sulfur in applications where superior oil is used.

Sulfur is used on all stone fruits, except apricots, to control brown rot. It is especially important in the bloom and early cover sprays on peaches to control not only brown rot, but also peach scab and powdery mildew.

Zineb (*zinc ethylene bisdithiocarbamate*) is sold as a 75% active wettable powder. At full strength, 2 lbs. are used per 100 gal. of water. In Michigan, it is used mainly for control of black knot of plums and prunes. Where sooty blotch and fly speck are a problem on apples, Zineb plus Captan, each at the 1 lb. rate, are used starting at third cover and repeated every 10 to 14 days until 30 days before harvest.

INSECTICIDES

Carzol (*m* — [[(Dimethylamino)methylene]amino]phenyl]methylcarbamate monohydrochloride) is a non-phosphate miticide registered for use either pre-bloom or post-bloom on apples and pears. Member of a new chemical class of miticides, the formamidines, it can provide residual control up to 30 days from single applications. Although most

effective for controlling immature and adult forms of European red and two-spotted mites, it does prevent the hatching of mite eggs present at time of spraying. It is especially efficient against organophosphate resistant mites and also controls those resistant to other types of pesticides. Formulated as a completely water-soluble powder, containing 92% formetanate hydrochloride, it dissolves rapidly in water to leave an invisible crop residue. Correct dosage rates and thorough tree coverage are important, since Carzol primarily kills the active stages of mites. Repeat applications should be made as needed or whenever mite infestations appear. No more than 4 lbs. per acre can be applied in any one crop season and no closer than 7 days before harvest. The product is not stable in alkaline water. Its spray mixture must be freshly prepared just before application. It is compatible with many orchard spray materials, moderately toxic to honeybees and comparatively non-toxic to fish, birds, man and animals.

Chloropropylate (*Isopropyl 4, 4-dichlorobenzilate*), trade-named *Acaralate*, is a miticide for control of European red mite and two-spotted mite on apples and pears. As an emulsifiable concentrate, it kills young and adult forms of these mites. It is useful in pre-bloom preventive sprays or whenever mite infestations first appear. Pre-bloom applications are made as close to egg hatch as possible for best results. Correctly applied, they give residual control until mid-summer. Post-bloom spraying must be done as often as necessary to keep mite populations at a minimum. Two applications spaced 7 to 10 days apart are required for maximum performance. Since only the active stages of mites are killed, it is essential that correct dosage is used and thorough coverage of trees obtained. Dilute or concentrate spray must reach all parts of the tree, especially the underside of leaves. Do not mix *Acaralate* with spray oils due to possible plant injury. Virtually non-toxic to warm blooded animals, it is also safe to bees and other beneficial insects.

Demeton (*O, O-diethyl-0-2-ethyl phosphorothioate*), better known as *Systox*, is a contact and systemic phosphate formulated as an emulsion concentrate. It is generally recognized for systemic control of sucking insects such as aphids, leafhoppers and mites, used no more than three times in a growing season. Its major use in Michigan has been on apples and pears, either pre-bloom or early post-bloom, for clean-up of aphids, although *Systox* does have label clearance on apricots, peaches, plums, prunes, grapes and strawberries for similar purposes. The material has further efficiency on white apple leafhopper at 1/3 pint per 100 gal. of water, applied on, or about, first

cover. An additional application is often needed in late August or September to control a second generation. As a systemic, it quickly penetrates plant tissues and is then translocated throughout the plant. This distinctive feature makes it harmless to beneficial insects. Like parathion or certain other phosphates, this chemical is highly toxic to man and safety precautions must be given due attention.

Diazinon (0, 0-diethyl-0-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate) ranks intermediate between parathion and malathion in toxicity to humans. It is active against a variety of fruit pests, offers residual activity of 11 to 14 days and has clearance for use on apples, pears, cherries, peaches, plums, prunes, strawberries, grapes and brambles. The principal uses of diazinon in Michigan involve a 50% wettable powder formulation for control of cherry fruit fly on sweet and tart cherries, summer insect complex on apples after First Cover and insects troublesome to strawberries in mid-season. Drenching crown treatments of emulsifiable concentrate will kill the overwintering stage of raspberry root borers when they are a problem. Diazinon is proving to be a selectively useful insecticide in integrated control programs, since it is relatively non-toxic to important predatory mites.

Dimethoate (0, 0-dimethyl S-(N-methylcarbamoylmethyl) phosphorodithioate) is marketed as *Cygon* and *De-Fend* for a wide range of insects on bearing apples and pears. Sold as a 2.67 lb. per gal. emulsion concentrate and 25% wettable powder, its systemic properties have specific value in aphid control, either pre-bloom or early post-bloom on these crops. It is likewise quite effective for white apple leafhopper at twice the rate of application required for aphids. Compared to many insecticides, it is practically without compatibility problems. While toxic to bees, the product is one of the least poisonous of the organic phosphates to humans and animals.

Ethion (0, 0, 0, 0-tetraethyl S, S-methylene bisphosphorodithioate) has use on apples in combination with oils, for preventive European red mite control, to eradicate overwintering stages of mites, aphids and scale. Application of oil and Ethion at 1/4 actual formulated ingredient is made between green tip and pre-pink period of bud development. Under Michigan conditions, oil plus Ethion have given better control of San Jose scale than oil alone. However, the addition of a phosphate insecticide does not improve the miticidal effectiveness of oil. Several formulations of Ethion-oil are available or the Ethion can be purchased separately and added to the oil prior to application. Ethion should not be sprayed after bloom on apple

varieties maturing before McIntosh, since severe leaf injury and subsequent fruit drop are likely to occur.

Galecron-Fundal (N-(4-chloro-o-totyl)-N, N-dimethylformamidine monohydrochloride), identical twins in active ingredient, are non-phosphate miticide, insecticide, ovicide materials. Registration approves their application pre-bloom and post-bloom for mite, codling moth and pear psylla control on apple and pear trees. Both compounds are formulated as completely water-soluble powders (forming no visible crop residues) and 4 lb. per gallon emulsion concentrates. As members of an entirely new and different class of acaracides—the formamidines—they give effective control of non-resistant and resistant mite strains. Effective rates are ½ lb. of soluble powder or 1 pint of its liquid equivalent per 100 gal. of water for dilute full coverage sprays. This amounts to a minimum 2 lbs. or 4 pints of respective formulation per acre for optimum results, regardless of concentration or number of gallons to the acre. To avoid excessive residues, do not apply more than 3 times a season after fruit forms nor less than 14 days before harvest of apples or 28 days before harvesting pears.

Both Galecron and Fundal will destroy European red and two-spotted mites in all stages—eggs, nymphs and adults. They can be used to control eggs and nymphs anytime up to bloom and post-bloom whenever mites appear, with repeat applications as necessary; in fact, from dormant (with or without oil) through post-bloom to post-harvest. Summer cover sprays for mites on apples and pears will combat codling moth as well. Before and after-bloom spraying of pears can help manage pear psylla nymphs too. Unlike most present day miticides, Galecron and Fundal are relatively slow-killing chemicals. Periods of 48 to 96 hours or more are frequently required for effect, but there is compensation in long-term residual activity. They further differ from typical phosphate miticides in not causing body shrinkage or leg distortion of dead mites—a feature that can easily result in mistaking dead mites for live ones. In addition to compatibility with the majority of orchard spray products, Galecron-Fundal are practically harmless to man, animals, plants, bees and other useful insects. Toxicity to birds, fish and wildlife in general is likewise favorably low.

Guthion (0, 0-dimethyl S-(4-oxo-1, 2, 3-benzotriazinyl-3-methyl) phosphorodithioate) effectively controls most insects that commonly infest both tree and small fruits. It has probably been the first line of defense in Michigan orchards since DDT and related chlorinated hydrocarbons began phasing out. Among the phosphates, it has proven itself as a broad-spectrum insecticide in every sense of the word. Available as a 50% wettable

powder or 2 lb. per gal. spray concentrate for dilution at equivalent rates, Guthion is registered for application on all major and most minor fruit crops with a residual action of 10 to 14 days. The spray concentrate is not cleared for apples and pears. There have been no phytotoxicity or residue problems when the compound is used properly and in accordance with label directions. To avoid prohibitive residues, no more than 8 applications of Guthion on deciduous fruit, nor 3 to 4 applications on grapes, strawberries and blueberries are permissible in a season. While Guthion is similar to parathion in toxicity to humans, it is not greatly injurious to natural parasites and predators of fruit pests. Make use of the safety measures reserved for many organo-phosphate insecticides.

Imidan (0, 0-dimethyl S-phthalimidomethyl phosphorodithioate) is a relatively new phosphate chemical with a low toxicity to mammals, that is comparable to Sevin. It is formulated as a 50% wettable powder for pre-bloom and post-bloom application on apples, pears, peaches, cherries, plums, prunes, grapes and apricots. It has consistently given excellent broad-spectrum control of codling moth, red-banded leafroller, fruit tree leafroller, apple maggot, plum curculio, tarnished plant bug, green and rosy apple aphid, peach twig borer, oriental fruit moth and pear psylla, non-resistant strains. In Michigan trials, Imidan has been outstanding in performance on apple maggot and pear psylla. The material can be a boon in attacking maggot outbreaks close to harvest. It also suppresses European red mite and two-spotted mite when used in a seasonal program, without significant interference to species of predatory mites important to integrated pest control. Imidan represents a biodegradable pesticide which in a short time interval dissipates into non-toxic residues harmless to man, wildlife and other living forms.

Kelthane (1, 1-bis(parachlorophenyl) 2, 2, 2-trichloroethanol) used as a specific miticide, has performed well in Michigan against the nymphs and adults of red mite, two-spotted mite and rust mites during the past several years. As a wettable powder or emulsifiable concentrate formulation, it is still likely to be the most widely used miticide from July to harvest on fruit crops infested by the previously mentioned mites. For best results, apply Kelthane when the average temperature is predicted to be above 70°F. for 5 to 7 days. Repeat applications 7 to 10 days apart are often necessary and advisable. Its toxicity ranks comparatively high in safeness to man and wildlife.

Lead Arsenate (Acid orthoarsenate) is an inorganic stomach poison of long standing value for codling moth, apple maggot and cherry fruit fly control. Besides having prolonged residual action, it is practically harmless to natural parasites and predators. Used on apples in combination with other insecticides, it offers an inexpensive, yet effective, spray program for apple maggot. The use of parathion with lead arsenate in the first two applications suggested for apple maggot also gives favorable control of second brood red-banded leafroller. Although dependable on cherry fruit fly, lead arsenate will not combat mineola moth. Standard acid lead arsenate should not be applied to fruit trees without including a corrective or safener against arsenical injury.

Malathion (0, 0-dimethyl dithiophosphate diethyl mercaptosuccinate) as a mild phosphate controls an unusual variety of fruit insects and is especially useful against several species of aphids. However, its residual effectiveness seldom exceeds 2 to 3 days. Thus, it can often be employed to best advantage in late season sprays. Its use is particularly indicated where a high degree of safety to man and animals becomes desirable. Obtainable as emulsifiable concentrate, wettable powder or dust, malathion is presently used in Michigan for certain insect pests attacking brambles, currants and blueberries. Unlike many chemicals, it is generally compatible with every insecticide and fungicide in common usage.

Methoxychlor (2, 2-bis(paramethoxyphenol)-1, 1, 1-trichloroethane) has long residual activity and, although a close relative to DDT, exhibits very low toxicity to humans and other warm blooded animals. It will restrain such major fruit invaders as plum curculio, codling moth, apple maggot and cherry fruit fly, but is generally inferior to alternative chemicals for these purposes. Also sold under the trade name *Marlate*, its only suggested use is in dust form as an optional material on blueberry insects. It is rarely plant phytotoxic.

Morestan (6-methyl-2, 3-quinoxaline-dithiol cyclic S, S-dithiocarbonate) is formulated as a 25% wettable powder for residual control of mites and their eggs. As characteristic of most miticides, Morestan is essentially free from harmful toxicity hazards. Registration permits its use pre-bloom and post-harvest on tree fruit crops. Do not apply after the first bloom. Used delayed dormant, pre-pink or pink, it is an ideal miticide when weather conditions often prevent successful application of spray oils. It not only kills mite eggs, but offers long-lasting residual protection against newly hatched nymphs and adults, includ-

ing strains resistant to other miticides. Morestan cannot be used after bloom due to the absence of legal residue tolerances.

Omite (2-(*p*-*tert*-butylphenoxy) cyclohexyl-2-propynyl sulfite) is closely related to Aramite in chemical structure and gives good control of mites when used at 1¼ lb. of 30% wettable powder per 100 gal. or 5 lbs. to the acre. It is effective against the mite strains resistant to phosphate and chlorinated hydrocarbon miticides, and is cleared for use on apples, peaches, pears, plums and prunes. Omite is not a systemic, therefore complete coverage of upper and lower leaf surfaces and fruit is important for maximum results. Likewise, it is not a prebloom miticide, since performance is best when temperatures are 70°F. or higher. Mites hit by the spray stop feeding and die within 48 to 72 hours. Initial kill is slow, often 3 to 5 days, but is compensated for by long residual action. This material is not an ovicide, and is mainly effective against young and adult mite stages. It doesn't affect beneficial insects, is reportedly less harmful to predator mites and data indicate it to be relatively non-toxic to man and animals. For best performance in cleaning up summer mite populations, make two applications 7 to 10 days apart.

Parathion (0, 0-diethyl 0-*p*-nitrophenol phosphorothioate) is extremely toxic to man and animals. Along with a complete understanding of the label, adequate safety precautions include rubber gloves, suitable protective clothing and an approved face mask. It has been widely used since 1949 for control of aphids, bud moth, pear psylla, plum curculio, codling moth, oriental fruit moth, mineola moth and a few lesser fruit pests. Some effectiveness from the 15% wettable powder and its liquid equivalent is apparent against mites and red-banded leafroller. No injury from this material has been observed on peaches, plums and cherries. Apples, and occasionally pears, have been injured when parathion was used in excess of dosages suggested in the Fruit Spraying Calendar. Parathion can often be used to good advantage in combination with other insecticides.

Perthane (1, 1-dichloro-2, 2-bis(*p*-ethylphenyl) ethane) exhibits the lowest toxicity of any presently available chlorinated hydrocarbon. It is quite unstable and without a reputation for persistence. Formulated as a 4 lb. per gal. emulsifiable concentrate and utilized at 1 qt. per 100 gal. (3 quarts/acre), it appears in the pear spraying schedule specifically for early spring and summer control of pear psylla where Guthion, Sevin, Imidan and parathion are no longer effective. Being non-active on eggs and nymphs of psylla, it is most important that Perthane applications be so timed as to

kill adults before they have opportunity for egg laying. Otherwise, there is no reason to use Perthane as an insecticide.

Phosalone (O, O-diethyl S-(6-chloro-2-oxobenzoxazolin-3-yl-methyl) phosphorodithioate), sold as Zolone, is a non-systemic phosphate insecticide-miticide that acts as a contact and stomach poison. Presently registered for use on apples, pears, grapes and the stone fruits, it controls aphids, codling moth, apple maggot, leafrollers, plum curculio, pear psylla, leafhoppers, oriental fruit moth and phosphate-susceptible European red and two-spotted mites. Marketed as an emulsifiable concentrate containing 3 lbs. of active ingredient per gallon, and a 25% wettable powder, it can be applied to within 14 days of harvest on the crops indicated. Somewhat weak in its Michigan performances on plum curculio, Phosalone is suggested here in cover spray applications. Applications are not advisable prior to Second Cover.

Phosalone is compatible with most fruit fungicides, some insecticides, offers residual properties averaging 7 to 14 days and has crop residue tolerances of 10 ppm. While somewhat hazardous to fish, Phosalone is only moderately toxic to honeybees, comparable with diazinon in having an average mammalian toxicity and much less harmful than DDT to quail, ducks, pheasants and other birdlife. It does not persist and accumulate, but rapidly metabolizes to non-contaminants in soils.

Phosphamidon (2-chloro-2-diethylcarbamoyl-1-methylvinyl dimethyl phosphate) offers limited usefulness in the battle between man and insects for the fruit crops. Its chief asset lies in its ability to control aphids, mites and leafhoppers as both a contact and systemic poison. Therefore, as an 8 lb. per gal. emulsifiable concentrate used at 1/4 pint, it favorably joins Systox and Dimethoate as an optional choice on apples prebloom and early post-bloom for disposal of aphid populations. An equal rate is likewise effective against white apple leafhopper. Phosphamidon warrants the same precautions granted any cholinesterase-inhibiting chemical.

Plictran (Tricyclohexyltin hydroxide), formulated as a 50% wettable powder, is a non-phosphate miticide with outstanding activity on destructive plant-feeding mites—those both susceptible and resistant to other miticides. It is registered for post-bloom use on apples and pears to control the motile forms of European red, two-spotted and rust mites. First application is recommended as soon as mites are active, usually at or shortly-after petal fall, with repeat treatments

as needed or whenever mite infestations appear. However, no more than 4 sprays can be applied between petal fall and harvest to apples nor more than 3 on pears. Since Plictran kills the hatched stages of mites, coverage of foliage must be thorough and complete to include uniform wetting of upper and lower leaf surfaces. The product mixes readily in water to form a suspension that can be applied with any conventional spray equipment. It is usable alone or compatible in tank-mix combinations with those insecticides and fungicides generally employed in orchard spray schedules. No phytotoxicity or adverse effects on fruit finish have been reported. Plictran is a preference miticide for "integrated-control" programs since it is not harmful to beneficial insects or predatory mites. Used as recommended, it presents no unusual health, contamination or environmental problems. It is non-toxic to honey bees, only somewhat hazardous to birds and fish, moderately toxic to animals and of low toxicity to man.

Sevin (*1-naphthyl N-methylcarbamate*) controls a wide range of insects at dosage rates from 1 to 2 lbs. of 50% wettable powder or that equivalent in liquid formulation per 100 gal. Carbaryl by common name, it finds its place somewhere in the spray program for every fruit crop grown in Michigan. Its residual effectiveness varies from 10 to 14 days, depending on the insects to control. In most cases, it can be applied within a day or closer of harvest without fear of excessive residues. Sevin is not a miticide, may encourage aphid build-ups and is inclined to be seriously toxic to bees. It is compatible with most pesticides and gives good control of certain pests resistant to other frequently used insecticides. Sevin offers a high degree of safety to animals and plants. There is the added advantage of its low toxicity to man and fish, lessening the hazards from spray drift that are associated with many pesticide chemicals. Inasmuch as Sevin is a recognized fruit thinning agent, its use is avoided until at least 30 days after full bloom on McIntosh, Jonathan, Northern Spy and Delicious apple varieties.

Thiodan (*hexachloro-hexahydro-methano-2, 4, 3-benzodioxathiepienoxide*), a distant relative to most conventional chlorinated hydrocarbons, has been the single effective insecticide available for peach tree borers. Both the lesser borer and true peach tree borer are controlled by this product. Thiodan is suggested for growers who have severe borer problems on peaches, plums and cherries. A period of 21 to 30 days between last application and harvest, depending on the crop treated, must elapse if the fruit is to be within safe residue tolerances. Post-harvest sprays of

Thiodan reduce late season infestations and there are no restrictions for post-harvest use of the product. It has further use on pears, in a comparable manner to Perthane, for control of pear psylla and especially where they are tolerant to parathion, Guthion, Imidan or Sevin. Summer applications should be made 7 days apart and when the nymphs are still small for best results. Its excellent insecticidal effectiveness against aphids, white apple leafhopper, tarnished plant bug and rust mites is of additional benefit. Plant bug control for peaches and strawberries would be difficult, if not impossible, without Thiodan. A 50% wettable powder and 2 lb. per gal. emulsifiable concentrate are available for any of the described uses, with no more than two applications after petal fall and during the fruiting season. Of moderate toxicity, Thiodan requires the same caution granted any chlorinated product similar to it.

