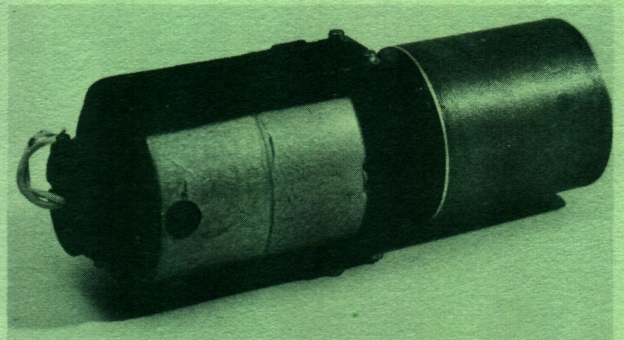


FILE COPY
DO NOT REMOVE

1972 FRUIT SPRAYING CALENDAR

Extension Bulletin 154 Farm Science Series February 1972

For Commercial Fruit Growers



COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY

Efficient fruit pest management requires the best combination of cultural, biological and chemical control methods. The cover illustrates a "new future" of economic and environmental conservation in the pest control program—natural predators for biological control of mites, pheromone (sex lure) and simplistic bait traps for accurate insect detection and ultra-low volume spray application for reducing insecticide cost and contamination.

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.

CONTENTS

General Information

Use Chemicals Safely	1
Phosphates, All Agricultural Chemicals	
Poison Control Centers	2
Nematode Control for Fruit Crops	4
Superior Oils	5
Dilute and Concentrate Application	6
Pesticide Chemicals and Their Use	6
Fungicides	7
Insecticides	9
Insect Pheromones	13
Accessory Materials	13
Wetting or Spreading Agents, Stickers	13
Liquid Pesticides and Surfactants	14
Correctives for Injury	14
Russetting of Apples	14
Pre-harvest Drop Control of Apples	15
Chemical Thinning of Apples	15
Chemical Thinning of Pears and Peaches	17
Mouse Control in Orchards	17

Schedules

Apple Scab Control	18
Compatibility Chart	20
Apples	21
Pears	27
Peaches	31
Apricots	35
Plums and Prunes	37
Red Tart Cherries	40
Sweet Cherries	43
Grapes	45
Strawberries	47
Brambles	49
Currants and Gooseberries	51
Blueberries	52
Residue Tolerances	53
Days Between Final Spray and Harvest	54
Spray Record Sheets	55

1972 FRUIT SPRAYING CALENDAR

PREPARED BY W. W. THOMPSON¹, JEROME HULL², A. L. JONES³,
A. J. HOWITT¹, C. W. LAUGHLIN¹

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, two extension 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. They have the following titles and bulletin numbers:

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 433.

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 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 54 as well as at the end of each spray schedule section.

¹Department of Entomology

²Department of Horticulture

³Department of Botany and Plant Pathology

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.

POISON CONTROL CENTERS

Name of Center, street address, telephone, name of director

ADRIAN

Poison Control Center
Emma L. Bixby Hospital
818 Riverside Dr. 49506
265-6161
Robert Greiner, M.D., Dir.
Thomas Arnold, R. Ph.,
Assoc. Dir.

COLDWATER

Poison Control Center
Community Health Center of
Branch County
274 E. Chicago St. 49036
279-9501
John C. Heffelfinger, M.D.
Office 278-2359

FLINT

Poison Control Center
Hurley Hospital
6th Ave. & Begole 48502
232-1161
William Nichols, M.D., Dir.
Douglas L. Vivian, R. Ph.,
Coordinator

ANN ARBOR

Poison Control Center
University Hospital
1405 E. Ann St. 48104
764-5102
Patricia O'Connor, M.D.
Owen Haig, M.D., Assoc. Dir.
Robert Pearson, R. Ph.

DETROIT

Poison Control Center
Children's Hospital
3901 Beaubien
494-5711
Paul V. Wooley, Jr., M.D.
Regine Aronow, M.D.
Poison Information Center
Detroit City Health Department
Herman Kiefer Hospital
1151 Taylor Ave. 48202
872-3334 or TR 2-1540 - Ext. 376
Paul T. Chapman, M.D.
William G. Frederick, Sc. D.

GRAND RAPIDS

Poison Control Center
Blodgett Memorial Hospital
1840 Wealthy, S.E. 49506
456-5301
John P. Foxworthy, M.D.
Donald Ekdorn, R. Ph.
Poison Control Center
Butterworth Hospital
100 Michigan, N.E. 49503
451-3591
John R. Wilson, M.D.
Poison Treatment Center
Grand Rapids Osteopathic
Hospital
1919 Boston St., S.E. 49506
452-5151
Eugene M. Johnson, D.O.
Oliver Gysin, R. Ph.

BATTLE CREEK

Poison Control Center
Community Hospital
200 Tomkins St. 49016
963-5521
Metta Lou Henderson, R. Ph.

BAY CITY

Poison Control Center
Mercy Hospital
100 15th St. 48706
895-8511
Frederick Meyer, R. Ph.

BERRIEN CENTER

Poison Control Center
Berrien General Hospital
Dean's Hill Rd. 49102
471-7761
Richard C. Chaudoir, R. Ph.

ELOISE

Poison Control Center
Wayne County General Hospital
30712 Michigan Ave. 48132
722-2500, Ext. 6230 - 6231
Kenneth Vaughn, M.D.
Gerald A. Rigg, M.D., Assoc.

Poison Control Center
St. Mary's Hospital
201 LaFayette, S.E. 49503
459-3131
Wallace Duffin, M.D.
Myrtle McLain, M.D.,
Assoc. Dir.

HANCOCK

Poison Control Center
St. Joseph's Hospital
200 Michigan Ave. 49930
482-1122
Howard E. Otto, M.D.
Sr. Mary Sharon Jones, R. Ph.

HOLLAND

Poison Control Center
Holland City Hospital
602 Michigan Ave.
Paul Dykema, M.D.
John W. West, R.Ph.

KALAMAZOO

Poison Control Center
Bronson Methodist Hospital
252 E. Lovell St. 49006
342-9821
H. Sidney Heersma, M.D.
Kenneth Huckendubler, R. Ph.

LANSING

Poison Control Center
St. Lawrence Hospital
1210 W. Saginaw St. 48914
372-3610
Howard Comstock, M.D.
Richard Campbell, R. Ph.

MARQUETTE

Poison Information Center
St. Luke's Hospital
West College Ave. 49855
226-3511
Norman Matthews, M.D.
Tom Finlan, R. Ph.

MIDLAND

Poison Control Center
Midland Hospital
4005 Orchard Drive 48640
835-6711
K. W. Linsenmann, M.D.
Mrs. Anne Gagne, R.N.

MONROE

Poison Control Center
Memorial Hospital of Monroe
700 Stewart Road 48161
241-6500
Donald Wojack, R. Ph.

PETOSKEY

Poison Control Center
Little Traverse Hospital
416 Connable 49770
347-2551
James M. Stamm, R. Ph.

PONTIAC

Poison Control Center
St. Joseph Mercy Hospital
900 Woodward Ave. 48053
338-9111
Robert J. Mason, M.D.

PORT HURON

Poison Control Center
Mercy Hospital
2601 Electric Ave. 48060
985-9531
Robert Lugg, M.D.

SAGINAW

Poison Control Center
Saginaw General Hospital
1447 N. Harrison Rd. 48602
753-3411
Wm. G. Mason, M.D.
Dale Schultz, R.Ph.

TRAVERSE CITY

Poison Control Center
Munson Medical Center
Traverse City 49684
947-6140
Philip K. Wiley, M.D.
A. McCrackin, R. Ph.

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.

NEMATODE CONTROL FOR FRUIT CROPS

Nematodes, particularly the dagger, root knot and root lesion nematodes, can cause extensive injury to fruit crops. Research has shown that certain newly set crops, principally tart cherries, peaches and strawberries, respond to soil fumigation practices. Where tart cherries are to be replanted in old fruit plantings, fumigation of the soil prior to planting is essential to produce a vigorous and healthy stand of young

trees. Likewise, strawberries to be planted in soil infested with root knot or root lesion nematodes will show a response from soil fumigation practices. Dagger nematodes are capable of transmitting viruses to several fruit crops including blueberries, grapes and peaches.

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 (Nemagon, Fumazone)	Broadcast: 24 pounds active ingredient Row: 15 pounds for 36-inch row	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.
Dichloropropene- dichloropropane (D-D, Vidden 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.
Dichloropropene (Telone)	Broadcast: 32 gallons	Same as dichloropropene-dichloropropane.
Ethylene dibromide (Dowfume MC-2)	Broadcast: 9 gallons	Same as dichloropropene-dichloropropane.
Methyl Bromide (98%) Chloropicrin (2%) (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 (67%) and Chloropicrin (33%) (Dowfume MC-33, Terr-O-Gas)	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.
Methyl Isothiocyanate (20%) Chlorinated C ₈ Hydrocarbons (80%) (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 (Nemagon, Fumazone)	60 pounds active ingredient	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.
Dichloropropene-dichloropropane (D-D, Vidden D)	40 gallons	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 by 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.
Dichloropropenes (Telone)	32 gallons	Same as dichloropropene-dichloropropane.
Ethylene dibromide (Dowfume W-85)	12 gallons	Same as dichloropropene-dichloropropane. Do not use for individual treatment.
Methyl Isothiocyanate (20% Chlorinated C ₈ Hydrocarbons (80%) (Vorlex)	15 gallons	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.

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
Un sulfonated 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.

Changing only rate of travel makes it possible to increase concentration but *without* the necessity of changing the rate of discharge of the nozzles.

For example, if rate of travel is 3 miles per hour and the change is to 4 miles per hour, an original concentration of 3x would change to 4x. Or, if the original concentration is 2x, the concentration would change to 2 2/3x.

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 [*methyyl 1-(butylcarbamoyl)-2-benzimidazole carbamate*] has been cleared for use on peaches, nectarines, apricots, cherries, prunes, and plums for the control of brown rot, powery mildew, peach scab, and cherry leaf spot. It is formulated as a 50% wettable powder under the trade name Benlate. 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 gal. of water in preharvest sprays or as a post-harvest 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 infection conditions but under severe conditions, higher rates performed significantly better.

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. **BOTRAN** (2, 6-dichloro-4-nitroaniline) is suggested for use as a pre-harvest spray on sweet cherries and peaches, as a post-harvest dip on peach fruit, as a spray for sweet cherry fruit while sorting, and in combination with wax on nectarines. It is not cleared for use on other stone fruits. Botran is formulated as a 75% wettable powder and is particularly effective on *Rhizopus* rot. Control of both *Rhizopus* rot and brown rot can be achieved by combining Botran at 2/3 lb. per 100 gal. of water with Captan at 1 lb. It may leave a yellow residue on fruit when used at high rates.

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, Botryospheria 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. It is also combined with Botran for control of both *Rhizopus* rot and brown rot.

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.

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-eradicator 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 in late cover sprays starting at third cover.

INSECTICIDES

CARZOL (*See bottom of page 17 for addendum*)

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 it does have label clearance on apricots, peaches, cherries, plums, prunes, grapes and strawberries for similar purposes. The material has further proven 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 (*O, O-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 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 (*O, O-dimethyl S-(N-methylcarbamoyl-methyl) phosphorodithioate*) is marketed as *Cygon* and *De-Fend* for a wide range of insects on bearing

apples and pears, but in most instances there are better rated materials for the same purposes. Sold as a 2.67 lb. per gal. emulsion concentrate and 25% wettable powder, its systemic properties do 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 on apple varieties maturing before McIntosh, since severe leaf injury and subsequent fruit drop are likely to occur.

GALECRON-FUNDAL (N-(4-chloro-o-tolyl)-N, N-dimethylformamide 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 outstanding 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.

Galecron and Fundal efficiently 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.

GARDONA (2-chloro-1-(2, 4, 5-trichlorophenyl) vinyl dimethyl phosphate) is a non-systemic, synthetic phosphate. It features low toxicity to man, animals and wildlife (comparable to malathion), moderate damage to beneficial insects, and a definite hazard to fish. Cleared for apples, it is formulated as a 75% wettable powder and suggested at 2/3 lb. per 100 gal. of water. Experience demonstrates its effectiveness against codling moth, red-banded leafroller, plum curculio, tarnished plant bug, fruit tree leafroller, and apple maggot when applied at 10 to 14 day intervals, starting with petal fall through late cover sprays. Usable within 7 days of harvest, it should greatly benefit growers faced with late season insect problems on apples. Data obtained from commercial application in apple-growing areas of the country indicate that Gardona is equal to, or better than, the commercial standard in respect to fruit finish and marketing quality.

GUTHION (0, 0-dimethyl S-(4-oxo-1, 2, 3-benzotriazinyl-3-methyl) phosphorodithioate) effectively controls an almost unlimited number of the insects found commonly infesting 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 another relatively new phosphate chemical with a preferable safety margin in its low toxicity to mammals, comparable to Sevin. Formulated as a 50% wettable powder for pre-bloom and post-bloom application on apples, pears and peaches, 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 on most tree fruits and both pre-bloom and post-bloom for apples and pears. 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, including strains resistant to other miticides. Trials show it equally effective in summer mite control programs on apples, applied as full coverage sprays. At present, Morestan cannot be used after blossom time elsewhere because legal residue tolerances are not established. To prevent fruit injury, never tank-mix Morestan with other materials.

OMITE (*2-(p-tert-butylphenoxy) cyclohexyl-2-propynyl sulfite*) was a newly introduced miticide this past season. Closely related to Aramite in chemical structure, it 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. Omitte 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 populations, make two applications 7 to 10 days apart.

PARATHION (*O,O-diethyl O-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 at 4 lb. per gal. emulsifiable 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 and grapes, it controls aphids, codling moth, apple maggot, red-banded leafroller, plum curculio, pear psylla, leafhoppers and phosphate susceptible European red and two-spotted mites. Marketed as an emulsifiable concentrate containing 3 lbs. of active ingredient per gallon, it can be applied to within 14 days of harvest on the three crops indicated. Somewhat weak in its Michigan

performances on plum curculio, Phosalone is suggested here in cover spray applications for apple. For this purpose, at a 1 pint rate or 4 pints per acre starting with 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.

PHOSDRIN (*alpha isomer of 2-carbomethoxy-1-methyl-vinyl dimethyl phosphate*) has given good results as a systemic clean-up material for aphids, mites and red-banded leafroller. Phosdrin is now labeled for most Michigan fruits. Although it controls a varied selection of insects, its insecticidal activity is lost in about 24 hours. From this standpoint, it is more useful as a clean-up material for adults than as a protective insecticide. In this respect, it is currently being used as a 4 lb. per gal. emulsion concentrate at 1/4 pint to reinforce Tedion effectiveness on adult mites. Since it is highly toxic to humans, due care and caution are necessary when using Phosdrin.

PHOSPHAMIDON (*2-chloro-2-diethylcarbamoyl-1-methyl-vinyl 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 successful against white apple leafhopper. Phosphamidon warrants the same precautions granted any cholinesterase-inhibiting chemical.

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.

TEDION (*4-chlorophenyl 2,4,5-trichlorophenyl sulfone*) is traded as a 25% wettable powder and emulsion concentrate. For Michigan, it rates well in performance as a miticide whenever mites are of economic importance on apples, pears, peaches, apricots, plums and prunes. Tedion offers long residue effectiveness and a high level of safety to man, plants and beneficial insects. It works best against eggs and young mites, providing little value as an adulticide. At present, Tedion is usually emphasized for use when mite control is necessary before July 1, with Kelthane suggested as the substitute after that date.

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, 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

What are pheromones? In simplest terms, they are nothing more than 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.

In 1971, a first-time availability to performance-rated pheromone (sex lure) traps, trademarked **SECTAR** insect traps, offered 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 are the best technique discovered for foolproof insect detection, because it is done nature's way. Also, they will 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 this season. They were of measureable 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 temporarily supplemental reinforcements and not replacements for other commonly used insect monitoring procedures. They can help you to better know your insects; which ones you are fighting and when "to" or "not to" fight them. With them you no longer have to be an exponent of, "when in doubt, better spray". 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.

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.

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).

When using spray masts or hand guns, fog the spray into the trees. *Do not* use a coarse stream, because the force of the droplets hitting the fruit will cause russetting. Dust applications on this variety during the critical period of *Pink* through *Second Cover* in place of sprays is a very favorable practice.

Avoid insecticides until *First Cover*, and then use wettable Guthion. Gardona may russet Golden Delicious under certain conditions. 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 before *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. Delay the use of an insecticide until *First Cover* and then use wettable Guthion.

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.

Only use 2,4,5-TP on varieties maturing after 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 5).

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 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.

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 wood-chuck 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.

Insecticide Addendum From Page 9 . . .

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.

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 eradivative 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			
Dichlone (Phygon)			
Dodine (Cyprex)			

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 eradivative 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 eradivative properties. Whether a ½-strength or full-strength eradivative 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 eradivative 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 and aphids, require supplemental applications with ground equipment.