INSECT PHEROMONES

Pheromones are man-made and chemically structured synthetic substances—products which imitate the natural hormones for sex stimulation and attraction found in the female of an insect species. When plastic wicks or capsules are charged with minute quantities of these attractants, they release them in metered amounts, for a long period, to lure the males of the insect involved. Since each insect species generally possesses its own personalized sex hormone, only a pure culture of the specific insect monitored is collected. This feature alone makes insect detection and identification easier for everyone concerned.

Pheromone (sex lure) traps offer new dimensions in near-infallible orchard detection, emergence timing and monitoring of red-banded leafroller, codling moth and Oriental fruit moth. These specially designed traps, baited with pheromones and with their interior surfaces pre-coated with adhesive, provide a convenient and simple means for trapping the fruit insects mentioned. This might be for no other purpose than to determine their presence or absence in an orchard. They may lead to an eventual systems approach to assess populations, emergence trends and economic damage thresholds for these insects. They eliminate much of the previous guesswork in spray timing for three of the more troublesome fruit insects found in Michigan orchards.

Pheromone traps have been successfully employed in systematically monitoring experimental orchards programmed to integrated mite control and new pest population management concepts. They are of measurable value in decisions on insecticide applications exclusively for "control based on need" and

to forestall economic crop damage with a minimum of insecticide applications.

These traps are supplemental reinforcements and not replacements for other commonly used insect monitoring procedures. They can help you to better know your insects; which ones are present and when "to" or "not to" fight them. You can now determine what, when, and where to spray—for red-banded leafroller, codling moth and Oriental fruit moth.

ACCESSORY MATERIALS

"Accessory materials" are those materials added to fungicides to make them less injurious to the foliage and fruit or to improve their wetting and adhesive properties, making them more effective in disease and insect control.

WETTING OR SPREADING AGENTS AND STICKERS

With present pesticides, it is seldom necessary for the orchardist to use wetting agents, spreading agents or adhesive agents. Occasionally—if the water is unusually hard, if hard-to-wet plants, such as plum fruits are involved, or in the case of hard-to-wet insects, such as waxy aphids or mites—it may be helpful to add a small amount of wetting agent to the tank. Their use in concentrate spray mixtures may cause excessive runoff or chemical injury to the fruit.

Some materials act as spreading or wetting agents when wet, and as stickers after they dry. Such "materials" usually increase retention or adhesiveness more than they increase deposit. Like wetting agents, stickers are often included by the manufacturer in the formulation of the spray material. Excessive use of stickers may cause *excessive* residues at harvest and should be used with caution.

LIQUID PESTICIDES AND SURFACTANTS OR WETTING AGENTS

Both liquid (flowable) and wettable formulations of insecticides and acaricides are suggested in the spraying schedules for the various fruits. However, in certain cases the liquid formulations may be more favorable to use because of ease of handling and cost.

The general use of wetting agents and adhesive agents is a questionable practice because of the wide variation in chemical and physical properties of available pesticides. As previously stated, all commercial insecticides and fungicides to be applied as sprays have wetting agents incorporated in their formulations. Also, when pesticides are used in concentrate spraying as in a 2x, 3x or 4x mixture, the amount of wetting agents is 2, 3 or 4 times the amount present in a dilute mixture. The wetting agent affects the

surface tension of the water and in turn increases the capacity of the water to wet the fruit and leaves. A commercial wetting agent improperly added to either dilute or concentrated mixtures could result in chemical injury to leaves or fruit. The liquid pesticides, such as liquid parathion and liquid Guthion have higher wetting properties than the wettable powder forms.

When using liquid fungicides on apples easily injured by certain pesticides, it is desirable to select an insecticide of wettable powder form rather than liquid form to avoid possible chemical injury. By contrast, when using a liquid insecticide on apples, select a fungicide of wettable powder formulation. Remember too, for apples, that chemicals with a narrow range of safety, such as Dichlone (Phygon), will be more likely to cause injury when used with the liquid pesticide formulations, or when a commercial wetting agent is added to the spray mixture.

Select pesticides carefully for each kind and each variety of fruit and for different times during the growing season. Calibrate your sprayer to deliver the correct amount of pesticide per acre. *Do not over spray or under spray.*

CORRECTIVES FOR SPRAY INJURY

Arsenical Injury

Bordeaux and fixed copper and lime will safen lead arsenate against arsenical injury to leaves and fruit. Hydrated lime alone, previously used to safen against arsenical injury, has been replaced by organic fungicides. One pound of hydrated lime will safen one pound of lead arsenate but may reduce the effectiveness of some other pesticides.

The organic fungicides and the minimum amounts necessary for safening against arsenical injury are as follows:

- One-fourth pound of Ferbam will safen one pound of Lead Arsenate.
- One-half pound of Captan will safen one pound of Lead Arsenate.
- One-half pound of Niacide M. will safen one pound of Lead Arsenate.
- One-half pound of Ziram will safen one pound of Lead Arsenate.

Thiram (Thylate) and Dodine (Cyprex) will *not* safen lead arsenate. When using these fungicides with lead arsenate, reduce the amount suggested per 100 gallons by one-third to one-half and add either Ferbam, Captan, Ziram or Niacide M in quantities required to safen the lead arsenate being used.

RUSSETING OF APPLES BY COLD AND CHEMICALS

Golden Delicious, Jonathan and Delicious are the three commercially important apple varieties most easily russeted by certain pesticide chemicals in years when freezing air temperatures (32° F. or lower) occur close to bloom.

The most critical time for pesticide injury is the period, *Full Bloom* through *Second Cover*. The opportunity for russetting is even more acute when cool, humid, rainy weather accompanies or follows freezing temperatures.

McIntosh:—Early season applications of Parathion may cause russetting.

Golden Delicious:—Ferbam or Dodine (Cyprex) should *not* be used on this variety during the time *pink* through *Second Cover*. Wettable Sulfur or Lime-Sulfur may cause unfavorable russetting during this same period when weather conditions are cool, humid and rainy. The most favorable precaution for good finish on Golden Delicious is to use Captan, beginning with *Pink* and continue its use through *Second Cover*.

If "back action" is necessary against possible apple scab infection, Dichlone (Phygon) at ¼ pound, plus Captan at 1 pound per 100 gallons may be used. Remember, Captan alone at 2 pounds per 100 gallons has "back action" of 18 to 24 hours against this organism, frequently eliminating the need for Dichlone (Phygon).

Dust applications on this variety during the critical period of *Pink* through *Second Cover* in place of sprays is a very favorable practice.

If fruit-feeding worms are a historic problem, add 15% wettable Parathion at 1 pound per 100 gallons at the time of *Pink*. Do *not* use Parathion again on Golden Delicious until after *Second Cover*, and then at no higher rate than one pound of 15% wettable or its equivalent per 100 gallons. Any of the pesticide chemicals suggested for apples in Michigan may be used for *Pink* and after *Second Cover* without danger of injury to the fruit.

Jonathan:—Although not as easily injured as Golden Delicious, this variety is russeted by certain pesticides when freezing temperatures (32° F. and lower) occur just before, during or shortly after *Bloom*. In years when the air temperature drops to 32° F. or lower at *Bloom* or shortly thereafter, use Captan through *Second Cover*, or Dodine (Cyprex) no higher than ¼ pound per 100 gallons.

Jonathan may be unfavorably russeted from the use of Bordeaux or fixed copper plus hydrated lime

during *Bloom* for the control of fireblight when freezing temperatures have occurred any time after *Pink* and before the application is made. See Apple Spray Schedule for timing and materials for fireblight control during and after *Bloom*.

If back action beyond 25 hours is required to control scab, use Dichlone (Phygon) at 1/4 pound plus Captan at 1 pound per 100 gallons. If no freezing air temperatures occur at *Pink* or thereafter, any of the fungicides as suggested for apples in Michigan may be used with safety.

The use of Parathion at *Petal Fall* following freezing injury close to *Bloom* frequently causes undue stem cavity russetting.

Any of the pesticide chemicals suggested for apples in Michigan may be used before *Bloom* and after *Second Cover* without danger of injury to the fruit.

Delicious:—Many Michigan growers have experienced unfavorable russetting of Delicious. In every case, these growers had used either wettable Sulfur, Sulfur paste, Lime-Sulfur or Dichlone (Phygon) as a spray after *Bloom*. If freezing conditions (32° F. or lower) occur close to *Bloom* and/or if humid, rainy, cool conditions prevail after *Bloom*, the use of sulfur pesticides or over-spraying with Dichlone (Phygon) *will russet Delicious*, including the red sports. Avoid the use of these above-mentioned chemicals as a spray *in* or *after Bloom*, and there should be no problem of russetting of Delicious in Michigan.

PRE-HARVEST DROP CONTROL OF APPLES

NAA (naphthaleneacetic acid), 2,4,5-TP (2,4,5-trichlorophenoxy propionic acid), and Alar, may be used to control harvest drop.

Apply NAA at first sign of fruit drop. It becomes effective in 1 to 2 days and controls drop for 6 to 10 days. A repeat application may be necessary if harvest is delayed. Apply NAA at 10 parts per million (ppm) on McIntosh and earlier ripening varieties and at 20 ppm on varieties maturing after McIntosh. Aircraft applications are made at 48 grams of NAA per acre.

Do not use 2, 4, 5-TP on varieties maturing before McIntosh. It becomes effective 6 to 10 days after application and provides drop control for 2 to 4 weeks. Apply at 10 to 20 ppm before foliage begins to deteriorate or is frosted.

NAA and 2,4,5-TP may stimulate ripening and treated fruit should be harvested before it becomes overmature.

Alar is effective for pre-harvest drop control when applied at 750 to 1,000 ppm, 10 days after bloom to 70 days before anticipated harvest. **Do not apply Alar**

within 60 days of Harvest. It does not tend to hasten maturity as the above hormone chemicals, but tends to delay maturity 7 to 10 days with improved fruit firmness.

CHEMICAL THINNING

APPLES

High labor costs, the demand for large sized fruits, and the need for thinning during the period *Petal Fall* to 14 days after *Petal Fall* to induce annual bearing have stimulated the practice of thinning with the naphthaleneacetic acid compounds, referred to as NAA, and naphthaleneacetamide, sold as Amid-Thin. NAA is available in acid form and as a sodium salt and is sold under such trade names as Fruitone and Stafast, or as naphthaleneacetic acid.

Thinning With NAA

Varieties differ greatly in their response to NAA thinning sprays. On this basis, they are divided into three groups: (1) easy to thin; (2) intermediate; and (3) hard to thin.

Listed below are the varieties and the suggested concentrations of NAA to use 5 to 7 days after *Petal Fall* as a guide when first starting a thinning program:

1. **Varieties Easy to Thin:** McIntosh, Delicious, Jonathan, Northern Spy, and Rhode Island Greening: 4 grams of *actual* NAA per 100 gallons (10 parts per million).

2. **Intermediate Group:** Grimes Golden, Oldenburg (Duchess), Fameuse (Snow), Hubbardston, and Wagener: 6 grams of *actual* NAA per 100 gallons (15 parts per million).

3. **Varieties Hard to Thin:** Yellow Transparent, Wealthy, Golden Delicious, Rome Beauty, and Baldwin: 8 grams of *actual* NAA per 100 gallons (20 parts per million).

If the first application of NAA (made 5 to 7 days after *Petal Fall*) does not give enough thinning, increase the concentration 2 to 5 parts per million and follow with a second application 7 to 10 days later.

Thinning With Amid-Thin

Amid-Thin is suggested for use on apples in Michigan at 60 parts per million at *Petal Fall* applying 350 gallons per acre. Concentrations lower than this, as recommended by the manufacturer, have not given adequate thinning. Applying Amid-Thin *after Petal Fall* has resulted in *no* thinning; and it has caused the fruit to stick fast to the tree so that no "June drop" occurred giving a large crop of valueless, small apples.

Amid-Thin is suggested especially for early varieties which ripen before McIntosh, and for varieties likely to be injured by NAA applications. These include Yellow Transparent, Oldenburg (Duchess), Early McIntosh, Wealthy and Northern Spy. Amid-Thin can also be used on most other varieties. However, there are cases where the material did not thin Delicious, but instead, led to a large crop of undersized, distorted apples. Be sure to use Amid-Thin *no later than Petal Fall* on this variety.

Evaluating Results

The results of the thinning spray (NAA or Amid-Thin) may be determined 7 to 10 days after application, as the affected fruits do not grow but remain the same size as when the spray was applied. Fruits *not affected* will continue to grow and become larger. This makes it possible for you to follow with an added application of NAA, if you desire.

Cautions

- As a general rule, apply NAA under fast-drying conditions, when the temperature is between 70 and 75° F. On the other hand, Amid-Thin gives best results when applied under slow-drying conditions. Amid-Thin is often applied in the evening.

- Weak trees are thinned more easily than vigorous ones.

- Thinning with NAA and Amid-Thin is much more excessive when weather conditions during *Bloom* do not favor good pollination and fruit set. However, when fruit set is questionable, but chemical thinning is a "must", use Amid-Thin at 60 parts per million at *Petal Fall*.

- If the weather during the week preceding *Bloom* or the week after *Bloom* is cloudy, wet, and humid, thinning is accomplished more easily than if the weather during these periods has been fair and sunny.

- When freezing temperatures (32° F. and lower) occur after *Pink* and before applying the thinning sprays, NAA may cause excessive thinning. Reduce the concentration by 2 or 3 parts per million.

- Each grower must work out the concentrations of NAA best suited for his orchard conditions. Sprays of NAA will remove all the fruit and severely damage the leaves if too high concentrations are used. When conditions exist which might result in injury or loss of crop from overthinning with NAA, Amid-Thin applied at *Petal Fall* using 60 parts per million is safer for widespread use. However, these decisions must be made by the grower.

Sevin as a Thinning Agent

Sevin can cause unfavorable crop reduction when used throughout the season, beginning at *Petal Fall*. Studies have revealed that it was only the use of Sevin during the period of *Petal Fall* through *Second Cover* which caused the reduced yield. Applications at other times in the growing season had no adverse effect.

Sevin may be useful for fruit thinning. However, growers evaluating Sevin for the first time should do so on a trial basis. The following rates may serve as a guide using Sevin (50-W): (a) McIntosh and Jonathan, 2 pounds per 100 gallons (b) Delicious to include red strains and Northern Spy, 1½ pounds per 100 gallons. The single application of Sevin should be made at *First Cover*, selecting some other insecticide for *Second Cover*. Sevin used at *Second Cover* following thinning applications of NAA can cause overthinning. After *Second Cover*, Sevin may be used as an insecticide without any danger of added thinning. Sevin used on Golden Delicious at the same time suggested for thinning may cause fruit russetting.

Thinning With Concentrated Mixtures

Fruit-thinning sprays can be applied in concentrate form with airblast equipment. A 2x concentration is suggested in the beginning whereby you use one-half the amount of spray per tree that would be used in conventional spraying (See Concentrate Spraying, page 6).

If higher concentrations are tried, a good starting point is a 3x concentration but applying only one-fourth the number of gallons of spray per tree or per acre that you would use in conventional spraying.

Here, also, to obtain the amount of thinning desired, you must work out the concentration and gallonage per tree or per acre best suited to your orchard conditions.

PEARS

Michigan growers continue to use Amid-Thin (naphthalene-acetamide-NAD) for thinning Bartlett pears with the suggested time of application *Petal Fall*.

The following rates are given as guides: (a) trees of low vigor 25 parts per million (ppm); (b) trees of medium vigor 35 ppm; and (c) trees of high vigor 45 ppm. When the thinning spray is applied after *Petal Fall*, leaves are more subject to epinasty or twisting.

Bosc pears may be completely defruited with NAD at 25 ppm. No suggestions are available for using NAD for pear thinning purposes other than Bartlett.

PEACHES

At the present time, no reliable chemicals are available for thinning peaches. Some growers are using DN compounds in early bloom, but results differ so greatly from orchard to orchard and from year to year that they cannot be suggested generally.

N-1-naphthylphthalamic acid has been sold and Nip-A-Thin has been tried experimentally and by growers in Michigan and in other states. This chemical has performed very erratically under Michigan conditions and thus cannot be suggested for thinning peaches except on a trial basis. Fruitone 3 CPA is available for peach thinning, but has performed poorly in Michigan. Peach thinning chemicals should be used according to the directions on the label.

MOUSE CONTROL IN ORCHARDS

By William Shake

U.S. Division of Wildlife Services

Habitat Control

Mouse control in orchards should begin in the spring with regular mowing of the orchard vegetation. Well-mowed orchards provide minimal habitat for mice.

Protective Wire Guards

Small mesh wire guards, of no less than one-fourth inch mesh, around the base of young trees will provide several years of protection against mice. This wire should be cut in strips long enough to enclose the tree and wide enough to extend three to four inches below the surface and at least 18 inches above the ground. In areas of extreme snow, it may be advisable to have the guards 24 inches above the soil. Guards will also protect trees from rabbit and woodchuck damage.

Baiting Methods

A bait of two-percent zinc phosphide-treated cracked corn and oats, or cracked corn alone, broadcast by aircraft or ground seeder is the most effective control method. Rates should be 10 pounds per acre when using aircraft, and six to eight pounds per acre when using ground methods. Seeders which may be set to apply materials only under the drip-line of the trees should be calibrated for the six pound per acre rate. Treatment of border areas will decrease reinfestation of mice into the treated area.

Treatment in apple orchards should begin after harvest and all apple drops have been picked up. Treatments should begin when weather conditions

will be dry and sunny for at least three days. Rain or snow will decrease mouse activity and control success.

A follow-up hand broadcast baiting program is recommended for areas in the orchard where control was not achieved after the first baiting.

DEER CONTROL IN ORCHARDS

Tankage, a livestock feed supplement and animal by-product, can be used to discourage deer browsing in young orchards. Tankage, available from local feed stores or elevators, has a strong odor that is apparently objectionable to deer. Place two to three tea-

spoonfuls of tankage in small 3" x 5" cloth bags and hang one bag in each young tree in the orchard. One hundred pounds of tankage will fill 600 bags if each is filled about three-fourths full.

The small bags of tankage should remain effective about 4 to 5 months—ample time to stop spring and summer browsing and antler rubbing. Bags freeze during winter months and do not provide repellent effect.

Deer are protected by the Department of Natural Resources and if it is necessary to remove the animals, a shooting permit must be obtained from the local conservation officer.

Spray Chemicals and Basic Information for the Control of Apple Scab

The key to effective apple scab control is to prohibit the establishment of the fungus during the primary scab infection periods. If this disease is not controlled at this time, a grower is forced to spray longer into the summer. The table (below) classifies most of the scab fungicides used in Michigan.

Classification of Apple Scab Fungicides

Protective	Eradicative	Mixtures with both eradicative and protective properties	Protectant-eradicants
Lime-sulfur	Lime-sulfur	Sulfur, Ferbam, or Captan at half-	Lime-sulfur
Wettable Sulfur	Dichlone (Phygon)	strength combined with half-strength	Dichlone (Phygon)
Sulfur paste	Dodine (Cyprex)	Dichlone (Phygon).	Dodine (Cyprex)
Ferbam	Captan		Captan
Captan			Benlate
Dichlone (Phygon)			
Dodine (Cyprex)			
Difolatan			

Protectant sprays are applied before infection takes place. They set up a chemical barrier between the susceptible tissue and the germinating spore.

Eradicant sprays "burn" out the fungus within a certain period of time after infection. These include lime-sulfur effective for 72 hours, Dichlone (Phygon) 40 to 48 hours, Dodine (Cyprex) 30 to 36 hours and Captan 18 to 24 hours after infection at suggested full strengths in the pre-cover sprays.

In recent years, with the introduction of chemicals having both protectant and eradicant properties, many apple growers spray on a 5 to 7 day schedule during the primary infection period. The length of spray interval will depend on the amount of rainfall and expanded new growth during this time. The compounds used this way are Lime-Sulfur, Dichlone, Captan, and Dodine. Half-strength combinations of Dichlone plus

½-strength protectants are also used in this manner.

The main disadvantage of this method is that in dry years an excessive number of sprays will be applied as compared to schedules based on rainfall and infection periods.

Growers should keep track of the start of a rain and average temperature and calculate from the following table the length of time it takes for infection to occur. For example, at an average temperature of 58° F. it takes 9 hours for primary infection to take place after the start of a rain. If a protective spray is not applied before or within this 9-hour period, you must rely on a chemical with eradicative properties. Whether a ½-strength or full-strength eradicant is used will depend on the number of hours after infection you apply the spray.

Most growers consider the start of the rain as the

beginning of the "infection period". This allows a leeway of several hours before actual infection takes place.

The approximate number of hours (A) of continuous wet period required for primary apple scab infection during average air temperature (B), and the approximate number of days (C) for conidia (secondary scab) development following infection.

(A) Hours	(B) Degrees F.	(C) Days
48	32-40	17+
30	40-42	17+
20	42-45	17+
14	45-50	17
12	50-53	16
10	53-58	14
9	58-76	9
11	76-	8+

In addition to good timing, the following points must be considered:

1. Thorough coverage. Adequate spray or dust equipment, rate of equipment travel and open trees all contribute to proper coverage.

2. Proper selection of chemicals. Select spray chemicals that are effective against the apple scab fungus but are still safe to the apple tree.

Dust programs of fungicides are not, in general, as effective as spray programs. Dusts are more effective for protection than for eradication. Dry dusts applied to dry foliage give no eradication unless the dusted tree becomes wet within the eradication time limitation for the fungicide used.

Some Properties of Apple Scab Fungicides

Fungicide	Rate Per 100 Gallons of Spray	Retention	Redistribution	*Eradication from Beginning of Infection Period
Captan 50% WP	2 lb.	Fair	Fair-Good	18-24 hrs.
Dichlone (Phygon) 50% WP	½ lb.	Fair	Fair	36-48 hrs.
Dodine (Cyprex) 65% WP	½ lb.	Good	Good	30-36 hrs.
Ferbam 75%	2 lb.	Good	Good	0
Sulfur 95%	5 lb.	Fair	Good	0
Lime Sulfur	2 gal.	Good	Good	60-72 hrs.

*Based on average temperatures of 50-60° F. Growers should use beginning of rain as start of infection. If average is 60-75° F, use the lower eradication time figures. For average temperatures lower than 50° F, use higher eradication time figures.

Retention—Ability of a chemical formulation to adhere to leaf and fruit surfaces during a rainy period, in order to continue protection against scab infection for the next infection period.

Redistribution—Ability of a chemical to move during a wet period to give added protection to some of the neighboring unsprayed tissues.
Note: Do not consider redistribution as a substitute for a complete spray application, especially in questionable infection periods.

Guidelines to Aerial Application for Control of Apple Scab

In Michigan, appreciable acreages of orchard are sprayed annually with pesticides applied from aircraft. Aerial application programs with protectant fungicides have provided good control of primary apple scab when applied in concentrations 70 times the recommended dilute rate and using 5 gallons of spray per acre. At these high concentrations, after-in-

fection control of scab has been poor. Under quick-drying, somewhat windy conditions, only light deposits of chemicals are obtained. Control of special problems, such as powdery mildew, mites, scale and white apple leafhopper, often require supplemental applications with ground equipment.

Single Application Technique For Apple Scab

DIFOLATAN 4EC has label clearance for use on apples at 5 quarts/100 gallons (5 gallons/acre) as a single spray applied at the green tip stage of bud development. Applications later than 1/4 inch green tip stage may produce leaf injury and fruit russetting. Use other suitable fungicides in a regular program for secondary scab infection, starting no later than petal fall. Supplemental sprays may be needed earlier if low rates are employed or if heavy scab pressure exists late in the primary scab period. Apply Difolatan under good drying conditions to avoid excessive loss of deposit from rain. Thorough spray coverage, especially in the top half of the tree, is essential for uniform redistribution and control.

In tests at MSU and Western Michigan, the single

application treatment of Difolatan at green tip has provided control of apple scab until petal fall. It has performed best in light to moderate scab years and on varieties like Golden Delicious and Jonathan, which are not as susceptible to scab as McIntosh. Effectiveness of the treatments is directly related to the dosage rate applied, and reductions in the amount of material used per acre will result in a corresponding shortening of the control period. Difolatan is not effective against powdery mildew. On mildew-susceptible varieties like Jonathan, mildew has become a problem where the single application technique has been used without supplemental mildew sprays.

(Primarily for apples; may be incomplete for other crops.)

(Primarily for apples; may be incomplete for other crops.)

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APPLE SPRAYING SCHEDULE

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference in the spraying schedule.

The rates of materials for use on apple are based on a standard of 400 gallons per acre dilute spray for trees pruned 20 to 22 feet high in rows 40 feet apart.

Silver Tip to Pre-Pink Non-Oil Schedule

DISEASES		INSECTS	
Sepal and Leaf Scab only* (Powdery Mildew and other diseases—see page 27)		Climbing Cutworms	
	<i>Rate/100 gallons Rate/acre</i>		<i>Rate/100 gallons Rate/acre</i>
LIME SULFUR	2 gallons .....8 gallons	PARATHION (15% WP)	2 pounds .....8 pounds
	<i>or</i>		<i>or</i>
DODINE (CYPREX)** (65% WP)	$\frac{1}{2}$ to $\frac{1}{4}$ pound .....1 $\frac{1}{2}$ to 2 pounds	PARATHION LIQUID	0.30 pounds .....1.20 pounds
	<i>or</i>		active ingred. active ingred.
DICHLONE (PHYGON) (50% WP)	$\frac{1}{4}$ pound, plus .....1 pound, plus	NOTE: Make spray applications at night for best cutworm control.	
PROTECTANT	$\frac{1}{2}$ strength $\frac{1}{2}$ strength		
	<i>or</i>	NOTE: Do not add parathion to oil when spraying McIntosh and related varieties.	
CAPTAN (50% WP)	2 pounds .....8 pounds		
	<i>or</i>	***NOTE: DIKAR is suggested primarily when scab, powdery mildew and mites are problems together.	
DIKAR (80% WP)***	2 pounds .....8 pounds		

Green Tip to Pre-Pink Oil Schedule

Sepal and Leaf Scab*

DODINE (CYPREX)** (65% WP)	$\frac{1}{2}$ to $\frac{1}{4}$ pound .....1 $\frac{1}{2}$ to 2 pounds
	<i>or</i>
BENOMYL (BENLATE) (50% WP)	4 to 6 oz. ....1 to 1 $\frac{1}{2}$ pounds
	<i>or</i>
BENOMYL (BENLATE) (50% WP)	2 to 3 oz., plus....8 to 12 oz., plus
SUPERIOR OIL, 70 sec. vis.	1 qt. ....4 qts.
(See **Note on BENLATE under non-oil schedule page 23.)	

If using DIFOLATAN as a single application, see page 20.

NOTE: Do not use SULFUR compounds, DICHLONE (Phygon), CAPTAN, DIKAR or DINOCAP (KARATHANE) with oil, or near time of oil applications.

*Scab spray may be necessary if infection period occurs from Silver Tip to Green Tip.

**Use Cyprex, $\frac{1}{2}$ pound for longer back action.

European Red Mite (preventive program)
San Jose Scale, Aphids, Tarnished Plant Bug,
Leafroller

Superior Oil, 70 sec. vis.	2 gallons .....8 gallons
NOTE: Oil must be used as dilute spray at the rate per acre shown for effective mite and scale control. Phosphate-oil combinations give much better control of San Jose scale than oil applied alone. If scale is a problem, add ETHION 1 pound actual or FLOWABLE PARATHION .6 pounds actual or DIAZINON 2 pounds actual or TRITHION 1 pound actual/acre to the recommended per acre rate of oil. Better mite and scale control can be achieved by spraying 4 sides of the tree. In this case an additional application using 4 gallons of oil in 400 gallons of water is applied immediately after the first application or later, but before bloom. Do not add parathion to oil when spraying McIntosh and related varieties. When sulfur compounds or Captan are used in pre-bloom disease control, follow a non-oil schedule for mites to avoid plant injury.	

Rosy apple aphid, other aphids*

PHOSPHAMIDON (8 pounds/gallon)	$\frac{1}{4}$ pint .....1 pint
	<i>or</i>
DEMETON (SYSTOX) (6 pounds/gallon)	$\frac{1}{4}$ pint .....1 pint
	<i>or</i>
DIMETHOATE (2.67 EC)	$\frac{1}{4}$ pint .....3 pints
	<i>or</i>
DIMETHOATE (25% WP)	1 pound .....4 pounds

*NOTE: Aphid control at pre-pink to early pink offers the best protection against fruit injury.

(Insect Control Continued on Page 23.)

INSECTS

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
Rosy Aphids, Other Aphids, Green Fruitworm, Leafrollers			Tarnished Plant Bug, Green Fruit Worms, Leafrollers, Climbing Cutworms		
PHOSALONE (ZOLONE) (3EC)**	1 pint	4 pints	PARATHION (15% WP)***	1 pound	4 pounds
	or			or	
PHOSALONE (ZOLONE) (25% WP)	1½ pounds	6 pounds	PARATHION LIQUID	0.15 pounds	0.60 pounds
	or			active ingred.	active ingred.
DIAZINON (50% WP)	1 pound	4 pounds		or	
	or		GUTHION (50% WP)	½ pound	2 pounds
IMIDAN (50% WP)	1 pound	4 pounds		or	
**NOTE: PHOSALONE (ZOLONE) may cause plant injury under certain conditions prior to Second Cover.			IMIDAN (50% WP)	1 pound	4 pounds
			***NOTE: Do not add PARATHION to oil when spraying McIntosh and related varieties.		

DISEASES

Pre-Pink and Pink Non-Oil Schedule

Scab

DODINE (CYPREX) (65% WP)	¾ to 1½ pound	1½ to 2 pounds
	or	
DICHLONE (PHYGON) (50% WP)	¾ pound, plus	1 pound, plus
PROTECTANT	½ strength	½ strength
	or	
CAPTAN (50% WP)	2 pounds	8 pounds
	or	
DIKAR* (80% WP)	2 pounds	8 pounds
	or	
BENOMYL (BENLATE)** (50% WP)	4 to 6 oz.	1 to 1½ pounds
	or	
BENOMYL (BENLATE) (50% WP)	2 to 3 oz., plus	8 to 12 oz., plus
SUPERIOR OIL, 70 sec. vis.	1 qt.	4 qts.

*NOTE: DIKAR is suggested primarily when scab, powdery mildew and mites are problems together.

**NOTE: BENOMYL (BENLATE) is active against apple scab, powdery mildew, sooty blotch and fly speck. In our tests, it has suppressed European Red mites, particularly at the 6 oz. rate and above. It is effective post-harvest for blue mold and gray mold.

We have also found that BENOMYL (BENLATE), when used in a seasonal program, has resulted in a slight roughing of the skin on red fruited varieties, like Red Delicious.

The apple industry will decide whether this injury will limit its use on extra fancy fruit.

*NOTE: If mite eggs have not started to hatch, delay ACARALATE application until First Cover.

**NOTE: Liquid formulation of GALECRON and FUNDAL are not compatible with DODINE (CYPREX). Do not mix SP or EC with the combination of DIMETHOATE and DODINE (CYPREX).

European Red Mite, Rosy Aphid, Tarnished Plant Bug, Green Fruitworms, Fruit Tree Leafroller.

European Red Mite		
MORESTAN (25% WP)	½ pound	2 pounds
	or	
CHLOROPROPYLATE (ACARALATE) (2EC)*	1 quart	4 quarts
	or	
GALECRON SP and FUNDAL SP (Soluble powder)	½ pound	2 pounds
	or	
GALECRON (4EC) and FUNDAL (4EC)**	1 pint	4 pints

Rosy Aphids, Other Aphids***, While Apple Leafhopper

DEMETON (SYSTOX) (6 pounds/gallon)		
	1/3 pint	1 1/3 pints
	or	
DIMETHOATE (2.67 EC)	1 1/2 pints	6 pints
	or	
DIMETHOATE (25% WP)	2 pounds	8 pounds
	or	
THIODAN (50% WP)***	1 pound	4 pounds
	or	
THIODAN (2 EC)	1 quart	4 quarts
	or	
PHOSALONE (ZOLONE) (3 EC)	1 pint	4 pints
	or	
DIAZINON (50% WP)	1 pound	4 pounds

Tarnished Plant Bug, Green Fruitworm, Fruit Tree Leafroller

PARATHION (15% WP)	1 pound	4 pounds
	or	
PARATHION LIQUID	0.15 pound	0.60 pound
	active ingred.	active ingred.
	or	
GUTHION (50% WP)	1/2 pound	2 pounds
	or	
IMIDAN (50% WP)	1 pound	4 pounds
	or	
DIAZINON (50% WP)	1 pound	4 pounds

***NOTE: THIODAN also controls Tarnished Plant Bug and Green Fruitworm.

NOTE: See Russetting of Golden Delicious when selecting pesticides — page 15.

APPLES

Period of Bloom

Fire Blight

On susceptible varieties*

BORDEAUX2-6-100

or

STREPTOMYCIN50 to 100 ppm

Timing of bloom sprays: Use STREPTOMYCIN when maximum temperatures above 65°F exist or are anticipated to occur and are accompanied by precipitation or follow rainy days. Use 100 ppm in orchards prone to blight. Dormant pruning of overwintering cankers ½ inch or larger is a must. Remove all cankers on young trees and lightly infected mature trees. (See bloom schedule under PEARS, page 30.)

Post-bloom sprays: STREPTOMYCIN can now be used to within 50 days of harvest. The following suggestions are provided on a trial basis for those wishing to attempt early and mid-summer control of shoot, leaf, and fruit blight. Apply 100 ppm sprays on a 7-day protective

schedule starting at petal fall or 5 to 7 days after the last in-bloom spray. During periods of wet, humid weather shorten interval to 5 to 7 days. Continue program until terminal growth stops. Spray during the evening or early morning hours to increase effectiveness.

Compatibility: Use protective compatible fungicides with STREPTOMYCIN if scab infection periods occur (see page 21). If BORDEAUX is used, fog-spray and apply only under fast drying conditions. Do not use STREPTOMYCIN after a BORDEAUX spray.

*Susceptible varieties include: Wagener, Monroe, Tompkins, King, Twenty Ounce, Rhode Island Greening, Yellow Transparent, Jonathan, Idared, Fenton (Beacon), and many Crab apple varieties. In some years, Golden Delicious and Stayman will develop twig infections. Do not use insecticides in bloom as they are toxic to bees. Remove bees from the orchard before applying Petal Fall Spray.

Petal Fall

(Three-fourths of the petals fallen)

Fruit Scab and Leaf Scab

Red-Banded Leaf Roller,* Plum Curculio,* White Apple Leafhopper, Aphids

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
Same Fungicides as for Pre-Pink and Pink.			Red-Banded Leafroller,**		
			Plum Curculio***		
			GUTHION (50% WP)	½ pound	2 pounds
			or		
			IMIDAN (50% WP)	1 pound	4 pounds
			White Apple Leafhopper, Aphids****		
			Same insecticides as in Pre-Pink and Pink.		

*NOTE: If Red-Banded Leafroller and Plum Curculio are not a serious problem, use PHOSALONE (ZOLONE) or DIAZINON for White Apple Leafhopper and aphid control.

**NOTE: PHEROMONE TRAPS may be used to detect red-banded leafroller and determine spray timing.

***NOTE: If CURCULIO IS VERY SERIOUS, INCREASE GUTHION RATE BY 25% AT PETAL FALL AND FIRST COVER. USE IMIDAN AT 1½ POUNDS (6 POUNDS/ACRE). APPLY SPRAYS 7 DAYS APART.

****NOTE: MAXIMUM KILL OF NYMPHS BY THOROUGH COVERAGE OF UPPER AND LOWER LEAF SURFACES IS MOST ESSENTIAL FOR EFFECTIVE LEAFHOPPER CONTROL. Additional applications of DEMETON or DIMETHOATE or THIODAN or PHOSALONE (ZOLONE) or DIAZINON may be necessary in late August or September to control a second generation of leafhoppers.

NOTE: See sections on Russetting of Jonathan and Golden Delicious on page 15 and Fruit Thinning, pages 16 and 17.

First Cover

(7 to 10 days after Petal Fall)

APPLES

Scab

**Red-Banded Leaf Roller, Plum Curculio,
White Apple Leafhopper, Aphids**

<i>Rate/100 gallons</i>	<i>Rate/acre</i>	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
Same fungicides as in Petal Fall		Same insecticides as in Petal Fall	
		NOTE: A repeat application of Petal Fall recommendations advised if leafhoppers are a major and continued problem.	

Second Cover

(10 to 14 days after First Cover)

Scab

Codling Moth*

CAPTAN (50% WP)	1½ to 2 pounds	6 to 8 pounds
	or	
DODINE (CYPREX)		
(65% WP)	¾ pound	1 pound
	or	
DIKAR (80% WP)	1½ to 2 pounds	6 to 8 pounds
	or	
BENOMYL (BENLATE)		
(50% WP)	4 to 6 oz.	1 to 1½ pounds
	or	
BENOMYL (BENLATE)		
(50% WP)	2 to 3 oz., plus	8 to 12 oz., plus
SUPERIOR OIL,		
70 sec. vis.	1 qt.	4 qts.

GUTHION (50% WP)	½ pound	2 pounds
	or	
SEVIN (50% WP)	1 pound	4 pounds
	or	
SEVIN LIQUID	0.5 pound	2 pounds
	active ingred.	active ingred.
	or	
IMIDAN (50% WP)	1 pound	4 pounds
	or	
DIAZINON (50% WP)	1 pound	4 pounds
	or	
PHOSALONE (ZOLONE)		
(3 EC)	1 pint	4 pints
	or	
PHOSALONE (ZOLONE)		
(25% WP)	1½ pounds	6 pounds

*NOTE: PHEROMONE TRAPS may be used to detect codling moth and determine spray timing.

SUMMER MITE PROGRAMS

Summer mite control is best accomplished by spraying before the mites have a chance to build up. Where mites have increased to large numbers, eradication of these populations is extremely difficult. The following "eradication" programs are suggested to reduce populations of European red mite, two-spotted mite and four-spotted mite. Two sprays spaced 7 to 10 days apart required.