Compatibility Chart

	Lead Arsenate	Methoxychlor	Kelthane	Chloropropylate	Parathion, Ethion	Systox	Malathion, Trithion	Diazinon	Guthion	Captan	Dichlone (Phygon)	Bordeaux	Fixed Copper	Lime Sulfur	Elemental Sulfur	Ferbam, Thiram	Ziram, Zineb	Niacide M	Lime	Dinocap (Karathane)	Rotenone	Sevin	Tedion	Dodine (Cyprex)	Superior Oil	Morestan	Thiodan	Phosphamidon	Dimethoate	Imidan	Omite	Phosdrin	Perthane	Gardona	Zolone	Galecron-Fundal	Dikar	Carzol		
Lead Arsenate		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Methoxychlor	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Kelthane	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Chloropropylate	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Parathion, Ethion	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Systox	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Malathion, Trithion	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Diazinon	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Guthion	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Captan	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Dichlone (Phygon)	+	+	+	N	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Bordeaux	+	+	N	Q	+	Q	+	Q	Q	N	Q	Q	Q	+	+	Q	Q	Q	Q	+	Q	N	N	Q	N	Q	N	Q	+	+	+	+	+	+	+	+	+	+		
Fixed Copper	+	+	N	N	+	Q	+	Q	Q	N	Q	+	+	N	+	Q	Q	Q	Q	+	Q	N	N	Q	N	Q	N	+	+	+	+	+	+	+	+	+	+	+		
Lime Sulfur	+	Q	N	Q	+	Q	+	Q	Q	N	Q	N	N	+	+	Q	Q	Q	Q	+	Q	N	N	+	N	Q	N	+	+	+	+	+	+	+	+	+	+	+		
Elemental Sulfur	+	+	+	N	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Ferbam, Thiram	+	+	+	+	+	+	+	+	+	+	+	Q	Q	Q	+	+	+	+	N	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Ziram, Zineb	+	+	+	Q	+	+	+	+	+	+	+	Q	Q	Q	+	+	+	+	N	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Niacide M	+	+	+	+	+	+	+	+	+	+	+	Q	Q	Q	+	+	+	+	N	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Lime	+	Q	N	Q	+	+	+	+	+	N	Q	+	+	+	+	N	N	N	N	+	Q	N	N	Q	N	+	Q	N	+	+	+	N	N	N	Q	Q	N	Q		
Dinocap (Karathane)	+	+	+	+	+	+	Q	+	+	+	+	Q	Q	Q	+	+	+	+	Q	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Rotenone	+	+	+	+	+	+	+	+	+	+	+	N	N	N	+	+	+	+	N	+	Q	Q	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
Sevin	+	+	+	+	+	+	+	+	+	+	+	N	+	N	+	+	+	+	N	+	Q	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Tedion	+	+	+	+	+	+	+	+	+	+	Q	Q	Q	+	+	+	Q	+	Q	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Dodine (Cyprex)	+	+	+	N	+	N	+	+	+	+	+	Q	N	N	+	+	+	+	N	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Superior Oil	N	+	+	N	+	+	+	+	+	N	N	+	+	N	N	+	+	+	N	N	+	+	+	+	+	+	N	+	+	+	+	Q	N	+	Q	+	+			
Morestan	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	N	Q	Q	Q	Q	+	Q	Q	Q	Q	+	Q			
Thiodan	+	+	+	+	+	+	+	+	+	+	+	N	+	N	+	+	+	+	N	+	+	+	+	+	+	+	Q	+	+	+	+	+	+	+	+	+	+	+		
Phosphamidon	+	+	+	+	+	+	+	+	+	+	+	Q	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Q	+	+	+	+	Q	Q	+	+	+	+	+	+	
Dimethoate	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Imidan	+	Q	+	Q	+	+	+	Q	Q	+	Q	N	Q	N	+	+	+	Q	N	+	Q	+	+	+	+	+	Q	+	+	+	+	+	Q	+	+	+	+	+		
Omite	+	Q	Q	Q	+	+	+	N	+	+	+	N	+	N	+	+	+	Q	N	+	Q	+	+	+	+	+	N	Q	+	Q	+	Q	+	+	Q	+	+	+		
Phosdrin	+	+	+	Q	+	+	+	+	+	+	+	N	+	N	+	+	+	+	N	+	+	+	+	+	+	+	Q	+	+	+	+	Q	+	+	+	Q	+	+		
Perthane	+	+	+	Q	+	+	+	+	+	+	+	+	+	Q	+	+	+	+	Q	+	+	+	+	+	+	Q	Q	+	+	+	+	Q	Q	+	Q	Q	+	Q		
Gardona	+	+	+	Q	+	+	Q	Q	N	+	Q	Q	Q	Q	+	+	+	+	Q	+	Q	+	+	+	+	+	+	Q	Q	+	Q	Q	+	Q	Q	Q	+	Q		
Zolone	+	Q	+	Q	+	+	Q	Q	Q	+	Q	Q	Q	+	+	+	+	+	Q	+	Q	Q	+	+	+	+	Q	Q	+	+	+	Q	Q	Q	Q	Q	+	Q		
Galecron-Fundal	+	Q	Q	Q	+	+	Q	+	+	+	+	Q	N	N	+	+	+	+	N	+	Q	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
Dikar	+	+	+	+	+	+	+	+	+	+	+	Q	+	+	+	+	+	+	Q	+	+	+	+	+	+	N	Q	+	+	+	+	+	+	+	+	+	+	+		
Carzol	Q	Q	Q	Q	Q	Q	Q	Q	+	+	N	Q	Q	N	Q	Q	Q	Q	N	Q	Q	+	Q	Q	Q	+	Q	Q	Q	Q	Q	+	Q	Q	Q	Q	Q	Q		

Q = Questionable; compatibility not clear.

N = Not compatible.

+ = Decomposes on standing; residual action reduced.

++ = Materials compatible.

*Compatible materials are those which can be mixed together in a spray tank without: (1) loss of effectiveness of the materials, or (2) unfavorable chemical reactions between the materials which might harm the plants.

Except when using ferbam, streptomycin is most favorably applied as a separate application, although it is compatible with ferbam or captan when necessary for scab control. Urea formulated for foliar applications is compatible with the commonly used pesticides. However, it doesn't seem to be compatible with fixed copper or Bordeaux.

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*		Climbing Cutworms	
(Powdery Mildew and other diseases—see page 25)			
	Rate/100 gallons		Rate/100 gallons
LIME SULFUR	2 gallons		8 gallons
	or		
DODINE (CYPREX)**		PARATHION (15% WP)	2 pounds
(65% WP)	½ to 1 pound		8 pounds
	or		or
DICHLONE (PHYGON)		PARATHION LIQUID	0.30 pounds
(50% WP)	¼ pound, plus		1.20 pounds
PROTECTANT	½ strength		active ingred.
	or		
CAPTAN (50% WP)	2 pounds		
	or		
DIKAR (80% WP)***	2 pounds		
	or		
WETTABLE SULFUR	6 pounds		

NOTE: Special Dylox (5%) and Sevin (5%) baits are available for cutworm control, applied at 2-4 ounces per tree in an area 6 feet by 6 feet around the base of the tree.

Green Tip to Pre-Pink

Oil Schedule

Sepal and Leaf Scab*

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

DODINE (CYPREX)**
(65% WP) ½ to 1 pound 1½ to 2 pounds

Superior Oil, 70 sec. vis. 2 gallons 8 gallons

NOTE: Oil must be used as a dilute spray at the rate per acre shown for effective mite and scale control. Superior oil, 70 sec. vis. plus ETHION ¼ pound actual or FLOWABLE PARATHION 0.15 pounds actual, has given better control of San Jose scale than oil applied alone. Better mite control has been 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 before bloom. Do not add parathion to oil when spraying McIntosh and related varieties. When sulfur compounds 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) ¼ pint 1 pint

DEMETON (SYSTOX)
(6 pounds/gallon) ¼ pint 1 pint

DIMETHOATE (2.67 EC) 1 pint 4 pints

DIMETHOATE (25% WP) 1 pound 4 pounds

Tarnished Plant Bug, Green Fruit Worms, Leafrollers,
Climbing Cutworms

PARATHION (15% WP) 1 pound 4 pounds

PARATHION LIQUID 0.15 pounds 0.50 pounds

GUTHION (50% WP) ½ pound 2 pounds

IMIDAN** (50% WP) 1 pound 4 pounds

NOTE: Do not use SULFUR compounds, DICHLONE (Phygon), CAPTAN, DIKAR or DINOCA (KARATHANE) with oil.

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

**NOTE: IMIDAN also controls Rosy and Green Apple Aphids.

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

**Use Cyprex, ½ pound for longer back action.

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

APPLES

Pre-Pink and Pink Non-Oil Schedule

Scab

	Rate/100 gallons	Rate/acre
DODINE (CYPREX) (65% WP)	¾ to 1½ pound	1½ to 2 pounds
or		
DICHLONE (PHYGON) (50% WP)	¾ pound, plus	1 pound, plus
PROTECTANT	¾ strength	¾ strength
or		
CAPTAN (50% WP)	2 pounds	8 pounds
or		
DIKAR (80% WP)	2 pounds	8 pounds
or		
WETTABLE SULFUR	6 pounds	24 pounds

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

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

	Rate/100 gallons	Rate/acre
European Red Mite		
MORESTAN (25% WP)	¾ pound	2 pounds
or		
TEDION (1EC)	1 quart	4 quarts
or		
CHLOROPROPYLATE (ACARALATE) (2EC)*	1½ pints	6 pints
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***		
PHOSPHAMIDON (8 pounds/gallon)	¼ pint	1 pint
or		
DEMETON (SYSTOX) (6 pounds/gallon)	¼ pint	1 pint
or		
DIMETHOATE (2.67 EC)	1 pint	4 pints
or		
DIMETHOATE (25% 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 active ingred.	0.50 pound active ingred.
GUTHION (50% WP)	½ pound	2 pounds
or		
IMIDAN (50% WP)	1 pound	4 pounds

*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).

***NOTE: PHOSPHAMIDON or DEMETON or DIMETHOATE application at pink to late pink offers systemic control of white apple leafhopper through bloom. Later problems with this insect may thus be reduced. Refer to rates given under petal fall.

NOTE: See Russetting of Golden Delicious when selecting pesticides — page 12.

Period of Bloom

Fire Blight

On susceptible varieties*

BORDEAUX	2-6-100
or	
STREPTOMYCIN	50 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 27.)

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 17). 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, 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
CAPTAN (50% WP)	2 pounds	8 pounds
	or	
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	
DIKAR (80% WP)	2 pounds	8 pounds
	or	
WETTABLE SULFUR	6 pounds	24 pounds

	Rate/100 gallons	Rate/acre
Red-Banded Leaf Roller,**		
Plum Curculio		
GUTHION (50% WP)	½ pound	2 pounds
	or	
IMIDAN (50% WP)	1 pound	4 pounds
	or	
GARDONA (75% WP)	2/3 pound	2½ pounds
White Apple Leafhopper,		
Aphids***		
DEMETON (SYSTOX)		
(6 pounds/gallon)	1/3 pint	1 1/3 pints
	or	
DIMETHOATE (2.67 EC)	1½ 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

*NOTE: IF CURCULIO IS A PROBLEM, INCREASE GUTHION OR IMIDAN OR GARDONA RATE BY 25%. APPLY A SECOND SPRAY 7 DAYS LATER.