PLICTRAN (50% WP)	4 to 6 ounces	1 to 1½ pounds
	or	
OMITE (30% WP)	1½ pounds	5 pounds
	or	
KELTHANE (18.5% EC)	1 quart	4 quarts
	or	
KELTHANE (35% WP)	1½ pounds	5 pounds
	or	
CARZOL SP	¼ to ½ pound	1 to 2 pounds
(Soluble powder)		
	or (Col. 2)	

CHLOROPROPYLATE		
(ACARALATE)	1 quart	4 quarts
	or	
GALECRON SP and		
FUNDAL SP (Soluble		
powder)	½ pound	2 pounds
	or	
GALECRON (4 EC) and		
FUNDAL (4 EC)**	1 pint	4 pints

**NOTE: Liquid formulation of GALECRON and FUNDAL is not compatible with DODINE (CYPREX).

NOTE: GALECRON and FUNDAL applied in post-bloom cover sprays for mites will control codling moth as well.

NOTE: Complete coverage of upper and lower leaf surfaces is important for maximum control with OMITE.

NOTE: If DIKAR is used as a fungicide program, its mite suppression may make other miticides unnecessary at this time.

Third Cover

(10 to 14 days after Second Cover)

Scab

Codling Moth

CAPTAN (50% WP)	1 to 1½ pound	4 to 6 pounds
	or	
DODINE (CYPREX)		
(65% WP)	¾ pound	1 pound
	or	
DIKAR (80% WP)	1½ pounds	6 pounds
	or	
BENOMYL (BENLATE)		
(50% WP)	4 to 6 oz.	1 to 1½ pounds
	or	
BENOMYL (BENLATE)		
(50% WP)	2 to 3 oz., plus	8 to 12 oz., plus
SUPERIOR OIL, 70 sec. vis.	1 qt.	4 qts.

Same insecticides as for Second Cover.

NOTE: If Green Aphids become a problem, use IMIDAN or DIAZINON or ZOLONE in subsequent Cover sprays.

APPLES

Fourth Cover

(Time to be announced by District Horticultural Agents between June 20 and July 15—based upon special bait trap detection)

Scab

Apple Maggot, Codling Moth

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
DODINE (CYPREX)			GUTHION (50% WP)	$\frac{1}{2}$ pound	2 pounds
(65% WP)	$\frac{1}{4}$ pound	1 pound		or	
	or		SEVIN* (50% WP)	2 pounds	8 pounds
CAPTAN (50% WP)	1 pound	4 pounds		or	
	or		SEVIN LIQUID*	1 pound	4 pounds
DIKAR (80% WP)	1½ pounds	6 pounds		active ingred.	active ingred.
	or			or	
BENOMYL (BENLATE)			GUTHION (50% WP)	$\frac{1}{4}$ pound, plus	1 pound, plus
(50% WP)	4 to 6 oz.	1 to 1½ pounds	SEVIN (50% WP)	$\frac{1}{2}$ pound, or	2 pounds, or
	or		SEVIN LIQUID	0.25 pound	1 pound
BENOMYL (BENLATE)				active ingred.	active ingred.
(50% WP)	2 to 3 oz., plus	8 to 12 oz., plus		or	
SUPERIOR OIL,			LEAD ARSENATE	2 pounds, plus	8 pounds, plus
70 sec. vis.	1 qt.	4 qts.	PARATHION (15% WP)	1 pound, or	4 pounds, or
			PARATHION LIQUID	0.15 pounds	0.60 pounds
				active ingred.	active ingred.
				or	
			LEAD ARSENATE	2 pounds, plus	8 pounds, plus
			SEVIN (50% WP)	1 pound, or	4 pounds, or
			SEVIN LIQUID	0.5 pounds	2 pounds
				active ingred.	active ingred.
				or	
			LEAD ARSENATE	2 pounds, plus	8 pounds, plus
			PHOSPHAMIDON		
			(8 pounds/gallon)	$\frac{1}{4}$ pint	1 pint
				or	
			IMIDAN (50% WP)	1 pound	4 pounds
				or	
			DIAZINON (50% WP)	1 pound	4 pounds
				or	
			PHOSALONE (ZOLONE)	1 pint	4 pints
			(3 EC)		
				or	
			PHOSALONE (ZOLONE)		
			(25% WP)	1½ pounds	6 pounds

CAUTION: Use $\frac{1}{2}$ pound FERBAM as an arsenical corrective if DODINE is used with LEAD ARSENATE. (See Arsenical Injury, page 14.)

Do not use LEAD ARSENATE on varieties ripening before Wealthy.

*NOTE: SEVIN may be used alone on a 10-day schedule only where Apple Maggot is not a severe problem.

APPLES

Fifth Cover

(10 to 14 days after Fourth Cover)

Scab

Codling Moth, Apple Maggot, Red-Banded Leaf Roller*

Same fungicides as for Fourth Cover

Same insecticides as for Fourth Cover

*NOTE: PHEROMONE TRAPS may be used to detect red-banded leafroller and determine spray timing.

Sixth Cover

(10 to 14 days after Fifth Cover)

Scab

Codling Moth, Apple Maggot, Red-Banded Leaf Roller

Same fungicides as for Fourth Cover

Same insecticides as for Fourth Cover

NOTE: To avoid possible excess residues do not apply lead arsenate after July 25 on varieties to be harvested before September 15, and do not use lead arsenate after August 10 on varieties to be harvested after September 15.

Two-spotted mite may attack in extreme numbers at this time. Adults may over-winter in the calyx end of the fruit. Adults of the European red mite may deposit eggs in the calyx end of fruit. Excessive insects in or on

fruit constitutes an adulteration of food products. To prevent excess insects in or on the fruit at harvest, follow the directions given for the control of mites listed under the Summer Mite Programs on page 25.

Seventh and Eighth Cover

(10-14 day intervals after Sixth Cover)

Scab
Codling Moth, Apple Maggot, Red-Banded Leaf Roller

Rate/100 gallons	Rate/acre	Rate/100 gallons	Rate/acre
Same fungicides as for Fourth Cover		GUTHION (50% WP)	½ pound 2 pounds
		or	
		GUTHION (50% WP)	½ pound, plus 1 pound, plus
		SEVIN (50% WP)	½ pound, or 2 pounds, or
		SEVIN LIQUID	0.25 pounds 1 pound
			active ingred. active ingred.
		or	
		IMIDAN (50% WP)	1 pound 4 pounds
		or	
		DIAZINON (50% WP)	1 pound 4 pounds
		or	
		PHOSALONE (ZOLONE)	
		(3 EC)	1 pint 4 pints
		or	
		PHOSALONE (ZOLONE)	
		(25% WP)	1½ pounds 6 pounds
		Codling Moth, Apple Maggot, Red-Banded Leaf Roller, White Apple Leafhopper*	
		SEVIN** (50% WP)	2 pounds 8 pounds
		or	
		SEVIN LIQUID**	1 pound 4 pounds
			active ingred. active ingred.
		*NOTE: DIAZINON or ZOLONE or SYSTOX or DIME- THOATE or THIODAN will also control second generation leafhoppers. See rates under Pre-Pink and Pink.	
		**NOTE: Refer to use of SEVIN for apple maggot under Fourth Cover.	

SPECIAL APPLE DISEASE CONTROLS

(Controls are suggested where these diseases are economic problems)

Silver Tip to Petal Fall

Powdery Mildew (on susceptible varieties)*

Scab fungicide plus	
WETTABLE SULFUR	2 pounds 8 pounds
or	
Scab fungicide plus	
DINOCAP (KARATHANE)	
(25% WP)	½ pound 2 pounds
or	
DIKAR (80% WP)	2 pounds 8 pounds
or	
BENOMYL (BENLATE)	
(50% WP)	4 to 6 oz. 1 to 1½ pounds
or	
BENOMYL (BENLATE)	
(50% WP)	2 to 3 oz., plus 8 to 12 oz., plus
SUPERIOR OIL,	
70 sec. vis.	1 qt. 4 qts.

NOTE: When LIME SULFUR is used, do not use SULFUR or DINOCAP (KARATHANE). Add wetting agent if necessary to wet fungal growth.

*Susceptible varieties to mildew include: Jonathan, Rome Beauty, Cortland, Baldwin, Mornoe, and Idared.

Cover Sprays Starting at Third Cover

Sooty Blotch, Fly Speck and Scab

CAPTAN (50% WP)	1 pound, plus 4 pound, plus
ZINEB (75% WP)	1 pound 4 pounds
or	
CAPTAN (50% WP)	2 pounds 8 pounds
or	
BENOMYL (BENLATE)	
(50% WP)	4 to 6 oz. 1 to 1½ pounds
or	
BENOMYL (BENLATE)	
(50% WP)	2 to 3 oz., plus 8 to 12 oz., plus
SUPERIOR OIL,	
70 sec. vis.	1 qt. 4 qts.

APPLES

First Cover to Third Cover (or cessation of terminal growth)

Powdery Mildew

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
BENOMYL (BENLATE) (50% WP)	4 to 6 oz.	1 to 1½ pounds
	<i>or</i>	
BENOMYL (BENLATE) (50% WP)	2 to 3 oz., plus	8 to 12 oz., plus
SUPERIOR OIL, 70 sec. vis.	1 qt.	4 qts.
Scab fungicide plus WETTABLE SULFUR (325 mesh)	2 pounds	8 pounds
	<i>or</i>	
Scab fungicide plus DINOCAP (KARATHANE) (25% WP)	½ pound	2 pounds
	<i>or</i>	
DIKAR (80% WP)	1½ pounds	6 pounds

Pink to Third Cover

Cedar-Apple Rust

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
FERBAM (76% WP)	2 pounds	8 pounds
	<i>or</i>	
FERBAM (76% WP)	¾ pound, plus	3 pound, plus
SCAB FUNGICIDE	½ strength	½ strength
	<i>or</i>	
THIRAM (THYLATE) (65% WP)	2 pounds	8 pounds

Northwestern Anthracnose (Bull's Eye Rot). Where this disease is a problem, use BENOMYL (BENLATE) (50% WP)

6 oz. per 100 gallons in the late cover sprays, starting in early August and repeat at 2-week intervals up to day of harvest.

Post-Harvest Blue Mold and Gray Mold Control

Blue mold or soft rot and gray mold are the most common storage rots of apple in Michigan. They occur on apple and pear and are caused by the fungi *Penicillium* and *Botrytis*, respectively. Spores of these fungi build up in solutions used to treat apples for scald or in water used in dumping bulk boxes. Decay from blue mold and gray mold can be prevented by adding one of the following fungicides to the storage control solution. Apply as a dip or drench treatment. Good agitation of the treatment solution is essential to keep sufficient

fungicide in suspension. In limited tests, the liquid concentrate appears to make a better mixture than the wettable powder, but this does not eliminate the need for good agitation. When drenching, be sure uniform coverage is obtained throughout the pallet box.

	<i>Rate/100 gallons</i>
THIABENDAZOLE (MERTECT) (42.28% F)	16 fl. oz.
	<i>or</i>
BENOMYL (BENLATE) (50% WP)	8 oz.

Control of Storage Scald

Storage scald or common scald is a functional disorder of apples associated with aging. The susceptible varieties of Cortland, McIntosh, Delicious, Stayman, Turley and Rome Beauty may develop scald after several months of cold or CA storage. Jonathan and Golden Delicious infrequently develop symptoms after 7 to 9 months of storage. Northern Spy, Idared and Steele Red are not affected. Good control of scald on susceptible varieties is attained by prestorage treatment of the fruit with diphenylamine (DPA) or ethoxyquin (Stop Scald). Use DPA at 1000 ppm on all Michigan varieties except Golden Delicious. Use ethoxyquin at 2700 ppm on Golden Delicious

and all other varieties except Delicious, for which it is not effective.

Apply either material as a drench to the crates or bins of fruit within a few days after harvest and prior to storage. The fruit and solution temperature should be in the 50 to 80°F range at the time of treatment. Thorough and constant agitation of the drench solution is essential to maintain the material in suspension. The extended use of a given batch of scald inhibitor will spread disease organisms and thereby increase subsequent fruit rot. Avoid this by changing the solution frequently or by adding a suitable fungicide (see "Post-harvest blue mold and gray mold control").

Days Between Final Spray and Harvest

Insecticides: IMIDAN—7, OMITE—7, and no more than 3 applications per year. PLICTRAN—14 and no more than 4 applications between petal fall and harvest. DIAZINON—14, PHOSALONE (ZOLONE)—14, GALECRON and FUNDAL—14 and no more than 3 applications while fruit is on the tree, THIODAN—21 when not more than 3 applications are used. CHLOROPROPYLATE (ACARALATE)—14; DIME-THOATE—28; DEMETON (SYSTOX)—21; GU-

THION—7; KELTHANE—7; LEAD ARSENATE—30; MORESTAN—35; PARATHION—14; PHOSPHAMIDON—30; SEVIN—1; CARZOL—7 and no more than 4 pounds per acre in a crop season.

Fungicides: CAPTAN—0; DICHLONE (PHYGON)—1; DIKAR—21, DODINE (CYPREX)—7; DINOCAP (KARATHANE)—21; SULPHUR—0; THIRAM (THYLATE)—0; ZINEB—50; STREPTOMYCIN—50; ZIRAM—7; BENOMYL (BENLATE)—0.

PEAR SPRAYING SCHEDULE

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference in the spraying schedule.

The rates of materials for use on pear are based upon a standard of 300 gallons per acre dilute spray for mature trees.

European red mites and two-spotted mites must be controlled to lessen pear leaf scorch. For European red mite control, the preventive schedules give the best control. These schedules include either (1) a superior oil applied

in the delayed-dormant period, or (2) a miticide applied at pre-bloom. For two-spotted mite control, use **two** consecutive applications of a summer miticide sprayed 7 to 10 days apart.

Late Dormant to Delayed Dormant

DISEASES

Pear Scab, Leaf Spot

	Rate/100 gallons	Rate/acre
FERBAM (76% WP)	1½ pounds	4½ pounds

INSECTS

Resistant Pear Psylla*

	Rate/100 gallons	Rate/acre
GROUND APPLICATION		
THIODAN (2 EC)	1 quart	3 quarts
<i>or</i>		
PERTHANE (4 EC)	1 quart	3 quarts
AERIAL APPLICATION		
Flat Fan Nozzles		
THIODAN (2 EC)	1 gallon, plus	
SUPERIOR OIL, 70 sec. vis.	2 gallons, plus	
WATER	2 gallons	
<i>or</i>		
PERTHANE (4 EC)	1 gallon, plus	
SUPERIOR OIL, 70 sec. vis.	2 gallons, plus	
WATER	2 gallons	
Beecomist (40-micron) Nozzles		
THIODAN (2 EC)	2 quarts	
<i>or</i>		
PERTHANE (4 EC)	2 quarts	

*NOTE: Resistant pear psylla refer to those orchards where control with PARATHION, GUTHION, SEVIN OR IMIDAN is no longer effective. Area control of overwintering adults is the single most effective program for psylla, in view of their migratory habits, the abandoned pear orchard situation, increasing resistance to available chemicals, and the fact that later overlapping summer generations are difficult, if not impossible, to manage satisfactorily.

NOTE: FOR BEST RESULTS, THE ABOVE RECOMMENDED MATERIALS MUST BE APPLIED TO CONTROL OVERWINTERING PSYLLA ADULTS BEFORE THEY LAY EGGS. SINCE EGG LAYING GENERALLY BEGINS ABOUT THE FIRST WEEK IN APRIL, WHEN ORCHARDS ARE OFTEN TOO WET TO OPERATE GROUND EQUIPMENT, AIR APPLICATIONS ARE ADVISABLE AND HAVE GIVEN SUPERIOR PSYLLA CONTROL. AIR APPLICATIONS DO NOT REQUIRE DILUTION WITH WATER EXCEPT AS INDICATED. Where GUTHION, SEVIN, PARATHION or IMIDAN still control pear psylla, pre-bloom sprays are not necessary.

PEARS

Green Tip to Pre-Pink

Oil Schedule

Pear Scab, Leaf Spot

European Red Mite, San Jose Scale*

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
FERBAM (76% WP)	1½ pounds	4½ pounds	SUPERIOR OIL, 70 sec. vis.	2 gallons	6 gallons
*NOTE: Refer to San Jose scale in oil schedule on apples.					

Pre-Pink and Pink

Non-Oil Schedule

Pear Scab, Leaf Spot

European Red Mite (preventive program)

FERBAM (76% WP)	1½ pounds	4½ pounds	CHLOROPROPYLATE (ACARALATE)* (2 EC)	1 quart	3 quarts
	or			or	
BORDEAUX	3-8-100		MORESTAN (25% WP)	½ pound	1½ pounds
	or			or	
CAPTAN (50% WP)	2 pounds	6 pounds	GALECRON SP and FUN- DAL SP** (Soluble powder)	½ pound	1½ pounds
				or	
			GALECRON (4 EC) and FUNDAL (4 EC)	1 pint	3 pints

*NOTE: If mite eggs have not started to hatch, delay ACARALATE application until First Cover.

**NOTE: GALECRON and FUNDAL also control pear psylla nymphs.

Tarnished Plant Bug, Green Fruit Worms, Leaf-rollers***

PARATHION (15% WP)	1 pound	3 pounds
	or	
PARATHION LIQUID	0.15 pounds active ingred.	0.45 pounds active ingred.
	or	
GUTHION (50% WP)	½ pound	1½ pounds
	or	
IMIDAN (50% WP)	1 pound	3 pounds
	or	
THIODAN (50% WP)	1 pound	3 pounds
	or	
THIODAN (2 EC)	1 quart	3 quarts

***NOTE: PHEROMONE TRAPS may be used to detect red-banded leafroller and determine spray timing.
NOTE: THIODAN is most specific for plant bugs.

Period of Bloom

(When first blooms start to open)

Fireblight

STREPTOMYCIN*	50 to 100 ppm*
	or
BORDEAUX	2-6-100

Insecticides should not be used during Bloom.

NOTE: Dormant pruning out of overwintering cankers is a must.

PEARS (Continued)

*Streptomycin sprays: Use STREPTOMYCIN when maximum temperatures above 65° exist or are likely, and are accompanied by precipitation or follow rainy days. Use 100 parts per million (ppm), when moderate to severe conditions occur. When temperatures slightly above 65°F are anticipated with moisture, use 50 to 75 ppm.

Apply the first spray before or within 24 hours after favorable conditions develop. Apply a second spray if favorable conditions reappear, or, if blossoms are opening rapidly and favorable conditions persist, 1 to 2 days after previous spray. Repeat applications if warm, wet conditions prevail.

BORDEAUX 2-6-100 is suggested when the fireblight problem is slight and timed as outlined for the STREPTOMYCIN sprays. Do not use STREPTOMYCIN after a BORDEAUX spray.

To avoid fruit russetting, apply BORDEAUX during quick

PEARS

drying conditions and fog the spray into the trees. BORDEAUX controls scab; STREPTOMYCIN does not.

Post-bloom sprays: STREPTOMYCIN can be used to within 30 days of harvest. The following suggestions are provided on a trial basis for those wishing to attempt early and mid-summer control of shoot, leaf, and fruit blight. Apply 100 ppm sprays on a 7-day protective schedule starting at petal fall or 5 to 7 days after the last in-bloom spray. During periods of wet, humid weather shorten interval to 5 to 7 days. Continue program until terminal growth stops. Spray during the evening or early morning hours to increase effectiveness.

BORDEAUX may also be used for late bloom, summer twig, leaf and fruit infection control.

NOTE: Do not encourage excessive growth by excessive fertilization. Insect control is a must in fireblight control.