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

***NOTE: MAXIMUM KILL OF NYMPHS BY THOROUGH COVERAGE OF UPPER AND LOWER LEAF SURFACES IS MOST ESSENTIAL FOR EFFECTIVE LEAFHOPPER CONTROL. An additional application of DEMETON or DIMETHOATE or THIODAN may be needed in late August or September to control a second generation of leafhoppers.

NOTE: See sections on Russetting of Jonathan and Golden Delicious on page 14 and Fruit Thinning, pages 15 and 16.

First Cover

(7 to 10 days after Petal Fall)

Scab

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

Same fungicides as in Petal Fall

Same insecticides as in Petal Fall

NOTE: A repeat application of DEMETON or DIMETHOATE or THIODAN advised if leafhoppers are a major and continued problem.

Second Cover

(10 to 14 days after First Cover)

Scab

Codling Moth,* Aphids, Plum Curculio

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

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	
GARDONA (75% WP)	2/3 pound	2½ pounds
	or	
DIAZINON (50% WP)	1 pound	4 pounds
	or	
PHOSALONE (ZOLONE)**		
(3 EC)	1 pint	4 pints

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

**NOTE: PHOSALONE (ZOLONE) will control non-phosphate resistant mites.

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.

	Rate/100 gallons	Rate/acre
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	
PHOSDRIN (4 EC)	¼ pint, plus	1 pint, plus
TEDION (1 EC)	1 quart	4 quarts
	or	
MORESTAN* (25% WP)	½ pound	2 pounds
	or	
CARZOL SP (Soluble powder)	¼ to ½ pound	1 to 2 pounds

	Rate/100 gallons	Rate/acre
CHLOROPROPYLATE	or	
(ACARALATE)	2 pints	8 pints
	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: To prevent fruit injury, do not tank-mix with other materials.		
**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

CAPTAN (50% WP)	1 to 1½ pound	4 to 6 pounds
	or	
DODINE (CYPREX) (65% WP)	¼ pound	1 pound
	or	
DIKAR (80% WP)	1½ pounds	6 pounds

Codling Moth, Aphids

GUTHION (50% WP)	½ pound	2 pounds
	or	
SEVIN (50% WP)	1 pound	4 pounds
	or	
SEVIN LIQUID	0.5 pounds	2 pounds
	active ingred.	active ingred.
	or	
IMIDAN (50% WP)	1 pound	4 pounds
	or	
GARDONA (75% WP)	2/3 pound	2½ pounds
	or	
DIAZINON (50% WP)	1 pound	4 pounds
	or	
PHOSALONE (ZOLONE) (3 EC)	1 pint	4 pints

Fourth Cover

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

Scab

DODINE (CYPREX) (65% WP)	¼ pound	1 pound
	or	
CAPTAN (50% WP)	1 pound	4 pounds
	or	
DIKAR (80% WP)	1½ pounds	6 pounds

Apple Maggot, Codling Moth, Aphids

GUTHION (50% WP)	½ pound	2 pounds
	or	
SEVIN* (50% WP)	2 pounds	8 pounds
	or	
SEVIN LIQUID*	1 pound	4 pounds
	active ingred.	active ingred.
	or	
GUTHION (50% WP)	¼ pound, plus	1 pound, plus
SEVIN (50% WP)	½ pound, or	2 pounds, or
SEVIN LIQUID	0.25 pound	1 pound
	active ingred.	active ingred.
	or	
LEAD ARSENATE	2 pounds, plus	8 pounds, plus
PARATHION (15% WP)	1 pound, or	4 pounds, or
PARATHION LIQUID	0.15 pounds	0.50 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)	¼ pint	1 pint

Apple Maggot, Codling Moth, Aphids (Continued)

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
IMIDAN (50% WP)	1 pound	4 pounds	DIAZINON (50% WP)	1 pound	4 pounds
	or			or	
GARDONA (75% WP)	2/3 pound	2½ pounds	PHOSALONE (ZOLONE)	1 pint	4 pints
			(3 EC)		
CAUTION: Use ½ 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,* Aphids

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,* Aphids

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 24.

Seventh and Eighth Cover

(10-14 day intervals after Sixth Cover)

Scab

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

Same fungicides as for Fourth Cover

GUTHION (50% WP)½ pound2 pounds
or
GUTHION (50% WP)¼ pound, plus1 pound, plus
SEVIN (50% WP)½ pound, or2 pounds, or
SEVIN LIQUID0.25 pounds1 pound
active ingred. active ingred.

IMIDAN (50% WP)1 pound4 pounds

GARDONA (75% WP)2/3 pound2½ pounds

DIAZINON (50% WP)1 pound4 pounds

PHOSALONE (ZOLONE)
(3 EC)1 pint4 pints

Codling Moth, Apple Maggot, Red-Banded Leaf Roller, Aphids, White Apple Leafhopper*

SEVIN** (50% WP)2 pounds8 pounds

SEVIN LIQUID**1 pound4 pounds
active ingred. active ingred.

*NOTE: SYSTOX or DIMETHOATE or THIODAN will also control second generation leafhoppers. Refer to rates given under Petal Fall.

**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)*

	Rate/100 gallons	Rate/acre
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

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

Cover Sprays Starting at Third Cover

Sooty Blotch, Fly Speck and Scab

	Rate/100 gallons	Rate/acre
CAPTAN (50% WP)	1 pound, plus	4 pound, plus
ZINEB (75% WP)	1 pound	4 pounds

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

Powdery Mildew

Scab fungicide plus WETTABLE SULFUR (325 mesh)	2 pounds	8 pounds
or		
Scab fungicide plus DINOCAP (KARATHANE) (25% WP)	½ pound	2 pounds
or		
DIKAR (80% WP)	1½ pounds	6 pounds

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

Northwestern Anthracnose (Bull's Eye Rot). Where this disease is a problem, use ZIRAM 1½ pounds or CAPTAN

Pink to Third Cover

Cedar-Apple Rust

FERBAM (76% WP)	2 pounds	8 pounds
or		
FERBAM (76% WP)	¾ pound, plus	3 pound, plus
SCAB FUNGICIDE	½ strength	½ strength
or		
THIRAM (THYLATE) (65% WP)	2 pounds	8 pounds

(50% WP) 2 pounds in the late cover sprays, starting in early August until 1 or 2 weeks before harvest at 2-week intervals.

Days Between Final Spray and Harvest

Insecticides: IMIDAN-7, GARDONA-7, PHOSDRIN-1, OMITE-7 and no more than 3 applications per year. DIAZINON-14, PHOSALONE (ZOLONE)-14, GALECRON and FUNDAL-14 and no more than 3 applications while fruit is on the tree, DYLOX- do not apply after fruit has formed, THIODAN-21 when not more than 3 applications are used. CHLOROPROPYLATE (ACARALATE)-14; DIMETHOATE-28; DEMETON (SYSTOX)-21; GUTHION-7; KELTHANE-7; LEAD ARSENATE-30; MORESTAN-35; PARATHION-14; PHOSPHAMIDON-30; SEVIN-1; TEDION-apply no more than 4 treatments after petal fall if the rate is either 1 pound of TEDION (25% WP) or 1 quart of TEDION (1 EC) per 100 gallons; CARZOL-7 and no more than 4 pounds per acre in a crop season.

Fungicides: CAPTAN-0; DICHLONE (PHYGON)-1; DIKAR-21, DODINE (CYREX)-7; DINOCAP (KARATHANE)-21; SULPHUR-0; THIRAM (THYLATE)-0; ZINEB-7; STREPTOMYCIN-50.

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

*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.

INSECTS

Resistant Pear Psylla*

	Rate/100 gallons	Rate/acre
THIODAN (2EC)	1 quart	3 quarts
	or	
PERTHANE (4 EC)	1 quart	3 quarts

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, air applications may be necessary and advisable if the orchard is too wet to operate ground equipment. Where GUTHION, SEVIN, PARATHION or IMIDAN still control pear psylla, pre-bloom sprays are not needed.

Green Tip to Pre-Pink

Oil Schedule

Pear Scab, Leaf Spot

FERBAM (76% WP)	1½ pounds	4½ pounds
-----------------	-----------	-----------

European Red Mite, San Jose Scale*

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

FERBAM (76% WP)	1½ pounds	4½ pounds
	or	
BORDEAUX	3-8-100	
	or	
CAPTAN (50% WP)	2 pounds	6 pounds

European Red Mite (preventive program)

TEDION (1 EC)	1 quart	3 quarts
	or	
CHLOROPROPYLATE (ACARALATE)* (2 EC)	1½ pint	4½ pints
	or	
MORESTAN (25% WP)	½ pound	1½ pounds
	or	
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.

Pears Scab, Leaf Spot (Continued)

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

European Red Mite (preventive programs) (Continued)

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

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

Period of Bloom

(When first blooms start to open)

Fireblight

	Rate/100 gallons	Rate/acre
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.

*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 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 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

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

1. FERBAM (76% WP)	1 1/2 pounds	4 1/2 pounds
or		
CAPTAN (50% WP)	2 pounds	6 pounds
2. BORDEAUX	2-6-100	

IMIDAN (50% WP)	1 pound	3 pounds
or		
GUTHION (50% WP)	1/2 pound	1 1/2 pounds
or		
SEVIN (50% WP)	2 pounds	6 pounds
or		
SEVIN LIQUID	1 pound	3 pounds
	active ingred.	active ingred.
or		

PEARS (Continued)

Non-Resistant Pear Psylla, Tarnished Plant Bug, Plum Curculio, Green Fruit Worms, Aphids (Continued)

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
PARATHION (15% WP)	1 pound	3 pounds
	<i>or</i>	
PARATHION LIQUID	0.15 pounds active ingred.	0.45 pounds 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.

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

Pear Psylla, Plum Curculio

Same insecticides as for Petal Fall

NOTE: If European red mites start to build up, use OMITE (30% WP) 1½ pounds (3¾ pounds/acre), or KELTHANE (35% WP) 1½ pounds (3¾ pounds/acre), or TEDION (1 EC) 1 quart (3 quarts/acre), or CHLOROPROPYLATE (ACARALATE) (2 EC) 2 pints (6 pints/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). More than 1 spray may be required if mites are numerous.

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.

Second Cover (12 to 14 days after First Cover)

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

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

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

SEVIN (50% WP)	2 pounds	6 pounds
	<i>or</i>	
SEVIN LIQUID	1 pound active ingred.	3 pounds active ingred.

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

**NOTE: If blister mite and pear rust mite are not present, GUTHION (50% WP) ½ pound (1½ pounds/acre) or IMIDAN (50% WP) 1 pound (3 pounds/acre) or PARATHION (15% WP) 1 pound (3 pounds/acre) or PARATHION LIQUID, 0.15 pound active ingredient (0.45 pounds active ingredient/acre), may be substituted for SEVIN. KELTHANE (35% WP) 1½ pounds (3¾ pounds/acre) or KELTHANE (18.5% EC) 1 quart (3 quarts/acre) will control pear rust mites and other mites if they are the only problem.

Aphids Only

DEMETON (SYSTOX) (6 pounds/gallon) ¼ pint	¾ pint
	<i>or</i>
DIMETHOATE (25% WP) 1 pound	3 pounds
	<i>or</i>
DIMETHOATE (2.67 EC) 1 pint	3 pints

Third Cover (10 to 14 days after Second Cover)

1. Pear Scab, Leaf Blight**2. Fireblight, Scab, Leaf Blight****Codling Moth**

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>		<i>Rate/100 gallons</i>	<i>Rate/acre</i>
1. FERBAM (76% WP)	1½ pounds	4½ pounds	GUTHION (50% WP)	½ pound	1½ pounds
	<i>or</i>			<i>or</i>	
CAPTAN (50% WP)	1½ pounds	5 pounds	SEVIN (50% WP)	1 pound	3 pounds
	<i>or</i>			<i>or</i>	
2. BORDEAUX	2-6-100		SEVIN LIQUID	0.5 pound	1.5 pounds
				active ingred.	active ingred.
				<i>or</i>	
			IMIDAN (50% WP)	1 pound	3 pounds

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

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.

Fourth Cover

(10 to 14 days after Third Cover)

Pear Scab, Leaf Blight**Codling Moth**

BORDEAUX	2-6-100		SEVIN (50% WP)	1 pound	3 pounds
	<i>or</i>			<i>or</i>	
FERBAM (76% WP)	1½ pounds	4½ pounds	SEVIN LIQUID	0.5 pounds	1.5 pounds
	<i>or</i>			active ingred.	active ingred.
CAPTAN (50% WP)	1½ pounds	4½ pounds		<i>or</i>	
			GUTHION (50% WP)	½ pound	1½ pounds
				<i>or</i>	
			IMIDAN (50% WP)	1 pound	3 pounds

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**Codling Moth**

Same fungicides as for Fourth Cover

Same insecticides as for Fourth 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 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; TEDION—not more than 4 applications after Petal Fall if 1 pound or 1 quart of TEDION is used per 100 gallons; CARZOL—7 and no more than 4 pounds per acre in a crop season.

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

PEACH 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 (EC-2) used at the rate of 5 pounds actual

per 100 gallons. Dip trees several inches above the bud scar and allow to dry before planting or returning to storage.

Dormant

DISEASES

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	6-100	
(Use on bacterial spot susceptible varieties.)		
In the spring only		
LIME SULFUR	5 gallons	15 gallons

INSECTS

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
	<i>active ingred.</i>	<i>active ingred.</i>

NOTE: When growth starts, spray ground 3 feet from tree trunk plus trunk and main branches thoroughly. Guthion will not control climbing cutworms. Special DYLOX (5%) and SEVIN (5%) baits are available for cutworm control, applied at 2-4 ounces per tree in an area 6 feet by 6 feet around the base of the tree.

Pink

Plant Bugs

PARATHION (15% WP)	1 pound3 pounds
	<i>or</i>	
IMIDAN (50% WP)	1 pound3 pounds
	<i>or</i>	
THIODAN (2 EC)	1 quart3 quarts
	<i>or</i>	
THIODAN (50% WP)	1 pound3 pounds

NOTE: THIODAN is most specific for plant bugs.

Bloom (Balloon pink through bloom)

Brown Rot (blossom blight)

	Rate/100 gallons	Rate/acre
LIME SULFUR (balloon pink only)	2 gallons	6 gallons
	or	
BENOMYL (BENLATE) (50% WP)	½ pound	1.5 pounds
	or	
DICHLONE (PHYGON) (50% WP)	½ pound	1.5 pounds
	or	
SULFUR PASTE	6 pounds	18 pounds
	or	
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

1. Brown Rot, Powdery Mildew
2. Bacterial Spot, Brown Rot

1. WETTABLE SULFUR	5 pounds	15 pounds
	or	
SULFUR PASTE	6 pounds	18 pounds
	or	
BENOMYL (BENLATE) (50% WP)	½ pound	1.5 pounds

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

2. On trial basis for susceptible varieties*

DODINE (CYPREX) (65% WP)	½ pound, plus	1.5 pounds, plus
CAPTAN (50% WP)	1 pound	3 pounds

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.

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

Oriental Fruit Moth*, Plant Bugs, Green Peach Aphid

Oriental Fruit Moth, Plant Bugs

PARATHION (15% WP)	1½ pounds	4½ pounds
	or	
PARATHION LIQUID	0.23 pounds	0.70 pounds
	active ingred.	active ingred.
	or	
SEVIN (50% WP)	2 pounds	6 pounds
	or	
SEVIN LIQUID	1 pound	3 pounds
	active ingred.	active ingred.

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

**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.

Shuck Split

(Usually 10 to 12 days after Petal Fall)

Brown Rot* and Powdery Mildew**

* Only if necessary

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

PEACHES

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

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

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:

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. **Good coverage, particularly of the susceptible areas mentioned above, is a must for good borer control.**

First Cover

(10 to 12 days after Shuck Split)

Peach Scab and Powdery Mildew

	Rate/100 gallons	Rate/acre
WETTABLE SULFUR	5 pounds	15 pounds
	or	
SULFUR PASTE	6 pounds	18 pounds
	or	
BENOMYL (BENLATE) (50% WP)	½ pound	1.5 pounds

Plum Curculio, Oriental Fruit Moth

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

Same insecticides as suggested for Shuck Split

Second Cover

(14 days after First Cover)

Powdery Mildew

Same as First Cover. If mildew was severe in 1971 use sulfur in the next two cover sprays.

Oriental Fruit Moth

Same insecticides as suggested for Shuck Split and First Cover.

Third Cover

(14 days after Second Cover)

Peach Scab

WETTABLE SULFUR	5 pounds	15 pounds
	or	
SULFUR PASTE	6 pounds	18 pounds
	or	
CAPTAN (50% WP)	2 pounds	6 pounds
	or	
BENOMYL (BENLATE) (50% WP)	½ pound	1.5 pounds

Oriental Fruit Moth, Mites

Same insecticides as suggested for Shuck Split and First Cover.

Mites

OMITE (30% WP)	1¼ pounds	3¾ pounds
	or	
KELTHANE (35% WP)	1¼ pounds	3¾ pounds
	or	
KELTHANE (18.5 EC)	1 quart	3 quarts
	or	
TEDION (1 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

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
CAPTAN (50% WP)	2 pounds	6 pounds
	<i>or</i>	
WETTABLE SULFUR	5 pounds	15 pounds
	<i>or</i>	
SULFUR PASTE	6 pounds	18 pounds
	<i>or</i>	
BENOMYL (BENLATE) (50% WP)	$\frac{1}{2}$ pound	1.5 pounds

Oriental Fruit Moth

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
GUTHION (50% WP)	$\frac{1}{2}$ pound	1 $\frac{1}{2}$ pounds
	<i>or</i>	
GUTHION (2 pounds/ gallon SC)	1 pint	3 pints
	<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)	1 $\frac{1}{2}$ pounds	4 $\frac{1}{2}$ 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

Pre-Harvest Covers

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

1. Brown Rot**2. Brown Rot and Rhizopus Rot**

1. Same fungicides as for Fourth Cover.
2. CAPTAN (50% WP)1 pound, plus3 pounds, plus
*BOTRAN (75% WP).....2/3 pound2 pounds

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.

*Compatible with wettable powder insecticides listed in Fourth Cover. Compatibility with liquid formations not known.