Petal Fall

(Three-fourths of the petals fallen)

1. Pear Scab, Leaf Spot

2. Fireblight, Scab, Leaf Spot

	Rate/100 gallons	Rate /acre
1. FERBAM (76% WP)	1½ pounds	4½ pounds
	or	
CAPTAN (50% WP)	2 pounds	6 pounds
2. BORDEAUX	2-6-100	

Non-Resistant Pear Psylla, Tarnished Plant Bug, Plum Curculio*, Green Fruit Worms

	Rate/100 gallons	Rate/acre
IMIDAN (50% WP)	1 pound	3 pounds
	or	
GUTHION (50% WP)	½ pound	1½ pounds
	or	
SEVIN (50% WP)	2 pounds	6 pounds
	or	
SEVIN LIQUID	1 pound	3 pounds
	active ingred.	active ingred.
	or	
PARATHION (15% WP)	1 pound	3 pounds
	or	
PARATHION LIQUID	0.15 pounds	0.45 pounds
	active ingred.	active ingred.

ADD 1 GALLON (3 GALLONS PER ACRE) OF 70 SECOND VISCOSITY SUPERIOR OIL TO SEVIN, GUTHION, IMIDAN or PARATHION in the cover sprays if resistant pear psylla are a problem. Time treatments with egg hatching and appearance of nymphs. Make combination oil applications no more often than required to maintain psylla control.

NOTE: THIODAN (50% WP) 1 pound (3 pounds/acre) in combination with the recommended rates of IMIDAN, GUTHION, SEVIN, or PARATHION will improve control of pear psylla, tarnished plant bug and green fruit worm.

*NOTE: IF CURCULIO IS VERY SERIOUS, INCREASE PARATHION OR GUTHION RATE BY 25% AT PETAL FALL AND FIRST COVER. USE IMIDAN AT 1½ POUNDS (4½ POUNDS/ACRE). APPLY SPRAYS 7 DAYS APART.

First Cover

(12 to 14 days after Petal Fall)

1. Pear Scab, Leaf Spot

2. Fireblight, Scab, Leaf Spot

Same fungicides as for Petal Fall

NOTE: If European red mites start to build up, use PLICTRAN (50% WP) 4 to 6 ounces (¾ to 1½ pounds/acre), or OMITE (30% WP) 1½ pounds (3½ pounds/acre), or CHLOROPROPYLATE (ACARALATE) (2 EC) 1 quart (3 quarts/acre), or GALECRON SP and FUNDAL SP ½ pound (1½ pounds/acre), or GALECRON (4 EC) and FUNDAL (4 EC) 1 pint (3 pints/acre), or CARZOL SP ¼ to ½ pound (¾ to 1½ pounds/acre). KELTHANE (35% WP) 1½ pounds (3½ pounds/acre) or KELTHANE (18.5% EC) 1 quart (3 quarts/acre) will control pear rust mites as well. More than 1 spray may be required if mites are numerous.

Pear Psylla, Plum Curculio

Same insecticides as for Petal Fall

NOTE: Complete coverage of upper and lower leaf surfaces is important for maximum control with OMITE.

NOTE: GALECRON and FUNDAL used post-bloom for mites will control pear psylla and codling moth as well.

PEARS

Second Cover

(12 to 14 days after First Cover)

1. Pear Scab, Leaf Blight (*Fabraea*)
2. Fireblight, Scab, Leaf Blight

Non-Resistant Pear Psylla, Codling Moth,* Pear Leaf Blister Mite, Pear Rust Mite

	Rate/100 gallons	Rate/acre
1. FERBAM (76% WP)	1½ pounds	4½ pounds
	or	
CAPTAN (50% WP)	2 pounds	6 pounds
2. BORDEAUX	2-6-100	

	Rate/100 gallons	Rate/acre
SEVIN (50% WP)	2 pounds	6 pounds
	or	
SEVIN LIQUID	1 pound	3 pounds
	active ingred.	active ingred.

Non-Resistant Pear Psylla, Codling Moth

GUTHION (50% WP)	½ pound	1½ pounds
	or	
IMIDAN (50% WP)	1 pound	3 pounds
	or	
PARATHION (15% WP)	1 pound	3 pounds
	or	
PARATHION LIQUID	0.15 pounds	0.45 pounds
	active ingred.	active ingred.
	or	
DIAZINON (50% WP)	1 pound	3 pounds
	or	
PHOSALONE (ZOLONE) (3 EC)	1 pint	3 pints
	or	

PHOSALONE (ZOLONE) (25% WP)	1½ pounds	4½ pounds
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*NOTE: PHEROMONE TRAPS may be used to detect codling moth and determine spray timing.

Aphids Only

DEMETON (SYSTOX) (6 pounds/gallon) ¼ pint	¼ pint
	or
DIMETHOATE (25% WP)	1 pound
	or
DIMETHOATE (2.67 EC)	1 pint
	or
THIODAN (50% WP)	1 pound
	or
THIODAN (2 EC)	1 quart

NOTE: IMIDAN, DIAZINON and ZOLONE also control aphids.

NOTE: THIODAN is also effective on pear psylla and rust mites.

Third Cover

(10 to 14 days after Second Cover)

1. Pear Scab, Leaf Blight
2. Fireblight, Scab, Leaf Blight

Codling Moth

1. FERBAM (76% WP)	1½ pounds	4½ pounds
	or	
CAPTAN (50% WP)	1½ pounds	4½ pounds
2. BORDEAUX	2-6-100	

GUTHION (50% WP)	½ pound	1½ pounds
	or	
SEVIN (50% WP)	1 pound	3 pounds
	or	
SEVIN LIQUID	0.5 pound	1.5 pounds
	active ingred.	active ingred.
	or	
IMIDAN (50% WP)	1 pound	3 pounds
	or	
DIAZINON (50% WP)	1 pound	3 pounds
	or	
PHOSALONE (ZOLONE)	1 pint	3 pints
(3 EC)	or	
PHOSALONE (ZOLONE) (25% WP)	1½ pounds	4½ pounds

NOTE: PERTHANE (4 EC) 1 quart (3 quarts/acre) or THIODAN (50% WP) 1 pound (3 pounds/acre) or THIODAN (2 EC) 1 quart (3 quarts/acre) in 2 applications 7 days apart will control summer populations of resistant psylla. THIODAN is also effective on rust mite and aphids.

NOTE: Continue Bordeaux in subsequent sprays if fireblight is not controlled.

Fourth Cover*(10 to 14 days after Third Cover)***Pear Scab, Leaf Blight**

Same fungicides as for Third Cover.

Codling Moth

Same insecticides as for Third Cover.

NOTE: Fungicides are not necessary in Late Cover sprays when good early control of scab and blight has been achieved.

Fifth Cover*(Time to be announced by District Horticultural agents – based on second brood codling moth emergence)***Pear Scab, Leaf Blight**

Same fungicides as for Third Cover.

Codling Moth

Same insecticides as for Third Cover.

Days Between Final Spray and Harvest

Insecticides: IMIDAN-7; PERTHANE-7; OMITE-14 and no more than 2 applications per season; THIODAN-7 and a limit of 2 applications or 21 with 5 applications during the fruiting period; GALECRON and FUNDAL-28 and not more than 3 applications while fruit is on the tree; DEMETON-21; DIMETHOATE-28; CHLOROPROPYLATE (ACARALATE)-14; GUTHION-7; KELTHANE-7; MORESTAN-35; PARATHION-14; SEVIN-1; PLICTRAN-14 and no more than 3 applications between petal fall and harvest; DIAZINON-14; PHOSALONE (ZOLONE)-14; CARZOL-7 and no more than 4 pounds per acre in a crop season.

Fungicides: FERBAM-7; CAPTAN-0; COPPER-0; STREPTOMYCIN-30.

PEACH-NECTARINE SPRAYING SCHEDULE

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference in the spraying schedule.

THE RATES OF MATERIALS FOR USE ON PEACH ARE BASED ON A STANDARD OF 300 GALLONS PER ACRE DILUTE SPRAY FOR MATURE TREES.**VALSA CANKER**

Delay pruning as close as possible to the beginning of tree growth or later to allow rapid healing. Some fungicidal protection is obtained against Valsa infection in newly exposed cuts from the leaf curl and bloom sprays. For best results time the spray or sprays before rain occurs after pruning.

NOTE: Control of borers is essential.

Cultural Practices

Cultural practices to reduce cold injury by hardening off the trees by the fall are important. These include late spring pruning, early fertilization and early cover cropping (by July 4) in clean cultivated orchards. Leave no stubs when pruning and remove and burn prunings as soon as possible. Develop trees with wide angle crotches to reduce splitting.

Check trees for dead and diseased wood after growth starts and cut out and burn.

PRE-PLANT TREATMENT TO CONTROL PEACH TREE BORER

Check plants for Crown Gall. If plants are not infected with Crown Gall, dip trees in bundles or individually in THIODAN (2 EC) used at the rate of 10 quarts per

100 gallons water. Dip trees several inches above the grafting bud scar and plant immediately or allow to dry before returning to storage.

PEACHES-NECTARINES

Dormant

Peach Leaf Curl

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
In fall after leaf drop or spring before bud swell		
FERBAM (76% WP)	1½ to 2 pounds	4.5 to 6 pounds
	<i>or</i>	
BORDEAUX	6-6-100	
(Use on bacterial spot susceptible varieties.)		
In the spring only		
LIME SULFUR	5 gallons	15 gallons

Climbing Cutworms

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
PARATHION (15% WP)	2 pounds	6 pounds
	<i>or</i>	
PARATHION LIQUID	0.30 pounds	1 pound
	active ingred.	active ingred.

NOTE: When growth starts, spray ground 3 feet from tree trunk plus trunk and main branches thoroughly. Guthion will not control climbing cutworms. Apply at night for best control.

Pink

Plant Bugs

PARATHION (15% WP)	1 pound	3 pounds
	<i>or</i>	
IMIDAN (50% WP)	1 pound	3 pounds
	<i>or</i>	
THIODAN (2 EC)	1 quart	3 quarts
	<i>or</i>	
THIODAN (50% WP)	1 pound	3 pounds

NOTE: THIODAN is most specific for plant bugs.

Bloom

(Balloon pink through bloom)

Brown Rot (blossom blight)

LIME SULFUR		
(balloon pink only)	2 gallons	6 gallons
	<i>or</i>	
BENOMYL (BENLATE)		
(50% WP)	½ pound	1.5 pounds
	<i>or</i>	
DICHLONE (PHYGON)		
(50% WP)	½ pound	1.5 pounds
	<i>or</i>	
WETTABLE SULFUR	5 pounds	15 pounds
Continue at 2 to 4 day intervals if wet, rainy weather prevails.		

Insecticides should not be used during Bloom.

Petal Fall

Oriental Fruit Moth*, Plant Bugs, Green Peach Aphid, Plum Curculio

Brown Rot, Powdery Mildew

WETTABLE SULFUR	5 pounds	15 pounds
	<i>or</i>	
SULFUR PASTE	6 pounds	18 pounds
	<i>or</i>	
BENOMYL (BENLATE)		
(50% WP)	½ pound	1.5 pounds

NOTE: Use only if Brown Rot control is necessary in Petal Fall or Shuck Split.

Oriental Fruit Moth, Plant Bugs, Plum Curculio

PARATHION (15% WP)	1½ pounds	4½ pounds
	<i>or</i>	
PARATHION LIQUID	0.23 pounds	0.70 pounds
	active ingred.	active ingred.
	<i>or</i>	
GUTHION (50% WP)	½ pound	1½ pounds
	<i>or</i>	

GUTHION
(2 pounds/gallon SC) 1 pint 3 pints

*NOTE: PHEROMONE TRAPS can be used to determine need for Oriental fruit moth control.

PEACHES-NECTARINES

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
Bacterial Spot, Brown Rot					
On trial basis for susceptible varieties*					
DODINE (CYPREX)			SEVIN (50% WP)	2 pounds	6 pounds
(65% WP)	¾ pound, plus	1.5 pounds, plus	or		
CAPTAN (50% WP)	1 pound	3 pounds	SEVIN LIQUID	1 pound	3 pounds
			active ingred.	active ingred.	
			or		
			IMIDAN (50% WP)	1 pound	3 pounds
Plant Bugs, Other Cat-facing Insects					
			THIODAN** (50% WP)	1 pound	3 pounds
			or		
			THIODAN** (2 EC)	1 quart	3 quarts
Green Peach Aphid					
			DEMETON (SYSTOX)		
			(6 pounds/gallon)	1/3 pint	1 pint
**NOTE: THIODAN is also effective on green peach aphid.					
NOTE: If used here, limit THIODAN to one application before harvest for peach tree borers to avoid possible illegal residues.					

NOTE: Repeat at 7- to 10-day intervals for 5 applications to reduce leaf and fruit infection. Spray injury may result if combined with, or applied near, solvent formulations of insecticides or sulfur. Do not apply during periods of high temperatures.

*Susceptible varieties include: Suncling, Babygold-5, Kalthaven, Suncrest, Blake, Sunhigh and certain nectarine varieties.

Shuck Split

(Usually 10 to 12 days after Petal Fall)

Brown Rot and Powdery Mildew**

BENOMYL (BENLATE)	
(50% WP)	½ pound 1.5 pounds
or	
WETTABLE SULFUR	5 pounds 15 pounds

**Powdery Mildew has been found on fruit in a number of orchards that had not been sprayed with sulfur in the early fruit development period. Symptoms are smooth, leathery, light-brown spots.

NOTE: Continue Bacterial Spot program in problem orchards.

Plum Curculio*, Oriental Fruit Moth

PARATHION (15% WP)	1½ pounds	4½ pounds
or		
PARATHION LIQUID	0.23 pounds	0.70 pounds
active ingred.	active ingred.	
or		
GUTHION (50% WP)	½ pound	1½ pounds
or		
GUTHION (2 pounds/gallon SC)	1 pint	3 pints
or		
SEVIN (50% WP)	2 pounds	6 pounds
or		
SEVIN LIQUID	1 pound	3 pounds
active ingred.	active ingred.	
or		
IMIDAN (50% WP)	1 pound	3 pounds

*NOTE: IF CURCULIO IS VERY SERIOUS, INCREASE PARATHION OR GUTHION RATE BY 25% AT SHUCK SPLIT AND FIRST COVER. USE IMIDAN AT 1½ POUNDS (4½ POUNDS/ACRE.) APPLY SPRAYS 7 DAYS APART.

Control Programs for Peach Tree Borers

Only a low degree of control of the lesser peach tree borer is obtained where phosphate insecticides are used in the regular cover sprays and applied with an air-blast sprayer. Better control may be obtained with phosphates if applied as a dilute spray.

In orchards where lesser peach tree borer and regular peach tree borer are a problem, the following program is suggested:

Use THIODAN (2 EC), 1½ quarts (4½ quarts/acre) or THIODAN (50% WP), 1½ pounds (4½ pounds/acre). Apply first spray June 3-10. Apply second spray 3 weeks later.

Lesser peach tree borer is present throughout the season until October. In problem orchards, a post-harvest spray of THIODAN can reduce late season infestations.

Make all insecticide applications with a high-pressure gun. Apply as a coarse dilute spray to the entire tree concentrating on the scaffold limbs, crotches, and trunk of the tree to the ground level. Thorough coverage, particularly of the susceptible areas mentioned above, is a must for effective borer control.

CAUTION: Plastic type mouse guards encourage peach tree borer problems and interfere with effective THIODAN spray coverage.

PEACHES-NECTARINES

First Cover

(10 to 12 days after Shuck Split)

Peach Scab and Powdery Mildew

Plum Curculio, Oriental Fruit Moth

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
WETTABLE SULFUR	5 pounds	15 pounds
	<i>or</i>	
BENOMYL (BENLATE)		
(50% WP)	½ pound	1.5 pounds

Same insecticides as suggested for Shuck Split

Second Cover

(14 days after First Cover)

Powdery Mildew

Oriental Fruit Moth

Same as First Cover. If mildew was severe in 1972 use sulfur in the next two cover sprays.

Same insecticides as suggested for Shuck Split and First Cover.

	<i>or</i>
PHOSALONE (ZOLONE)	
(3 EC)	1 pint 3 pints
	<i>or</i>
PHOSALONE (ZOLONE)	
(25% WP)	1½ pounds 4½ pounds

Third Cover

(14 days after Second Cover)

Peach Scab

Oriental Fruit Moth, Mites

WETTABLE SULFUR	5 pounds	15 pounds
	<i>or</i>	
CAPTAN (50% WP)	2 pounds	6 pounds
	<i>or</i>	
BENOMYL (BENLATE)		
(50% WP)	½ pound	1.5 pounds

Same insecticides as suggested for Second Cover.

Mites

OMITE (30% WP)	1¼ pounds	3¾ pounds
	<i>or</i>	
KELTHANE (35% WP)	1¼ pounds	3¾ pounds
	<i>or</i>	
KELTHANE (18.5 EC)	1 quart	3 quarts

NOTE: Lecanium Scale—Use Parathion or Sevin at rates given under Shuck Split spray. Apply when crawlers are first observed (June 25 to July 15). Make second application 10 to 14 days later.

Fourth Cover

(10 to 14 days after Third Cover)

Brown Rot

Oriental Fruit Moth

CAPTAN (50% WP)	2 pounds	6 pounds
	<i>or</i>	
WETTABLE SULFUR	5 pounds	15 pounds
	<i>or</i>	
BENOMYL (BENLATE)		
(50% WP)	½ pound	1.5 pounds

GUTHION (50% WP)	½ pound	1½ pounds
	<i>or</i>	
GUTHION (2 pounds/	1 pint	3 pints
gallon SC)		
	<i>or</i>	
SEVIN (50% WP)	2 pounds	6 pounds
	<i>or</i>	
SEVIN LIQUID	1 pound	3 pounds
	active ingred.	active ingred.
	<i>or</i>	
PARATHION (15% WP)	1½ pounds	4½ pounds
	<i>or</i>	
PARATHION LIQUID	0.23 pounds	0.70 pounds
	active ingred.	active ingred.
	<i>or</i>	
IMIDAN (50% WP)	1 pound	3 pounds
	<i>or</i>	
PHOSALONE (ZOLONE)		
(3 EC)	1 pint	3 pints
	<i>or</i>	
PHOSALONE (ZOLONE)		
(25% WP)	1½ pounds	4½ pounds

Pre-Harvest Covers

(10 to 14 days after Fourth Cover. Repeat as often as needed until harvest)

Brown Rot

Same fungicides as for Fourth Cover.

Oriental Fruit Moth

Same insecticides as for Fourth Cover and also later as needed for insect control.

CAUTION: Since dates of harvest of peaches will vary considerably depending on variety, special consideration should be given to the interval between final spray and harvest, depending on the chemical used and the peach variety.

Post-Harvest Disease Control

See Page 48.

CHOCKECHERRY ERADICATION FOR X-DISEASE CONTROL

Eradication of chokecherry bushes within a 500-foot radius of stone fruit orchards is important in the control of X-disease. Chokecherry bushes are commonly found in hedgerows, along property lines, in woods, and on other non-crop areas. Their removal can be accomplished by bulldozing, deep plowing, burning, or pulling the individ-

ual bushes. Brush killers are effective in areas where cultivation is not possible or is too costly. During the growing season following treatment or cultivation, check the treated area carefully for chokecherry sprouts. Any sprouts, or new chokecherry seedlings should be marked for treatment in the fall, or pulled out.