NOTE: BOTRAN is effective on Rhizopus Rot.

Oriental Fruit Moth

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

Chokecherry 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, by deep plowing, by burning, or by pulling out individual bushes. Brush killers are effective in areas where cultivation is not possible or is too costly. In the fall or early winter (after October 1), kill chokecherry plants by applying a mixture of 2,4,5-T in oil to the basal

part of the trunk to a height of 12 to 15 inches above the ground line. Another method which is equally effective, is to cut off the chokecherry tops and spray the freshly cut stumps and stubs with the spray mixture. Follow the directions on the container for preparing the spray. 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.

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; DYLOX-do not apply after fruit forms. GUTHION-21; KELTHANE-14; PARATHION-14; SEVIN-1; TEDION-not more than 2 applications after shuck-split if 1 pound or 1 quart of TEDION is used per 100 gallons. THIODAN-21 for Peach Tree Borer and 30 for Lesser Peach Tree Borer. Do not make more than 2 applications during fruiting period.

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)

DISEASES

INSECTS

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.		
	<i>or</i>				
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

DISEASES

INSECTS

Brown Rot, Scab

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

Shuck Split Spray

DISEASES

INSECTS

Brown Rot, Scab

Plum Curculio, Oriental Fruit Moth

CAPTAN (50% WP)	2 pounds	6 pounds	GUTHION (50% WP)	½ pound	1½ pounds
or			or		
BENOMYL (BENLATE)			SEVIN (50% WP)	2 pounds	6 pounds
(50% WP)	½ pound	1.5 pounds	or		
			PARATHION (15% WP)	2 pounds	6 pounds

First Cover Spray (8-10 Days After Shuck Split)

DISEASES

INSECTS

Apricot Scab

Plum Curculio, Oriental Fruit Moth

Same as Shuck Split Spray

Same as Shuck Split Spray

Second Cover Spray

(8-10 Days After First Cover)

DISEASES

Apricot Scab

Same as Shuck Split Spray

INSECTS

Plum Curculio, Oriental Fruit Moth

Same as Shuck Split Spray

Summer Sprays

(Starting End of June)

DISEASES

Apricot Scab, Brown Rot

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

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

INSECTS

Oriental Fruit Moth

	Rate/100 gallons	Rate/acre
SEVIN (50% WP)	2 pounds	6 pounds
	<i>or</i>	
GUTHION (50% WP)	$\frac{1}{2}$ pound	1 $\frac{1}{2}$ pounds

NOTE: Three applications at 10-day intervals starting about June 25.

NOTE: Two applications at 14-day intervals. Last application not closer than 21 days before harvest.

After-Harvest Spray

INSECTS

Peach Tree Borer

THIODAN (endosulfan) (50% WP)	1 $\frac{1}{2}$ pounds	4 $\frac{1}{2}$ pounds
	<i>or</i>	
THIODAN (endosulfan) (2 EC)	1 $\frac{1}{2}$ quarts	4 $\frac{1}{2}$ quarts

NOTE: Thoroughly soak trunk to ground level.

Special Problems

INSECTS

European Red Mite

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

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

	<i>or</i>	
TEDION (1 EC)	1 quart	3 quarts

NOTE: One application after shuck split is permissible.

Days Between Final Spray and Harvest

Insecticides: GUTHION—21; PARATHION—14; TEDION—14; SEVIN—3; THIODAN—21.

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.

Delayed Dormant

Oil Schedule

DISEASES

Black Knot (Problem orchards)

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
ZINEB (75% WP)	2 pounds	6 pounds

NOTE: Prune out and burn all knots in the dormant season and repeat in early June. Continue to remove knots whenever they are observed.

CAUTION: When using oil, fill tank $\frac{1}{2}$ full of water, with agitators running, adding Zineb. Add oil after Zineb has been mixed in the spray tank.

INSECTS

European Red Mite (preventive program) Lecanium Scale*

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
Superior Oil, 70 second viscosity	2 gallons	6 gallons

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

*See apple schedule, Page 20. See Page 5

Delayed Dormant

Non-Oil Schedule

Black Knot (Problem orchards)

ZINEB (75% WP)	2 pounds	6 pounds
----------------------	----------	----------

Pink

Oil Schedule

Black Knot (problem orchards)

ZINEB (75% WP)	2 pounds	6 pounds
----------------------	----------	----------

Pink

Non-Oil Schedule

Black Knot (problem orchards)

European Red Mite (preventive mite program)

ZINEB (75% WP)	2 pounds	6 pounds
----------------------	----------	----------

TEDION (1 EC)	1 quart	3 quarts
<i>or</i>		
MORESTAN (25% WP)	$\frac{1}{2}$ pound	1 $\frac{1}{2}$ pounds

Bloom

1. Black Knot, Brown Rot
2. Black Knot

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>		<i>Rate/100 gallons</i>	<i>Rate/acre</i>
1. LIME SULFUR (early bloom)	2 gallons	6 gallons	Insecticides should not be used during Bloom.		
	<i>or</i>				
BENOMYL (BENLATE).....	½ pound	1.5 pounds			
(50% WP)					
	<i>or</i>				
DICHLONE (PHYGON) (50% WP)	½ pound	1.5 pounds			
	<i>or</i>				
WETTABLE SULFUR	5 pounds	15 pounds			
2. ZINEB (75% WP)	2 pounds	6 pounds			

Petal Fall

1. Leaf Spot, Brown Rot
2. Black Knot*

Plum Curculio, Leaf Rollers

1. FERBAM (76% WP)	1 pound, plus		GUTHION (50% WP)	½ pound	1½ pounds
WETTABLE SULFUR	3 pounds			<i>or</i>	
	<i>or</i>		GUTHION (2 pounds/ gallon SC)	1 pint	3 pints
BENOMYL (BENLATE).....	½ pound	1.5 pounds		<i>or</i>	
(50% WP)			PARATHION (15% WP)	1½ pounds	4½ pounds
2. ZINEB (75% WP)	2 pounds	6 pounds		<i>or</i>	
			PARATHION LIQUID	0.23 pounds	0.70 pounds
				active ingred.	active ingred.

*NOTE: Recent Pennsylvania studies indicate most black knot infection occurs from petal fall until growth stops.

Shuck Split

(Usually 10 to 14 days after Petal Fall)

1. Leaf Spot, Brown Rot
2. Black Knot

Plum Curculio

1. 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 (2 pounds/gallon SC)	1 pint	3 pints
LIME SULFUR	2 gallons	6 gallons			
2. ZINEB (75% WP)	2 pounds	6 pounds			

NOTE: Check compatibility of insecticides with lime sulfur.

PLUMS AND PRUNES (Continued)

First Cover

(10 days after Shuck Split)

1. Leaf Spot
2. Black Knot

Plum Curculio

	Rate/100 gallons	Rate/acre		Rate/100 gallons	Rate/acre
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/gallons 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: For peach tree borer control, see section under Peach Spraying Schedule, page 31, Thiodan may be used up to 7 days of harvest.			MITES: If European red mites build up, spray with OMITE (30% WP), 1½ pounds (3½ pounds/acre) or KELTHANE (18.5% EC), 1 quart (3 quarts/acre), or TEDION (1 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.		

Second Cover

(10 to 14 days later)

1. Leaf Spot
2. Black Knot

Leafhoppers

1. FERBAM (76% WP)	1½ pounds	4.5 pounds	PARATHION (15% WP)	1½ pounds	4½ pounds
2. ZINEB (75% WP)	2 pounds	6 pounds	<i>or</i>		
			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). 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)

1. Brown Rot, Leaf Spot
2. Brown Rot only

Apple Maggot

1. CAPTAN (50% WP)	2 pounds	6 pounds	See Special Apple Maggot Sprays under Second Cover.		
<i>or</i>			NOTE: See interval to harvest for lead arsenate.		
BENOMYL (BENLATE)					
(50% WP)	½ pound	1.5 pounds			
<i>or</i>					
2. WETTABLE SULFUR	5 pounds	15 pounds			

Fourth Cover

(15 days before harvest)

1. Brown Rot, Leaf Spot
2. Brown Rot only

Apple Maggot

Same fungicides as Third Cover. (Repeat if necessary near or at harvest. Add spreader if necessary.)			See Special Apple Maggot Sprays under Second Cover.		
			NOTE: See interval to harvest for lead arsenate.		

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; TEDION—apply no more than 3 applications during fruiting season. THIODAN—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

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). Timing will be announced by county agricultural agent.

Bloom

1. European Brown Rot (Problem Orchards)

2. Common Brown Rot (Blossom Blight)

1. BORDEAUX	4-6-100	
2. DICHLONE (PHYGON)		
(50% WP)	$\frac{1}{2}$ pound	1.5 pound
	or	
WETTABLE SULFUR	5 pounds	15 pounds
	or	
BENOMYL (BENLATE)		
(50% WP)	$\frac{1}{2}$ pound	1.5 pounds

Insecticides should not be used during Bloom.

Petal Fall

(Three-fourths of the petals fallen)

Leaf Spot

DODINE (CYPREX)*		
(65% WP)	$\frac{1}{4}$ to $\frac{1}{2}$ pounds	$\frac{1}{4}$ to 1 pound
	or	
DIFOLATAN* (4 EC)	1 to 2 pints	3 to 6 pints
	or	
BENOMYL (BENLATE)		
(50% WP)	$\frac{1}{2}$ pound	1.5 pounds

*CYPREX at $\frac{1}{4}$ pound in most years will control leaf spot when proper timing and thorough coverage is practiced. Increase to $\frac{1}{2}$ to $\frac{1}{2}$ pound if necessary.

*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.

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

PARATHION (15% WP)	$\frac{1}{2}$ 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

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

*NOTE: IF CURCULIO IS A PROBLEM, INCREASE PARATHION OR GUTHION RATES BY 25 PERCENT. APPLY A SECOND SPRAY 7 DAYS LATER.

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 (15% WP) at 1½ pound rate 4½ pounds/acre) or 0.23 pounds active ingredient (liquid formulation) (0.70 pounds active ingredients/acre) or GUTHION (2 pounds/gallon SC), 1 pint (3 pints/acre). 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. Make applications with a high pressure gun using methods detailed for borer control on sweet cherry, page 42.

Second Cover

(10 days after First Cover)

Leaf Spot

	Rate/100 gallons	Rate/acre
DODINE (CYPREX) (65% WP)	¼ to ½ pound	¼ to 1 pound
	or	
DIFOLATAN (4 EC)	1 to 2 pints	3 to 6 pints
	or	
BENOMYL (BENLATE) (50% WP)	½ pound	1.5 pounds
	or	
FIXED COPPER PLUS LIME	0.75 pound	2½ pound
	actual copper	actual copper
	plus	plus
HYDRATED LIME	3 pounds	9 pounds

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.

Plum Curculio, Mineola Moth**

	Rate/100 gallons	Rate/acre
GUTHION (2 pounds/ gallon SC)	1 pint	3 pints
	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)	1½ pounds	4½ pounds
	or	
PARATHION LIQUID	0.23 pounds	0.70 pounds
	active ingred.	active ingred.

NOTE: Third Cover usually coincides with cherry fruit fly emergence. The emergence of cherry fruit flies will be announced by your county agricultural agent. **Timing for Mineola Moth will be announced by your county agricultural agent.

Forbes Scale: Use GUTHION (50% WP)—1½ pounds (3½ pounds/acre) or GUTHION (2 pounds/gallon SC), 1½ pints (3½ pints/acre), or SEVIN (50% WP)—2 pounds

(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)

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

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>		<i>Rate/100 gallons</i>	<i>Rate/acre</i>
Same fungicides as suggested for Second Cover			LEAD ARSENATE**2 pounds6 pounds		
			<i>or</i>		
			DIAZINON (50% WP)1 pound3 pounds		
			<i>or</i>		
			GUTHION (50% WP)½ pound1½ pounds		
			<i>or</i>		
			GUTHION (2 pounds/ gallon SC)1 pint3 pints		
			<i>or</i>		
			SEVIN (50% WP)2 pounds6 pounds		
			<i>or</i>		
			SEVIN LIQUID0.5 pounds1.5 pounds		
			active ingred.active ingred.		
			<i>or</i>		
			PARATHION (15% WP)1½ pounds4½ pounds		
			<i>or</i>		
			PARATHION LIQUID0.23 pounds0.70 pounds		
			active ingred.active ingred.		

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

*Timing of spray applications for cherry fruit fly will be announced by your county agricultural agent, based upon special bait trap detection.

After Harvest Cover

Leaf Spot

DODINE (CYPREX)	
(65% WP)	¼ to ½ pound ½ to 1½ pounds
<i>or</i>	
DIFOLATAN (4 EC)	1 to 2 pints 3 to 6 pints
<i>or</i>	
BENOMYL (BENLATE)	
(50% WP)	½ pound 1.5 pounds

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.

*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.

		<i>Bloom</i>			
DISEASES				INSECTS	
Common Brown Rot (Blossom Blight)					
	<i>Rate/100 gallons</i>	<i>Rate/acre</i>		<i>Rate/100 gallons</i>	<i>Rate/acre</i>
BORDEAUX (early bloom)	4-6-100				
	<i>or</i>				
WETTABLE SULFUR	5 pounds	20 pounds			
	<i>or</i>				
BENOMYL (BENLATE)					
(50% WP)	½ pound	2 pounds			
	<i>or</i>				
DICHLONE (PHYGON)					
(50% WP)	½ pound	2 pounds			
	<i>or</i>				
SULFUR PASTE	6 pounds	24 pounds			
If wet weather prevails, additional sprays or dusts of PHYGON or SULFUR will be necessary.					

Insecticides should not be used during Bloom.

Petal Fall

1. Leaf Spot, Brown Rot
2. Leaf Spot

1. CAPTAN (50% WP)	2 pounds	8 pounds
	<i>or</i>	
BENOMYL (BENLATE)		
(50% WP)	½ pound	2 pounds
	<i>or</i>	
FERBAM (76% WP)	1 pound <i>plus</i>	4 pounds <i>plus</i>
WETTABLE SULFUR	3 pounds	12 pounds
2. DODINE (CYPREX)		
(65% WP)	¼ pound	1 pound

NOTE: Dodine may not be compatible with Guthion emulsion if water is hard.

Plum Curculio, Black Cherry Aphid

PARATHION (15% WP)	1½ pounds	6 pounds
	<i>or</i>	
PARATHION LIQUID	0.23 pounds	0.90 pounds
	active ingred.	active ingred.
	<i>or</i>	
GUTHION (50% WP)	½ pound	2 pounds
	<i>or</i>	
GUTHION		
(2 pounds/gallon SC)	1 pint	4 pints

First Cover (10 to 14 days later)

1. Leaf Spot, Brown Rot
2. Leaf Spot

1. Same fungicides as for Petal Fall
2. 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

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

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. Apply a post-harvest spray if needed. GUTHION and PARATHION, when used in the regular spray program, do not provide control of this insect.

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

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

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.

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

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)

SWEET CHERRIES

1. Leaf Spot, Brown Rot

2. Leaf Spot

	Rate/100 gallons	Rate/acre
1. CAPTAN (50% WP)	2 pounds	8 pounds
or		
BENOMYL (BENLATE) (50% WP)	$\frac{1}{2}$ pound	2 pounds
or		
FERBAM (76% WP)	1 pound plus	4 pounds plus
WETTABLE SULFUR	3 pounds	12 pounds
2. DODINE (CYPREX) (65% WP)	$\frac{1}{4}$ pound	1 pound

Plum Curculio, Red-Banded Leaf Roller, Black Cherry Aphid

	Rate/100 gallons	Rate/acre
GUTHION (50% WP)	$\frac{1}{2}$ pound	2 pounds
or		
GUTHION (2 pounds/gallon SC)	1 pint	4 pints
or		
PARATHION (15% WP)	1 $\frac{1}{2}$ pounds	6 pounds
or		
PARATHION LIQUID	0.23 pounds	0.90 pounds
	active ingred	active ingred.

Third Cover (Based on cherry fruit fly emergence)

1. Leaf Spot, Brown Rot

2. Brown Rot, Rhizopus Rot*

3. Leaf Spot

1. CAPTAN (50% WP)	2 pounds	8 pounds
or		
BENOMYL (BENLATE) (50% WP)	$\frac{1}{2}$ pound	2 pounds
or		
FERBAM (76% WP)	1 pound plus	4 pounds plus
WETTABLE SULFUR	3 pounds	12 pounds
2. CAPTAN (50% WP)	1 pound plus	4 pounds plus
BOTRAN (75% WP)	$\frac{2}{3}$ pound	2.6 pounds

*NOTE: BOTRAN is effective on Rhizopus Rot and is compatible with wettable powder insecticides listed under Third Cover.

3. DODINE (CYPREX) (65% WP)	$\frac{1}{4}$ pound	1 pound
--------------------------------------	---------------------	---------

Cherry Fruit Flies**

LEAD ARSENATE	2 pounds	8 pounds
or		
GUTHION (50% WP)	$\frac{1}{2}$ pound	2 pounds
or		
GUTHION (2 pounds/gallon SC)	1 pint	4 pints
or		
DIAZINON (50% WP)	1 pound	4 pounds
or		
SEVIN (50% WP)	2 pounds	8 pounds
or		
SEVIN LIQUID	1 pound	4 pounds
	active ingred.	active ingred.

**Timing of spray applications for cherry fruit fly will be announced by your county agricultural agent, 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) during harvest, if necessary. CAPTAN plus BOTRAN should be applied in pre-harvest and, if necessary, in harvest sprays. BOTRAN may leave a yellow residue on fruit.

Cherry Fruit Flies

Same insecticides as for Third Cover.

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

Post Harvest

Leaf Spot

	Rate/100 gallons	Rate/acre
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 section on borer control, pages 31 and 32.

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.

*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 rates of materials for use on grape are based on a standard of 200 gallons per acre dilute spray.

Bud Swell

DISEASES

Dead Arm (Problem Vineyards)

	Rate/100 gallons	Rate/acre
CAPTAN (50% WP)	2 pounds	4 pounds
<i>or</i>		
FOLPET (PHALTAN) (50% WP)	2 pounds	4 pounds

When shoot growth is 1 to 2 inches, and repeat when shoot growth is 4 to 6 inches.

INSECTS

Grape flea beetle, Climbing cutworms

	Rate/100 gallons	Rate/acre
PARATHION (15% WP)	2 pounds	4 pounds
<i>or</i>		
PARATHION LIQUID	0.3 pounds active ingred.	0.6 pounds active ingred.

NOTE: Special Dylox (5%) and Sevin (5%) baits are available for cutworm control, applied 25 to 30 pounds per acre as a band under the vines.