Summer Control

- | Herbicide | Amount | Method of Application |
|----------------------------|----------------------|-----------------------|
| 1. Ammonium Sulfamate..... | ¼ pound/gallon..... | spray to run-off |
| (Ammate) | | |
| 2. Ammonium Sulfamate..... | 2½ pound/gallon..... | brush on freshly |
| (Ammate) | | cut stubs |

Fall or Early Winter

1. 2, 4, 5-T ester in See label Apply to basal part of
fuel oil trunk to 12 to 15
inches above ground line
2. 2, 4, 5-T ester in See label Cover freshly cut stump
fuel oil and stubs

NOTE: The use of 2, 4, 5-T is prohibited in some grape growing areas from May 1 to October 1. Consult local authorities concerning such laws before using this herbicide.

Fall Soil Fumigation

See Nematode Control, page 4

Days Between Final Spray and Harvest

Insecticides: IMIDAN-14; OMITE-14 and no more than 2 applications per year; DEMETON (SYSTOX)-30; GUTHION-21; KELTHANE-14; PARATHION-14; SEVIN-1 on peaches and 3 for nectarines; THIODAN-21 for Peach Tree Borer and 30 for Lesser Peach Tree Borer. Do not make more than 2 applications during fruiting period; PHOSALONE (ZOLONE)-14.

Fungicides: BENOMYL (BENLATE)-0; BOTRAN-1; CAPTAN-0; DODINE (CYPREX)-15; SULFUR-0.

APRICOT SPRAYING SCHEDULE

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference in the spraying schedule.

THE RATES OF MATERIALS FOR USE ON APRICOT ARE BASED ON A STANDARD OF 300 GALLONS PER ACRE DILUTE SPRAY FOR MATURE TREES.

Period of Bloom

(Balloon Pink Through Bloom)

Brown Rot (blossom blight)

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>		<i>Rate/100 gallons</i>	<i>Rate/acre</i>
CAPTAN (50% WP)	2 pounds	6 pounds	Insecticides should not be used during Bloom.		
or					
BENOMYL (BENLATE)					
(50% WP)	½ pound	1.5 pounds			
Repeat applications at 2-to-4 day intervals if wet, rainy weather prevails.					

Petal Fall Spray

Brown Rot, Scab

CAPTAN (50% WP)	2 pounds	6 pounds
or		
BENOMYL (BENLATE)		
(50% WP)	½ pound	1.5 pounds

Plum Curculio

GUTHION (50% WP)	½ pound	1½ pounds
or		
GUTHION (2 pounds/ gallon SC)	1 pint	3 pints
or		
SEVIN (50% WP)	2 pounds	6 pounds
or		
PARATHION (15% WP)	2 pounds	6 pounds
or		
IMIDAN (50% WP)	1 pound	3 pounds
*NOTE: IF CURCULIO IS VERY SERIOUS, INCREASE PARATHION OR GUTHION RATE BY 25% AT PETAL FALL AND SHUCK SPLIT. USE IMIDAN AT 1½ POUNDS (4½ POUNDS/ACRE). APPLY SPRAYS 7 DAYS APART.		

Shuck Split Spray

Brown Rot, Scab

CAPTAN (50% WP)	2 pounds	6 pounds
or		
BENOMYL (BENLATE)		
(50% WP)	½ pound	1.5 pounds

Plum Curculio,* Oriental Fruit Moth

Same as Petal Fall Spray.

First Cover Spray

(8-10 Days After Shuck Split)

Apricot Scab

Same as Shuck Split Spray

Plum Curculio, Oriental Fruit Moth

Same as Petal Fall and Shuck Split Spray.

PEACH TREE BORERS: Refer to control programs under Peach Spraying Schedule. THIODAN may be used up to 21 days of harvest for peach tree borer and 30 for lesser peach tree borer.

Second Cover Spray

(8-10 Days After First Cover)

Apricot Scab

Oriental Fruit Moth

Same as Shuck Split Spray

Same as First Cover Spray.

Summer Sprays

(Starting End of June)

Apricot Scab, Brown Rot

Oriental Fruit Moth, Apple Maggot

	Rate/100 gallons	Rate/acre
CAPTAN (50% WP)	2 pounds	6 pounds
or		
BENOMYL (BENLATE) (50% WP)	$\frac{1}{2}$ pound	1.5 pounds

NOTE: Repeat applications if wet, humid conditions prevail (preharvest period).

SEVIN (50% WP)	2 pounds	6 pounds
NOTE: Three applications at 10-day intervals starting about June 25.		
or		
GUTHION (50% WP)	$\frac{1}{2}$ pound	1 $\frac{1}{2}$ pounds
or		
GUTHION (2 pounds/ gallon SC)	1 pint	3 pints
or		
IMIDAN (50% WP)	1 pound	3 pounds
or		
PHOSALONE (ZOLONE) 3 EC	1 pint	3 pints
or		
PHOSALONE (ZOLONE) (25% WP)	1 $\frac{1}{2}$ pounds	4 $\frac{1}{2}$ pounds
NOTE: Two applications at 14-day intervals. Last application not closer than 14 days before harvest.		
NOTE: Timing for apple maggot to be announced by District Horticultural Agents — based upon special bait trap detection.		

Special Problems

European Red Mite

KELTHANE (35% WP)1 $\frac{1}{4}$ pounds3 $\frac{3}{4}$ pounds

NOTE: Two applications any time from shuck split to end of season. 14 days of harvest.

Days Between Final Spray and Harvest

Insecticides: GUTHION—21; PARATHION—14; KELTHANE—14; SEVIN—3; THIODAN—21 for Peach Tree Borer and 30 for Lesser Peach Tree Borer. Do not make more than 2 applications during fruiting period. IMIDAN—14; PHOSALONE (ZOLONE)—14.

Fungicides: BENOMYL (BENLATE)—0; CAPTAN—0.

PLUM AND PRUNE SPRAYING SCHEDULE

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference in the spraying schedule. The rates of materials for use on plum and prune are based on a standard of 300 gallons per acre dilute spray for mature trees.

For European red mite control, the preventive schedules give the best control. These schedules include either

(1) a "superior oil" applied in the Delayed Dormant stage, or (2) a miticide applied at Pink.

DISEASES *Delayed Dormant* INSECTS *Oil Schedule*

European Red Mite (preventive program)
Lecanium Scale*

Rate/100 gallons Rate/acre

Superior Oil, 70 second
viscosity2 gallons6 gallons

NOTE: For scale control, add 3 pounds/acre of PARATHION (15% WP) to the oil.

*See apple schedule, Page 22. Also see Page 5.

BLACK KNOT OF PLUM AND PRUNE

Black knot can be controlled by carrying out a combined cultural and spray program. The control measures follow:

1. Prune out and burn all knots in the dormant season and continue to remove knots whenever they are observed. Make all pruning cuts at least 6 to 8 inches below visible swellings.

2. Do not plant new plum orchards next to old plantings with black knot. Remove infected wild plums and cherry seedlings from fence rows and nearby wooded

areas before planting. Examine the border area for at least a distance of 600 feet annually for black knot and remove infected plants (see herbicide recommendations for X-disease hosts, Page 37).

3. Carry out the fungicide program outlined on the following pages. Timing of sprays has been changed in recent years based on new knowledge on the life cycle of the disease and is now similar to the schedule for cherry leaf spot control. Continue sprays until growth stops.

Pink *Non-Oil Schedule*

European Red Mite (preventive mite program)

MORESTAN (25% WP)½ pound1½ pounds

Bloom

Rate/100 gallons Rate/acre

Brown Rot

LIME SULFUR
(early bloom)2 gallons6 gallons

or
BENOMYL (BENLATE)½ pound1.5 pounds
(50% WP)

or
DICHLONE (PHYGON)
(50% WP)½ pound1.5 pounds

or
WETTABLE SULFUR5 pounds15 pounds

Black Knot

ZINEB (75% WP)2 pounds6 pounds

NOTE: In recent tests at MSU, Zineb 75W at 2 lbs. per 100 gallons reduced leaf spot on plum along with black knot. In this and similar tests, BENOMYL (BENLATE) looked promising for black knot.

Insecticides should not be used during Bloom.

Petal Fall**Plum Curculio*, Leaf Rollers**

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>		<i>Rate/100 gallons</i>	<i>Rate/acre</i>
Leaf Spot, Brown Rot					
FERBAM (76% WP)	.....1 pound, plus		GUTHION (50% WP)	.....½ pound	.....1½ pounds
WETTABLE SULFUR	.....3 pounds		<i>or</i>		
BENOMYL (BENLATE)	.....½ pound	.....1.5 pounds	GUTHION (2 pounds/ gallon SC)	.....1 pint	.....3 pints
(50% WP)			<i>or</i>		
Black Knot*			PARATHION (15% WP)	.....1½ pounds	.....4½ pounds
ZINEB (75% WP)	.....2 pounds	.....6 pounds	<i>or</i>		
			PARATHION LIQUID	.....0.23 pounds	.....0.70 pounds
			active ingred.		active ingred.
			<i>or</i>		
			IMIDAN (50% WP)	.....1 pound	.....3 pounds
*NOTE: Recent Pennsylvania studies indicate most black knot infection occurs from petal fall until growth stops.			*NOTE: IF CURCULIO IS VERY SERIOUS, INCREASE PARATHION OR GUTHION RATE BY 25% AT PETAL FALL AND SHUCK SPLIT. USE IMIDAN AT 1½ POUNDS (4½ POUNDS/ACRE). APPLY SPRAYS 7 DAYS APART.		

Shuck Split*(Usually 10 to 14 days after Petal Fall)***Plum Curculio**

Leaf Spot, Brown Rot					
FERBAM (76% WP)	.....1½ to 2 pounds	.....4.5 to 6 pounds	PARATHION (15% WP)	.....1½ pounds	.....4½ pounds
<i>or</i>			<i>or</i>		
FERBAM (76% WP)	.....1 pound, plus	.....3 pounds, plus	PARATHION LIQUID	.....0.23 pounds	.....0.70 pounds
WETTABLE SULFUR	.....3 pounds	.....9 pounds	active ingred.		active ingred.
<i>or</i>			<i>or</i>		
BENOMYL (BENLATE)	.....½ pound	.....1.5 pounds	GUTHION (15% WP)	.....½ pound	.....1½ pounds
(50% WP)			<i>or</i>		
<i>or</i>			GUTHION		
LIME SULFUR	.....2 gallons	.....6 gallons	(2 pounds/gallon SC)	.....1 pint	.....3 pints
Black Knot			<i>or</i>		
ZINEB (75% WP)	.....2 pounds	.....6 pounds	IMIDAN (50% WP)	.....1 pound	.....3 pounds
			NOTE: Check compatibility of insecticides with lime sulfur.		

First Cover*(10 days after Shuck Split)***Leaf Spot, Black Knot****Plum Curculio**

Same fungicides as Shuck Split, except LIME SULFUR

Same insecticides as for Shuck Split

LECANIUM SCALE: The young crawlers can be controlled with PARATHION (15% WP) 1½ pounds (4½ pounds/acre), or PARATHION LIQUID, 0.23 pounds active ingredient (0.70 pounds active ingredient/acre), or GUTHION (50%

WP), ½ pound (1½ pounds/acre) or GUTHION (2 pounds/gallon SC), 1 pint (3 pints/acre) applied when crawlers are first observed (usually June 25 to July 15). Make a second application 10 to 12 days later.

PEACH TREE BORERS: See control section under Peach Spraying Schedule, page 35. Thiodan may be used up to 7 days of harvest.

MITES: If European red mites build up, spray with OMITE (30% WP), 1¼ pounds (3¾ pounds/acre) or KELTHANE (18.5% EC), 1 quart (3 quarts/acre). Do not repeat KELTHANE application within 30 days of last application. Complete coverage of upper and lower leaf surfaces is important for maximum control with OMITE.

PLUMS AND PRUNES

Second Cover

(10 to 14 days later)

Leaf Spot, Black Knot

Leafhoppers

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>		<i>Rate/100 gallons</i>	<i>Rate/acre</i>
Same fungicides as shuck split, except lime sulfur.			PARATHION (15% WP)	.....1½ pounds	.....4½ pounds
			or		
			PARATHION LIQUID	.....0.23 pounds	.....0.70 pounds
				active ingred.	active ingred.
SPECIAL APPLE MAGGOT SPRAYS. LEAD ARSENATE—2 pounds (6 pounds/acre), or GUTHION (50% WP)—½ pound (1½ pounds/acre) or GUTHION (2 pounds/gallon SC)—1 pint (3 pints/acre), or IMIDAN (50% WP) 1 pound (3 pounds/acre). If maggot is a problem, the timing of sprays is the same as in the apple spraying schedule.					

Third Cover

(About 1 month before harvest)

Apple Maggot

Brown Rot, Leaf Spot

CAPTAN (50% WP)2 pounds6 pounds
or

BENOMYL (BENLATE)
(50% WP)½ pound1.5 pounds

Brown Rot only

WETTABLE SULFUR5 pounds15 pounds

NOTE: Continue with a Black Knot material until growth stops.

See Special Apple Maggot Sprays under Second Cover.

NOTE: See interval to harvest for lead arsenate.

Fourth Cover

(15 days before harvest)

Brown Rot, Leaf Spot

Same fungicides as Third Cover. (Repeat if necessary near or at harvest. Add spreader if necessary.)

Apple Maggot

See Special Apple Maggot Sprays under Second Cover.

NOTE: See interval to harvest for lead arsenate.

Post-Harvest Disease Control

See Page 48.

Days Between Final Spray and Harvest

Insecticides: GUTHION—15; KELTHANE—7; LEAD ARSENATE—30; MORESTAN—Do not apply after first bloom. OMITE—28 and no more than 2 applications per year. PARATHION—14; THIODAN—7; IMIDAN—7.

Fungicides: BENOMYL (BENLATE)—0; CAPTAN—0; FERBAM—7; SULFUR—0; ZINEB—30.

Red Tart (Sour) Cherry Spraying Schedule

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference in the spraying schedule. The rates of materials for use on cherry are based on a standard of 300 gallons per acre dilute spray for mature trees.

Dormant

(1 to 2 weeks before bud break)

DISEASES

European Brown Rot

	Rate/100 gallons	Rate/acre
--	------------------	-----------

NOTE: In orchards north of Ottawa County along Lake Michigan where European Brown Rot is a problem, cutting out the twigs and branches killed by the fungus will aid in blossom blight control. Pruning trees to allow for good air drainage will also help.

INSECTS

	Rate/100 gallons	Rate/acre
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If case-bearers, mineola moth, bud moth, or peach twig borer were a problem the previous season, use one of the following control programs: Delayed Dormant: Spray with PARATHION (15% WP), 1 pound (3 pounds/acre); or GUTHION (2 pounds/gallon SC), 1 pint (3 pints/acre).

Bloom

American Brown Rot (Blossom Blight)

DICHLONE (PHYGON)		
(50% WP)	$\frac{1}{2}$ pound	1.5 pound
	or	
WETTABLE SULFUR	5 pounds	15 pounds
	or	
BENOMYL (BENLATE)		
(50% WP)	$\frac{1}{4}$ to $\frac{1}{2}$ pound	$\frac{1}{4}$ to 1 $\frac{1}{2}$ pounds

Insecticides should not be used during Bloom.

NOTE: European brown rot may be a problem in bloom where a previous history of the disease exists. In tests in California and Oregon, BENOMYL (BENLATE) has given control of both European and American brown rot blossom blight. Michigan tests have been with American brown rot.

Petal Fall

(Three-fourths of the petals fallen)

Leaf Spot

DODINE (CYPREX)*		
(65% WP)	$\frac{1}{4}$ to $\frac{1}{2}$ pounds	$\frac{1}{2}$ to 1 pound
	or	
DIFOLATAN** (4 EC)	1 to 2 pints	3 to 6 pints
	or	
BENOMYL (BENLATE)		
(50% WP)	$\frac{1}{4}$ to $\frac{1}{2}$ pound	$\frac{1}{4}$ to 1 $\frac{1}{2}$ pounds

*Increase Dodine (Cyprex) to $\frac{1}{2}$ pound under severe leaf spot conditions.

**NOTE: DIFOLATAN at 1 pint has given good leaf spot control with proper timing and thorough spray coverage. Use 2 pints for brown rot control or when conditions for leaf spot are severe.

NOTE: BENOMYL (BENLATE) at $\frac{1}{4}$ to $\frac{1}{2}$ pound per 100 gallons has given good leaf spot and brown rot control on tart cherries in tests at MSU and outstate Michigan. A post-harvest application was needed to prevent early defoliation when conditions for leaf spot were severe.

Plum Curculio,* Cherry Fruitworm, Leafrollers, Peach Twig Borer

PARATHION (15% WP)	1 $\frac{1}{2}$ pounds	4 $\frac{1}{2}$ pounds
	or	
PARATHION LIQUID	0.23 pounds	0.70 pounds
	active ingred.	active ingred.
	or	
GUTHION (50% WP)	$\frac{1}{2}$ pound	1 $\frac{1}{2}$ pound
	or	
GUTHION (2 pounds/ gallon SC)	1 pint	3 pints
	or	
IMIDAN (50% WP)	1 pound	3 pounds

NOTE: Cyprex may not be compatible with Guthion (SC), particularly under hard water conditions.

*NOTE: IF CURCULIO IS VERY SERIOUS, INCREASE PARATHION OR GUTHION RATES BY 25% AT PETAL FALL AND FIRST COVER. USE IMIDAN AT 1 $\frac{1}{2}$ POUNDS (4 $\frac{1}{2}$ POUNDS/ACRE). APPLY SPRAYS 7 DAYS APART.

RED TART CHERRIES

First Cover

(10 to 14 days after Petal Fall)

Leaf Spot

Same fungicides as Petal Fall.

Plum Curculio, Cherry Fruitworm, Mineola Moth*, Lesser Peach Tree Borer**

Same insecticides as Petal Fall.

*Mineola Moth: Timing will be announced by your county agricultural agent. Use PARATHION or GUTHION at the rates shown under Petal Fall. Two sprays at 10-day intervals will be necessary to control first brood adult emergence.

**NOTE: Lesser Peach Tree Borer has become a serious problem on tart cherry trees due to mechanical harvesting. Shaking the trees bruises and breaks the bark on the trunk and scaffold limbs, thus attracting and providing egg-laying sites for the moth. Air blast applications are not effective. Applications must be made with a high-pressure gun. Refer to control programs under the Sweet Cherry Spraying Schedule, page 46.

Second Cover

(10 days after First Cover—Not needed unless Mineola Moth is a problem)

Leaf Spot

Mineola Moth*

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
DODINE (CYPREX)			GUTHION (2 pounds/		
(65% WP)	¼ to ½ pound	¾ to 1 pound	gallon SC)	1 pint	3 pints
	or			or	
DIFOLATAN (4 EC)	1 to 2 pints	3 to 6 pints	GUTHION (50% WP)	½ pound	1½ pounds
	or			or	
BENOMYL (BENLATE)			PARATHION (15% WP)	1½ pounds	4½ pounds
(50% WP)	¼ to ½ pound	¾ to 1½ pounds		or	
			PARATHION LIQUID	0.23 pounds	0.70 pounds
				active ingred.	active ingred.

NOTE: Use ½ pound FERBAM when DODINE (CYPREX) is used with LEAD ARSENATE.

If Diazinon, Guthion, or Sevin are mixed with fixed Copper and Lime, spray immediately, since their effectiveness will be reduced if left standing in the tank.

NOTE: A spotting of tart cherry fruit was observed in 1971 when liquid GUTHION and DODINE (CYPREX) or DIFOLATAN or BENOMYL (BENLATE) were applied at 65X concentration from aircraft, with high temperatures at application or soon thereafter. Injury was noted again in 1972 and subsequent laboratory studies confirmed that high concentrations and high temperatures accentuate the problem, particularly with DODINE (CYPREX) and with liquid GUTHION. Avoid these combinations at high concentration under extreme temperature conditions. Wettable powder mixtures are preferred to mixtures of wettable powders with emulsifiable concentrates.

Forbes Scale: Use GUTHION (50% WP)—1½ pounds (3¾ pounds/acre) or GUTHION (2 pounds/gallon SC), 1½ pints (3¾ pints/acre), or SEVIN (50% WP)—2 pounds

*NOTE: Timing for Mineola Moth will be announced by your county agricultural agent.

MINEOLA MOTH: Populations appear to be increasing in northern counties. Be alert to a need for their control this season.

(6 pounds/acre), or SEVIN LIQUID—1 pound active ingredient (3 pounds active ingredient/acre), in the Second and Third Cover sprays.

Third and Fourth Cover

(10-14 day intervals)

(Third Cover usually coincides with cherry fruit fly emergence. Timing will be announced by District Horticultural Agent — based upon special bait trap detection.)

Leaf Spot**Cherry Fruit Flies*, Mineola Moth**

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
Same fungicides as suggested for Second Cover			LEAD ARSENATE**	2 pounds	6 pounds
			or		
			DIAZINON (50% WP)	1 pound	3 pounds
			or		
			GUTHION (50% WP)	$\frac{1}{2}$ pound	1 $\frac{1}{2}$ pounds
			or		
			GUTHION		
			(2 pounds/gallon SC)	1 pint	3 pints
			or		
			SEVIN (50% WP)	2 pounds	6 pounds
			or		
			SEVIN LIQUID	0.5 pounds	1.5 pounds
				active ingred.	active ingred.
			or		
			PARATHION (15% WP)	1 $\frac{1}{2}$ pounds	4 $\frac{1}{2}$ pounds
			or		
			PARATHION LIQUID	0.23 pounds	0.70 pounds
				active ingred.	active ingred.
			or		
			IMIDAN (50% WP)	1 pound	3 pounds

**NOTE: LEAD ARSENATE is not effective against Mineola Moth adults or larvae. Use PARATHION or GUTHION (wettable powder or liquid equivalents) at rates shown.

*THERE MAY BE ECONOMIC ADVANTAGES IN AIR APPLICATIONS FOR CHERRY FRUIT FLY CONTROL. THE FOLLOWING PROGRAMS ARE SUGGESTED FOR THESE PURPOSES:

Flat Fan Nozzles**CYTHION ULV**

(95% technical) 12 ounces

Beecomist (40 micron) Nozzles**CYTHION ULV**

(95% technical) 4-6 ounces

After Harvest Cover**Leaf Spot****Lesser Peach Tree Borer****DODINE (CYPREX)**(65% WP) $\frac{1}{2}$ pound 1 $\frac{1}{2}$ pounds

or

DIFOLATAN (4 EC) 1 $\frac{1}{2}$ to 2 pints 4.5 to 6 pints

or

BENOMYL (BENLATE)(50% WP) $\frac{1}{4}$ to $\frac{1}{2}$ pound $\frac{1}{4}$ to 1 $\frac{1}{2}$ pounds

Refer to Sweet Cherry Schedule for control program.

Chokecherry Eradication for X-Disease Control

See Page 37.

Days Between Final Spray and Harvest

Insecticides: DIAZINON—10; GUTHION—15; LEAD ARSENATE*—30 (fresh fruit)—14 (processing); PARATHION—14; SEVIN—1; THIODAN—21; Do not make more than two applications of Thiodan after shuck split; IMIDAN—7; CYTHION ULV—1.

*30-day interval if sold outside Michigan or for fresh fruit.

Fungicides: BENOMYL (BENLATE)—0; COPPER—0; DODINE (CYPREX)—0; CAPTAN—0; SULFUR—0; DIFOLATAN—0.

SWEET CHERRY SPRAYING SCHEDULE

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference. The rates of material for use on sweet cherry are based on a standard 400 gallons per acre dilute spray for mature trees.

Bloom

Common Brown Rot (Blossom Blight) (From Pink to Petal Fall)

	Rate/100 gallons	Rate/acre	Rate/100 gallons	Rate/acre
BORDEAUX (early bloom).....	4-6-100			
	or			
WETTABLE SULFUR	5 pounds	20 pounds		
	or			
BENOMYL (BENLATE) (50% WP)	½ pound	2 pounds		
	or			
DICHLONE (PHYGON) (50% WP)	½ pound	2 pounds		
Insecticides should not be used during Bloom.				
If wet weather prevails, additional sprays or dusts of PHYGON or SULFUR will be necessary.				

Petal Fall

Plum Curculio,* Black Cherry Aphid, Leafrollers

Leaf Spot, Brown Rot		PARATHION (15% WP).....	1½ pounds	6 pounds
CAPTAN (50% WP)	2 pounds	8 pounds	or	
	or	PARATHION LIQUID	0.23 pounds	0.90 pounds
BENOMYL (BENLATE)*		active ingred.	active ingred.	
(50% WP)	½ pound	2 pounds	or	
	or	GUTHION (50% WP)	½ pound	2 pounds
FERBAM (76% WP)	1 pound plus	4 pounds plus	or	
WETTABLE SULFUR	3 pounds	12 pounds		
Leaf Spot		GUTHION (2 pounds/gallon SC)	1 pint	4 pints
DODINE (CYPREX)		or		
(65% WP)	¼ pound	1 pound	IMIDAN (50% WP)	1 pound
*BENOMYL (BENLATE), as with other fungicides, is more effective on a seasonal rather than emergency basis.				4 pounds
NOTE: Dodine may not be compatible with Guthion emulsion if water is hard.			*NOTE: IF CURCULIO IS VERY SERIOUS, INCREASE PARATHION OR GUTHION RATES BY 25% AT PETAL FALL AND FIRST COVER. USE IMIDAN AT 1½ POUNDS (6 POUNDS/ACRE). APPLY SPRAY 7 DAYS APART.	

First Cover

Leaf Spot, Brown Rot (10 to 14 days later)

Same fungicides as for Petal Fall

Plum Curculio, Red-Banded Leaf Roller,* Black Cherry Aphid, Mineola Moth

Same insecticides as for Petal Fall

NOTE: Refer to tart cherry schedule for Mineola Moth Control Programs.

*NOTE: PHEROMONE TRAPS may be used to detect red-banded leafroller and determine spray timing.

CONTROL PROGRAM FOR PEACH TREE BORERS

Thiodan may be used in two applications during the fruiting season but not within 21 days of harvest. On some

varieties of sweet cherries, only one application can be made and still stay within the 21-day interval to harvest.

REGULAR PEACH TREE BORER

THIODAN (50% WP), 1½ pounds per 100 gallons (6 pounds/acre)—Apply 3 weeks before harvest. Apply a post harvest spray if necessary. Apply with a gun as a

coarse dilute spray to the trunk of the tree to the ground line. To avoid excess residues, do not spray the scaffold limbs, fruit or foliage.

LESSER PEACH TREE BORERS

THIODAN (50% WP), 1½ pounds per 100 gallons (6 pounds/acre). Apply June 3–10 depending on harvest date of that particular variety. Two applications are possible before harvest in northern counties, the second applied June 16-23. GUTHION and PARATHION, when used in the regular spray program, do not provide control of this insect.

and trunk to the ground level. Thorough coverage, particularly of the susceptible areas mentioned above, is a must for borer control.

Apply with a gun as a coarse dilute spray to the entire tree concentrating on the scaffold limbs, crotches, cankers,

Lesser Peach Borer is present throughout the season until October. In problem orchards, a post-harvest spray of THIODAN will reduce late season infestations. There are no restrictions for post-harvest use of THIODAN on sweet cherries. There is restriction before harvest.

Second Cover*(10 to 14 days later)***Red-Banded Leaf Roller, Black Cherry Aphid
Cherry Aphid**

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>		<i>Rate/100 gallons</i>	<i>Rate/acre</i>
Leaf Spot, Brown Rot			GUTHION (50% WP) $\frac{1}{2}$ pound 2 pounds		
CAPTAN (50% WP)	2 pounds	8 pounds		<i>or</i>	
	<i>or</i>		GUTHION		
BENOMYL (BENLATE)			(2 pounds/gallon SC)	1 pint	4 pints
(50% WP)	$\frac{1}{2}$ pound	2 pounds		<i>or</i>	
	<i>or</i>		PARATHION (15% WP) $1\frac{1}{2}$ pounds 6 pounds		
FERBAM (76% WP)	1 pound <i>plus</i>	4 pounds <i>plus</i>		<i>or</i>	
WETTABLE SULFUR	3 pounds	12 pounds	PARATHION LIQUID 0.23 pounds 0.90 pounds		
				active ingred	active ingred.
Leaf Spot				<i>or</i>	
DODINE (CYPREX)			IMIDAN (50% WP) 1 pound 4 pounds		
(65% WP)	$\frac{1}{4}$ pound	1 pound			

Third Cover*(Based on cherry fruit fly emergence)***Cherry Fruit Flies****

Leaf Spot, Brown Rot			LEAD ARSENATE 2 pounds 8 pounds		
CAPTAN (50% WP)	2 pounds	8 pounds		<i>or</i>	
	<i>or</i>		GUTHION (50% WP) $\frac{1}{2}$ pound 2 pounds		
BENOMYL (BENLATE)				<i>or</i>	
(50% WP)	$\frac{1}{2}$ pound	2 pounds	GUTHION		
	<i>or</i>		(2 pounds/gallon SC)	1 pint	4 pints
FERBAM (76% WP)	1 pound <i>plus</i>	4 pounds <i>plus</i>		<i>or</i>	
WETTABLE SULFUR	3 pounds	12 pounds	DIAZINON (50% WP) 1 pound 4 pounds		
				<i>or</i>	
Leaf Spot			SEVIN (50% WP) 2 pounds 8 pounds		
DODINE (CYPREX)				<i>or</i>	
(65% WP)	$\frac{1}{4}$ pound	1 pound	SEVIN LIQUID 1 pound 4 pounds		
				active ingred.	active ingred.
				<i>or</i>	
			IMIDAN (50% WP) 1 pound 4 pounds		

**Timing of spray applications for cherry fruit fly will be announced by District Horticultural Agents – based upon special bait trap detection.

Fourth Cover*(12 to 14 days after Third Cover)*

1. Leaf Spot, Brown Rot
2. Brown Rot and Rhizopus Rot
3. Leaf Spot

Same fungicides as for Third Cover.

NOTE: Use CAPTAN (2 pounds) or BENOMYL (BENLATE) during harvest, if necessary for brown rot.

Cherry Fruit Flies

Same insecticides as for Third Cover.

See "Days Between Final Spray and Harvest" when using LEAD ARSENATE.

NOTE: See Tart Cherry Schedule for aerial application program.

Post Harvest**Leaf Spot**DODINE (CYPREX)
(65% WP) $\frac{1}{4}$ to $\frac{1}{2}$ pound 1 to 1.5 pounds**Peach Tree Borer, Lesser Peach Tree Borer**

See borer control on page 46.

POST-HARVEST DISEASE CONTROL FOR STONE FRUIT

1. Carry out a good pre-harvest spray or dust program.
2. Dip or drench fruit after harvest before storing and again during the sorting operation.
3. Store fruit at 32 to 36°F. At higher temperatures, infections may continue to develop in storage.

Fungicides	Amount/100 gallons
BENOMYL (BENLATE) ½ pound (50% WP)	
PLUS	
BOTRAN (75% WP)* ½ pound	

NOTE: Good agitation of the treatment solution is a must to maintain an effective fungicide suspension. Containers must be uniformly treated with sufficient volume of solution to achieve thorough wetting in the container. BOTRAN is added for *Rhizopus* control.

*Omit BOTRAN from this mixture when treating apricots, nectarines, and prunes. BOTRAN has not been cleared for this use on these fruits as a drench or dip, although attempts are being made to obtain label clearance. Check with local authorities for changes in registration status. BOTRAN has been cleared for post-harvest treatment of sweet cherries and peaches.

Days Between Final Spray and Harvest

Insecticides: DIAZINON-10; GUTHION-15; LEAD ARSENATE*-14 or 30; PARATHION-14; SEVIN-1; THIODAN-21; Do not make more than 2 applications after shuck split, CYTHION ULV-1; IMIDAN-7.

*30-day interval if sold outside Michigan or for fresh fruit.

Fungicides: BENOMYL (BENLATE)-0; BOTRAN-0; CAPTAN-0; DODINE (CYPREX)-0; FERBAM-0; SULFURS-0.

GRAPE SPRAYING SCHEDULE

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference. The rate of materials for use on grape are based on a standard of 200 gallons per acre dilute spray. Vines trained to Geneva double curtain trellis should receive 300 gallons per acre of dilute spray after vines are in full leaf. If you are concentrate spraying—(less than 200 gallons of water per acre), use the rate/acre column, regardless of the amount of water you are spraying per acre.

DISEASES		<i>Bud Swell</i>		INSECTS	
Dead Arm (Problem Vineyards)				Grape flea beetle, Climbing cutworms	
	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
CAPTAN (50% WP)	2 pounds	4 pounds	PARATHION (15% WP)	2 pounds	4 pounds
	or			or	
FOLPET (PHALTAN) (50% WP)	2 pounds	4 pounds	PARATHION LIQUID	0.3 pounds	0.6 pounds
				active ingred.	active ingred.
When shoot growth is 1 to 2 inches, and repeat when shoot growth is 4 to 6 inches.			NOTE: Spray at night for best cutworm control.		

First Cover

(Shoots 4 to 8 inches long)

Black Rot

FERBAM (76% WP)	1½ pounds	3 pounds
	or	
FOLPET (50% WP)	2 pounds	4 pounds

No insecticides recommended in this spray.

Second Cover

(Blossom Opening)

Grape Berry Moth

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
Black Rot			GUTHION (50% WP)	.....½ pound	.....1 pound
FERBAM (76% WP)	.....1½ pounds	.....3 pounds		or	
Black Rot, Powdery and Downy Mildew			GUTHION		
*FERBAM (76% WP)	.....1½ pounds, plus	.....3 pounds	(2 pounds/gallon SC)	.....1 pint	.....2 pints
FOLPET (50% WP)	.....2 pounds	.....4 pounds		or	
	or		SEVIN (50% WP)	.....2 pounds	.....4 pounds
**FIXED COPPER (actual)	.....1½ pounds	.....3 pounds,		or	
	plus	plus	SEVIN LIQUID	.....1 pound	.....2 pounds
HYDRATED LIME	.....6 pounds	.....12 pounds		active ingred.	active ingred.
				or	
			IMIDAN (50% WP)	.....1 pound	.....2 pounds
*FERBAM does not control either Powdery or Downy Mildew.			**If FIXED COPPER is used with GUTHION or SEVIN spray immediately as these materials may lose some insecticidal effectiveness when combined with LIME or in alkaline solutions.		

Third Cover

(Immediately after bloom)

Black Rot	Grape Berry Moth, Grape Leafhopper, Rose Chafer*
Black Rot, Powdery and Downy Mildew	
Same fungicides as for Second Cover	Same insecticides as for Second Cover
NOTE: Do not use GUTHION more than three times during the growing season.	
	*If rose chafers are a problem, use SEVIN (50% WP)—2 pounds (4 pounds/acre) or SEVIN LIQUID, 1 pound active ingredient (2 pounds active ingredient/acre). PARATHION (15% WP)—2 pounds (4 pounds/acre) or PARATHION LIQUID—0.3 pounds active ingredient (0.6 pounds active ingredient/acre) will also give control.
	Timing for second brood berry moth is announced by your county agricultural agent.

Fourth Cover

(10 to 14 days after Third Cover)

Black Rot	Grape Berry Moth, Grape Leafhopper, Rose Chafer
Black Rot, Powdery and Downy Mildew	
Same fungicides as for Second Cover	Same insecticides as for Second Cover

Fifth Cover

(Time to be announced)

Black Rot	Grape Berry Moth, Grape Leafhopper
Black Rot, Powdery and Downy Mildew	
Same fungicides as for Second Cover	Same insecticides as for Second Cover

Sixth Cover

(10 to 14 days after Fifth Cover)

Grape Berry Moth

Same insecticides as for Second Cover

GRAPES

Seventh Cover*
(about Aug. 7)

Powdery Mildew		Grape Berry Moth	
	Rate/100 gallons	Rate/acre	
Same insecticides as for Sixth Cover			
FOLPET (50% WP)	2 pounds	4 pounds	

Eighth Cover*
(about Aug. 20)

		Grape Berry Moth	
		Same insecticides as for Sixth Cover	
*Seventh and eighth cover sprays are necessary only when third brood berry moth is present. Check vineyard for this		brood. Need for these covers will be announced by your county agricultural agent.	

Days Between Last Spray and Harvest

Insecticides: GUTHION-0; PARATHION-14; SEVIN-0; IMIDAN-7.

Fungicides: FERBAM-7; COPPERS-0; ZINEB-7; FOLPET-0; CAPTAN-0.

STRAWBERRY SPRAYING SCHEDULE

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference. The rates of materials for use on strawberry are based on a standard of 200 gallons per acre dilute spray. If you are concentrate spraying (less than 200 gallons of water per acre), use the rate/acre column, regardless of the amount of water you are spraying per acre.

PRE-PLANT TREATMENT FOR WHITE GRUBS, ROOT WEEVILS, AND STRAWBERRY ROOT APHIDS

To reduce white grub and root weevil injury and to avoid root aphid injury in strawberry plantings:—Just before planting, treat the upper 3 inches of soil with CHLORDANE, at the rate of 10 pounds actual CHLORDANE per acre. These insecticides may be applied as

dusts, sprays, or granular formulations. The chemical should be broadcast (sprayed, dusted or drilled) and thoroughly mixed with the soil immediately after application. About 40 percent of the effectiveness may be lost in 5 hours if the chemical remains exposed on the surface of the soil. This treatment is effective against white grub and root weevil for about 3 years. Where sod has been turned under, this treatment is very necessary before planting.

First Cover
(New leaves expanded and blossom buds visible)

Stem-end Fruit Rot, Leaf Blight, Leaf Spot	Spittlebug*
BENLATE (50% WP) .....½ pound .....1 pound	SEVIN (50% WP) .....2 pounds .....4 pounds
or	or
CAPTAN (50% WP) .....2.5-3 pounds .....5-6 pounds	SEVIN LIQUID .....1 pound .....2 pounds
	active ingred. active ingred.
	or
	THIODAN (50% WP) .....1 pound .....2 pounds
	or
	THIODAN (2 EC) .....1 quart .....2 quarts
	*NOTE: Use THIODAN for spittlebug where tarnished plant bugs are active.

Do not use Guthion, Sevin or Benlate with fixed copper and lime. The effectiveness of GUTHION, SEVIN, or BENLATE is markedly reduced when mixed with lime or in an alkaline solution.

If two-spotted mites are a problem, include KELTHANE (35% WP) 1¼ pounds (2½ pounds/acre) or KELTHANE (18.5% EC) 1 quart (2 quarts/acre).

Second Cover*(pre-bloom—just as flowers start to open)***Gray Mold, Stem-End Fruit Rot, Leaf Blight,
Leaf Spot**

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
BENLATE (50% WP)	½ pound	1 pound
	<i>or</i>	
CAPTAN (50% WP)	2.5-3 pounds	5-6 pounds

**1. Tarnished Plant Bug, Spittlebug
2. Strawberry Leafroller, Spittlebug**

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
1. THIODAN (50% WP)	1 pound	2 pounds
	<i>or</i>	
THIODAN (2 EC)	1 quart	2 quarts
NOTE: Tarnished plant bug control is critical at this time. Best results are gotten with a specific THIODAN application at or before 10% king bloom.		
	<i>or</i>	
2. GUTHION (50% WP)	½ pound	1 pound
	<i>or</i>	
GUTHION (2 pounds/gallon SC)	1 pint	2 pints
	<i>or</i>	
SEVIN (50% WP)	2 pounds	4 pounds
	<i>or</i>	
SEVIN LIQUID	1 pound	2 pounds
	active ingred.	active ingred.

Third Cover*(50% Bloom and green fruit)***Gray Mold, Stem-End Fruit Rot, Leaf Blight,
Leaf Spot**

Same fungicides as for Second Cover.

Insecticides should not be used during bloom.

Fourth Cover*(Berries one-half grown or 7 to 10 days after Third Cover)***Gray Mold, Stem-End Fruit Rot, Leaf Blight,
Leaf Spot**

CAPTAN (50% WP)	2.5-3 pounds	5-6 pounds
	<i>or</i>	
CAPTAN DUST (7.5% Captan)		40 pounds
	<i>or</i>	
*BENLATE (50% WP)	¼ pound	½ pound

*NOTE: After full bloom only ½ pound/acre of BENLATE is allowable as per label.

A repeat application of THIODAN may be necessary when tarnished plant bug continues as a problem.* If other insects are present in troublesome numbers, include DIAZINON (50% WP) at 1 pound (2 pounds/acre), DIAZINON (4 EC) at 1 pint (2 pints/acre), GUTHION (50% WP) at ½ pound (1 pound/acre) or GUTHION (2 pounds/gallon SC) at 1 pint (2 pints/acre) in this period.

*NOTE: Do not re-apply THIODAN within 15 days of a previous application or more than twice within a 35-day interval once fruit is present. Use no closer than 4 days to harvest.

Pre-Harvest*(At least 10 days before harvest)***Gray Mold, Stem-End Fruit Rot, Leaf Blight,
Leaf Spot**

CAPTAN (50% WP)	2.5-3 pounds	5-6 pounds
	<i>or</i>	
CAPTAN DUST (7.5% CAPTAN)		40 pounds
	<i>or</i>	
BENLATE (50% WP)	¼ pound	½ pound

Strawberry Sap Beetle

GUTHION (50% WP)	1 pound
	<i>or</i>
GUTHION (2 pounds/gallon SC)	1 quart
	<i>or</i>
DIAZINON (50% WP)	2 pounds
	<i>or</i>
DIAZINON (4 EC)	1 quart
Apply GUTHION or DIAZINON through the overhead irrigation system at the end of the sprinkling period. Introduce material over a time interval of at least 15 minutes. Begin applications when beetles first become numerous or when injury first appears. Repeat as necessary, but not within 5 days of harvest.	

or (Page 52)

STRAWBERRIES (Continued)

BREWERS GRAIN or CORN COB WITH MOLASSES-GUTHION (1.25%)

BAIT 40 pounds/acre

Apply bait when beetles are first seen migrating into plantings or when first injury is noticed. Repeat treatment as necessary. Peak populations or migrations that occur near harvest demand more frequent baiting—often weekly. Baits should be fresh and moist when applied. Ground application is much superior to air application. If ground applicators are employed, concentrate the bait between plant rows. Do not apply closer than 5 days before harvest.

During Harvest Period

Gray Mold, Stem-End Fruit Rot, Leaf Diseases

For 1 and 2, same fungicides as in Pre-Harvest sprays.

Same fungicides as in Pre-Harvest sprays.

Control of Cyclamen Mites

Under certain circumstances, cyclamen mites may become established in a planting. Usually, the infestation is limited to small areas in the field. These areas can be spot treated with one of the following programs: THIODAN (2 EC) 1 quart (2 quarts/acre) or THIODAN (50% WP) 1 pound (2 pounds/acre), applied at Early Blossom or in multiple applications

during the fruiting season, but no closer than 4 days to harvest. KELTHANE (35% WP) 1½ pounds (2½ pounds/acre) or KELTHANE (18.5% EC) 2 pints (4 pints/acre), applied any time during the season, but not closer than 2 days before harvest. KELTHANE should be applied so the plants are thoroughly drenched. The addition of a wetting agent will improve control.

Post-Harvest and New Plantings

Strawberry Leaf Spot*

	Rate/100 gallons	Rate/acre
BENLATE (50% WP)	½ pound	1 pound

*Especially for new plantings. Apply a minimum of two applications starting 10 days-2 weeks after normal harvest and repeat 2 weeks later. These treatments will keep new plants relatively disease free and will allow maximum growth to occur in the fall.

Strawberry Leaf Roller, Leafhoppers, Aphids

	Rate/100 gallons	Rate/acre
Strawberry Leafroller		
GUTHION (50% WP)	½ pound	1 pound
GUTHION	or	
(2 pounds/gallon SC)	1 pint	2 pints
SEVIN (50% WP)	2 pounds	4 pounds
SEVIN LIQUID	1 pound	2 pounds
	active ingred.	active ingred.
DIAZINON (50% WP)*	1 pound	2 pounds
DIAZINON (4 EC)	1 pint	2 pints

*NOTE: DIAZINON also controls leafhoppers and aphids.

Leafhoppers, Aphids

PARATHION** (15% WP)	2 pounds	4 pounds
PARATHION LIQUID	0.3 pounds	0.6 pounds
	active ingred.	active ingred.
DEMETON (SYSTOX)	1/3 pint	2/3 pint

**NOTE: PARATHION will control Strawberry Leafroller.

STRAWBERRIES

Days Between Final Spray and Harvest

Insecticides: DIAZINON-5; GUTHION-5; KELTHANE-2; SEVIN-1; THIODAN-4; PARATHION-14; DEMETON-21.

Fungicides: CAPTAN-0; BENLATE-0.

BRAMBLE SPRAYING SCHEDULE

(Red Raspberries, Black Raspberries, Dewberries and Blackberries)

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference. The rates of materials for use on bramble are based on a standard of 200 gallons per acre dilute spray.

Delayed Dormant

DISEASES

1. Anthracnose (when first leaves are exposed $\frac{1}{4}$ to $\frac{3}{4}$ inch)

2. Anthracnose (when a few leaves have unfolded)

INSECTS

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
1. LIME SULFUR	10 gallons	20 gallons	No insecticides recommended in this spray.		
2. LIME SULFUR	5 gallons	10 gallons			

CAUTION: If unable to apply the first-mentioned eradica-
tive spray for Anthracnose, a LIME-SULFUR spray at 5
gallons per 100 when a few leaves have unfolded from buds

will give effective control. There is a greater risk of LIME-
SULFUR burn, however, by spraying at this later date.

Pre-Blossom

(When blossom buds are breaking or new canes 6 to 8 inches long)

1. Anthracnose

2. Spur Blight (Red Raspberry)

Leafroller, Raspberry Sawfly, Raspberry Fruit
Worm and Raspberry Cane Borers

1. CAPTAN (50% WP)	2 pounds	4 pounds	GUTHION (50% WP)	$\frac{1}{2}$ pound	1 pound
	or			or	
FERBAM (76% WP)	1 $\frac{1}{2}$ pounds	3 pounds	GUTHION (2 pounds/gallon SC)	1 pint	2 pints
				or	
2. BORDEAUX	3-3-100		DIAZINON (50% WP)	1 pound	2 pounds
(Repeat BORDEAUX 10 to 14 days later.)				or	
			DIAZINON (4 EC)	1 pint	2 pints

NOTE: If GUTHION is used with BORDEAUX, spray
out tank without delay.

BRAMBLES

First Cover
(At Petal Fall)

Anthracnose		Aphids, Leafrollers, Cane Borers	
	Rate/100 gallons	Rate/acre	
CAPTAN (50% WP)	2 pounds	4 pounds	Same insecticides as for Pre-Blossom
	or		
FERBAM (76% WP)	1½ pounds	3 pounds	

Pre-Harvest
(15 days before harvest)

Aphids, Mites (See Mite section below)

PARATHION (15% WP)	2 pounds	4 pounds
	or	
PARATHION LIQUID	0.3 pounds	0.6 pounds
	active ingred.	active ingred.
	or	
DIAZINON (50% WP)	1 pound	2 pounds
	or	
DIAZINON (4 EC)	1 pint	2 pints

MITES

Where mites are a problem use KELTHANE (35% WP), 1½ pints (2½ pounds/acre), or KELTHANE (18.5% EC), 2 pints (4 pints/acre) plus PHOSDRIN (4 EC), ¼ pint (½ pint/acre).

Post-Harvest

Aphids

PARATHION (15% WP)	2 pounds	4 pounds
	or	
PARATHION LIQUID	0.3 pounds	0.6 pounds
	active ingred.	active ingred.
	or	
DEMETON (SYSTOX) (6 pounds/gallon)	¼ pint	½ pint
	or	
DIAZINON (50% WP)	1 pound	2 pounds
	or	
DIAZINON (4 EC)	1 pint	2 pints

RASPBERRY ROOT BORER

NOTE: Where raspberry root borers are a major problem, apply a drenching crown spray using DIAZINON (4 EC)—2 pints or DIAZINON (50% WP)—2 pounds for each 100 gallons of spray. Use 400-500 gallons of spray per acre. Apply the spray any time from November to April to kill the overwintering stage which is found on the plant crown just below the ground line.

Days Between Final Spray and Harvest

Insecticides: DIAZINON—7; GUTHION—14; KELTHANE—2; MALATHION—1; PARATHION—15; PHOSDRIN—3; DEMETON (SYSTOX)—Post-harvest.

Fungicides: CAPTAN—0; FERBAM—40.

Currant and Gooseberry Spraying Schedule

NOTE: See end of schedule for intervals between final spray and harvest. Chemicals are not necessarily listed in order of preference. The rates of materials for use on currant and gooseberry are based on a standard of 200 gallons per acre dilute spray.

Dormant

(For both currants and gooseberries)

DISEASES

INSECTS

Currant Aphid

<i>Rate/100 gallons</i>	<i>Rate/acre</i>	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
		ELGETOL 318	1 quart 2 quarts

Green Tip

Powdery Mildew (Gooseberries only)

LIME SULFUR 5 gallons 10 gallons

Thorough coverage is essential.

First Cover

(As soon as the fruit has set)

Powdery Mildew (Gooseberries only)

Currantworm, Currant Aphid

LIME SULFUR 5 gallons 10 gallons

PARATHION (15% WP) 1½ pounds 3 pounds

or

PARATHION LIQUID 0.23 pounds 0.46 pounds
active ingred. active ingred.

or

MALATHION (25% WP) 2 pounds 4 pounds

Second Cover

(2 to 3 weeks after bloom)

Leaf Spot (Currants and Gooseberries)*

Currantworm, Aphids

FERBAM (76% WP) 2 pounds 4 pounds

MALATHION (25% WP) 2 pounds 4 pounds

*The timing of the spray for leaf spot varies with the individual planting. However, for best disease control, spray when leaf spot is first noticed. Generally, it is observed first on the lower leaves of the bushes.

If leaf spot is present at harvest time, spray immediately after harvest with the fungicide suggested for second cover.

Days Between Final Spray and Harvest

Insecticides: MALATHION—1; PARATHION—30 for currants; 15 for gooseberries.

Fungicides: FERBAM—14.

BLUEBERRY SPRAYING SCHEDULE

NOTE: See end of schedule for intervals between final spray and harvest. **THE BLUEBERRY SCHEDULE IS REVISED FOR AIRPLANE APPLICATION OF CHEMICALS.** Rates of materials for blueberry are based on the standard amounts per acre used in air applications.

Dormant

(At bud swell when apothecia are developing, but before green tip stage)

Mummy berry—apothecia (mushroom) eradication—Ground treatment only.

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
PREMERGE or SINOX PE	1½ quarts	3 quarts
	<i>or</i>	
CALCIUM CYANAMID*		400 pounds
<i>*Apply with ground or aerial application equipment.</i>		
<i>NOTE: Calcium cyanamid is far more effective than Premerge or Sinox PE for eradication of apothecia.</i>		

First Cover

(At Petal Fall or as soon as Curculio is active)

Plum Curculio, Blueberry Tip Borer

	<i>Rate/acre</i>
GUTHION (2 pounds/gallons SC)	1 quart
	<i>or</i>
SEVIN (80 S)*	2 pounds active ingred.
<i>*NOTE: Use SEVIN whenever lakes, ponds or streams are nearby.</i>	

Second Cover

(10 days after First Cover)

Plum Curculio, Cranberry Fruitworm, Blueberry Tip Borer, White Tussock Moth, Leafrollers

AQUA MALATHION (8 EC)	1 quart
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Third Cover

(10 days after Second Cover)

Cranberry Fruitworm

Same insecticide as for Second Cover

Fourth Cover

(Time to be announced by District Horticultural Agents about July 1 — based upon special bait trap detection.)

Blueberry Maggot

CYTHON ULV (95% Tech. Malathion)	10 ounces
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Pre-Harvest Covers*(During Blueberry Maggot Fly Emergence)***Blueberry Maggot***Rate/acre*

Same insecticide as for Fourth Cover

NOTE: Additional applications should be continued at 10-14 day intervals after Fourth Cover and until the fruit is harvested. Extending the intervals between applications or using less than the recommended rate per acre may not give control of the blueberry maggot.

After-Harvest Cover**White Tussock Moth**

SEVIN (80 S) 2 pounds
active ingred.

CANKER CONTROL

No chemical control program is available for Phomopsis or Fusicoccum Canker. Prune out dead or cankered stems. Cut several inches below diseased tissue. Haul the stems out of the field and burn them. Do not chop them and leave them in the field.

BLUEBERRY BORER

NOTE: The insect known as the Blueberry Borer has been identified as the Dogwood Borer. Within the past few years, this insect has become a major problem in some southwest Michigan blueberry plantations. PARATHION (15% WP), 1½ pounds, or equivalent in Flowable or EC formulations (0.23 pounds active ingredient) per 100 gallons water applied at the rate of 250 gallons per acre will control the Dogwood Borer. Apply spray July 1 in the Benton Harbor area; July 15 in the Grand Haven area. Thorough coverage of the base of the plant is necessary for control.

Days Between Final Spray and Harvest

Insecticides: GUTHION-3; PARATHION-14; MALATHION-0; SEVIN-0; CYTHION-0.

RESIDUE TOLERANCE OF PESTICIDES ON FRUITS

According to regulations established under "the Miller Bill", certain small amounts (tolerances) of pesticides may legally remain on harvested fruits. You, as a grower, are responsible for producing legally marketable fruit.

By following three rules, you can be reasonably sure your harvested fruit will be "within the limits of the law":

Rule No. 1

Do not use dosage rates above those suggested in the spraying schedule for the specific fruits.

Rule No. 2

Do not use pesticides and growth regulators on crops not cleared by the Food and Drug Administration.

Rule No. 3

Do not use pesticides closer to harvest than

suggested in the spraying schedules for specific fruits or in the table on page 54.

Information on materials used in the dormant, pre-bloom, and post-harvest periods has been omitted. Ordinarily, materials used at these times do not present a residue problem on harvested fruits.

The information found in Table 1 on page 54 is up-to-date as of Jan. 1, 1972. Minor changes may occur during the growing season. County agricultural agents will be notified when these occur.

It is not safe to feed apple pomace treated with certain pesticides (especially chlorinated hydrocarbons) to livestock. OMITE, TEDION, and CYPREX, for example, have definite label restrictions against this use. Be sure to check the label restrictions for all the chemicals you use on fruit crops.

Table 1. — DAYS BETWEEN FINAL SPRAY AND HARVEST

Listed below are some of the commonly used pesticides and the intervals from last application to harvest for each crop. See spray schedules for recommended materials.

Fungicides	Apples	Pears	Peaches	Plums and Prunes	Cherries	Grapes	Straw- berries	Rasp- berries	Currants and Goose- berries	Blue- berries	Apricot
Dikar.....	21										
Difolatan.....					0 (Sour)						
Botran.....			1j		0j (Sweet)						
Captan.....	0	0	0j	0	0j	0	0	0		0	0
Copper (copper-lime mix- tures).....	h	h			h	h	h	h			
Dodine (Cyprex).....	7		15		0		14				
Dichlone (Phygon).....	1		7	3	3						
Ferbam.....	7	7		7	0	7		40	14	40	
Folpet.....						0					
Glyodin.....	0e				7 (Sour)						
Dinocap (Karathane).....	21						21	7			
Mercuries.....							af				
Streptomycin.....	50	30									
Sulfurs.....	h		h	h	h						
Thiram (Thylate).....	0		7				3e				
Zineb.....	0			30		7					
Ziram.....	0									k	
Benomyl (Benlate).....	7j	7j	0j	0j	0j	7	0				0j
Insecticides											
Chloropropylate.....	14	14									
Dimethoate.....	28	28									
Omite.....	7f	14f	14f	28f							
Demeton (Systox).....	21f	21f	30f	30f	f	21	21	d	d		30
Diazinon.....	14	14	20	10	10	10	5	7		7	10
Imidan.....	7f	7f	14f	7	7	7					14
Ethion.....	60f	60f	30f	21f	f	30f	2				f
Guthion.....	7	7	21	15	15	0	5	14		14i	21
Kelthane.....	7	7	14	7b	7b	7	2	2			14
Lead Arsenate.....	30g	30g		30g	14g, 30g	a	a	a	a	a	30
Malathion.....	3	1	7	3	3	3	3	1	1, 3f	0-1f	7
Methoxychlor.....	7	7	21	7	7	14	3	3	14g	14	21
Morestan.....	35f	35f	a, e	a, e	a, e						a
Parathion.....	14	14	14	14	14	14	14	15	30, 15f	14	14
Perthane.....	7	7			2						
Phosphamidon.....	30				f						
Sevin.....	1	1	1	1	1	0	1	7		0	3
Superior oil.....	e	e	e	e	e	e	e	e	e	e	e
Thiodan.....	30f	7f	30f	7f	21f	7	4f				30f
Zolone.....	14	14	14f	14f	14f	14					14f
Galecron-Fundal.....	14f	28f	d								
Carzol.....	7f	7f									
Plictran.....	14f	14f									
Cythion ULV.....					1						

Legend: a = Not after fruit begins to form.
b = Do not repeat application within 30 days.
c = Pre-bloom or Post-harvest application only.
d = Post-harvest application only.
e = No residue if used according to recommendations.
f = See label restrictions on use.
g = Remove excess residues at harvest.

h = Sulfurs and copper plus lime mixtures are
exempt if used as recommended.
i = 4 hours of harvest using 3% dust at 20 pounds per acre.
j = May be used as Post-harvest treatment—See label.
k = 3 Weeks after full bloom.

SPRAY RECORD SHEET

GROWER	YEAR
CROP	HARVEST DATE

[illegible]

Tear out along this line

SPRAY RECORD SHEET

GROWER	YEAR
CROP	HARVEST DATE

[illegible]

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 fear out along this line

SPRAY RECORD SHEET

GROWER	YEAR
CROP	HARVEST DATE

[illegible]

Tear out along this line

SCHEDULES

Apples

Pears

Peaches-Nectarines

Apricots

Plums-Prunes

Red Tart Cherries

Sweet Cherries

Stone Fruit

Grapes

Strawberries

Brambles

Currants-Gooseberries

Blueberries

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