First Cover

(Shoots 4 to 8 inches long)

Black Rot

FERBAM (75% WP)	1½ pounds	3 pounds
<i>or</i>		
FOLPET (50% WP)	2 pounds	4 pounds

No insecticides recommended in this spray.

Second Cover

(Blossom Opening)

1. Black Rot

2. Black Rot, Powdery and Downy Mildew

1. FERBAM (76% WP)	1½ pounds	3 pounds
2. FERBAM (76% WP)	1½ pounds, plus	
FOLPET (50% WP)	2 pounds	4 pounds
<i>or</i>		
*FIXED COPPER (actual)	1½ pounds, plus	3 pounds, plus
HYDRATED LIME	6 pounds	12 pounds

*If FIXED COPPER is used with GUTHION or SEVIN, spray immediately as these materials may lose some insecticidal

Grape Berry Moth

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.

effectiveness when combined with LIME or in alkaline solutions.

Third Cover

(Immediately after bloom)

1. Black Rot

2. Black Rot, Powdery and Downy Mildew

1. Same fungicides as for Second Cover
2. Same fungicides as for Second Cover

Grape Berry Moth, Grape Leafhopper, Rose Chafer*

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)*

- | | |
|--|--|
| 1. Black Rot | Grape Berry Moth, Grape Leafhopper, Rose |
| 2. Black Rot, Powdery and Downy Mildew | Chafer |

<i>Rate/100 gallons</i>	<i>Rate/acre</i>	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
-------------------------	------------------	-------------------------	------------------

- | | |
|--|---------------------------------------|
| 1. Same fungicides as for Second Cover | Same insecticides as for Second Cover |
| 2. Same fungicides as for Second Cover | |

Fifth Cover*(Time to be announced)*

- | | |
|--|------------------------------------|
| 1. Black Rot | Grape Berry Moth, Grape Leafhopper |
| 2. Black Rot, Powdery and Downy Mildew | |

- | | |
|--|---------------------------------------|
| 1. Same fungicides as for Second Cover | Same insecticides as for Second Cover |
| 2. Same fungicides as for Second Cover | |

Sixth Cover*(10 to 14 days after Fifth Cover)*

Grape Berry Moth

Same insecticides as for Second Cover

Seventh Cover**(about Aug. 7)*

- | | |
|----------------|------------------|
| Powdery Mildew | Grape Berry Moth |
|----------------|------------------|

Same insecticides as for Sixth Cover

FOLPET (50% WP).....2 pounds4 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 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;
DYLOX - do not apply after fruit forms.

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

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.

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)

DISEASES

INSECTS

Stem-end Fruit Rot, Leaf Blight, Leaf Spot

	Rate/100 gallons	Rate/acre
CAPTAN (50% WP)	2 pounds	4 pounds
	<i>or</i>	
FIXED COPPER (actual copper)	1½ pounds, plus 3 pounds, plus	
HYDRATED LIME	6 pounds	12 pounds

Do not use Guthion or Sevin with fixed copper and lime. The insecticidal effectiveness of GUTHION or SEVIN is reduced 50% when mixed with lime or in an alkaline solution.

NOTE: For fruit rot control apply 5-6 pounds of CAPTAN or THIRAM (THYLATE) per acre.

Spittlebug*

	Rate/100 gallons	Rate/acre
SEVIN (50% WP)	2 pounds	4 pounds
	<i>or</i>	
SEVIN LIQUID	1 pound	2 pounds
	active ingred.	active ingred.
	<i>or</i>	
THIODAN (50% WP)	1 pound	2 pounds
	<i>or</i>	
THIODAN (2 EC)	1 quart	2 quarts

*NOTE: Use THIODAN for spittlebug where tarnished plant bugs are active.

If two-spotted mites are a problem, include KELTHANE (35% WP) 1½ pounds (2½ pounds/acre) or KELTHANE (18.5% EC) 1 quart (2 quarts/acre).

Second Cover

(pre-bloom—just as flowers start to open)

1. Gray Mold, Stem-End Fruit Rot, Leaf Blight 2. Gray Mold

1. CAPTAN (50% WP)	2 pounds	4 pounds
	<i>or</i>	
2. THIRAM (THYLATE) (65% WP)	2 pounds	4 pounds

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

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
(Berries one-half grown)

- 1. Gray Mold, Stem-End Fruit Rot, Leaf Blight
- 2. Gray Mold

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

Same fungicides as for Second Cover.

A repeat application of THIODAN may be necessary when tarnished plant bug continue 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 or more than twice within a 35-day interval when fruit is present.

Pre-Harvest

(At least 10 days before harvest)

- 1. Gray Mold, Stem-End Fruit Rot, Leaf Blight
- 2. Gray Mold

1. CAPTAN (50% WP)	2 pounds	4 pounds
or		
CAPTAN DUST (7.5% CAPTAN)		40 pounds
2. THIRAM (THYLATE)		
(65% WP)	2 pounds	4 pounds
or		
THIRAM (THYLATE) DUST		
(7.5% THYLATE)		40 pounds

Strawberry Sap Beetle

GUTHION (50% WP)	1 pound
or	
GUTHION (2 pounds/gallon SC)	1 quart
or	
DIAZINON (50% WP)	2 pounds
or	
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.	
or	
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

- 1. Gray Mold, Stem-End Fruit Rot, Leaf Diseases
- 2. Gray Mold Fruit Rot

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

NOTE: During harvest, rainy periods are conducive to gray mold fruit rot development. If THIRAM is applied within three days of harvest, residues must be removed by washing. CAPTAN may be used up to harvest.

The need for an After-Harvest insecticide application is determined by observation. If leafrollers are present in damaging numbers, use GUTHION (50% WP) at ½ pound (1 pound/acre) or GUTHION (2 pounds/gallon SC) at 1 pint (2 pints/acre).

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) 1¼ 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.

STRAWBERRIES

Days Between Final Spray and Harvest

Insecticides: DIAZINON-5; GUTHION-5; KELTHANE-2; SEVIN-1; THIODAN-4.

Fungicides: CAPTAN-0; THIRAM (THYLATE)-3; Remove residues of THIRAM from strawberries by washing if application is made within 3 days of harvest.

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)

	Rate/100 gallons	Rate/acre
1. LIME SULFUR	10 gallons	20 gallons
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

INSECTS

No insecticides recommended in this spray.

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

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

2. Spur Blight (Red Raspberry)

1. CAPTAN (50% WP)	2 pounds	4 pounds
	<i>or</i>	
FERBAM (76% WP)	1½ pounds	3 pounds
2. BORDEAUX	3-3-100	

GUTHION (50% WP)	½ pound	1 pound
	<i>or</i>	
GUTHION (2 pounds/gallon SC)	1 pint	2 pints

(Repeat BORDEAUX 10 to 14 days later.)

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

First Cover*(At Petal Fall)***Anthracnose**

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
CAPTAN (50% WP)	2 pounds	4 pounds
	<i>or</i>	
FERBAM (76% WP)	1½ pounds	3 pounds

Aphids, Leafrollers, Cane Borers

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
GUTHION (50% WP)	½ pound	1 pound
	<i>or</i>	
GUTHION (2 pounds/gallon SC)	1 pint	2 pints
	<i>or</i>	
MALATHION (50% WP)	2 pounds	4 pounds

Pre-Harvest*(15 days before harvest)***Aphids, Mites (See Mite section below)**

PARATHION (15% WP)	2 pounds	4 pounds
	<i>or</i>	
PARATHION LIQUID	0.3 pounds	0.6 pounds
	active ingred.	active ingred.

MITES

Where mites are a problem use KELTHANE (35% WP), 1½ pounds (2½ pounds/acre), or KELTHANE (18.5% EC), 2

pints (4 pints/acre) plus PHOSDRIN (4 EC), ¼ pint (½ pint/acre).

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.

Fungicides: CAPTAN—0.

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 3181 quart2 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
				<i>or</i>	
			PARATHION LIQUID	0.23 pounds	0.46 pounds
				active ingred.	active ingred.
				<i>or</i>	
			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. Chemicals are not necessarily listed in order of preference in the spraying schedule. The rates of materials for use on blueberry are based on a standard of 200 gallons per acre dilute spray.

Dormant

(When buds begin to swell)

DISEASES

INSECTS

Mummy Berry

	<i>Rate/100 gallons</i>	<i>Rate/acre</i>
PREMERGE	1½ quarts	3 quarts
	<i>or</i>	

Rake and cultivate planting floor to cover the mummified berries, or broadcast AERO CALCIUM CYANAMID (57% special grade) 150 to 200 pounds per acre. Apply

Rate/100 gallons Rate/acre
spray or dust over entire plantation area, including plant crowns.

Important: If plants have broken dormancy and green tips are showing, do not use AERO CALCIUM CYANAMID dust.

First Cover

(Immediately after bloom or as soon as Curculio is active)

Plum Curculio, Blueberry Tip Borer*

GUTHION (50% WP)	½ pound	1 pound
	<i>or</i>	
GUTHION (2 pounds/ gallon SC)	1 pint	2 pints
	<i>or</i>	
PARATHION (15% WP)	1½ pounds	3 pounds
	<i>or</i>	
SEVIN (50% WP)	2 pounds	4 pounds
	<i>or</i>	
SEVIN 4 FLOWABLE	1 quart	2 quarts
	<i>or</i>	
MALATHION DUST (4%)	40 pounds/acre	
	<i>or</i>	
SEVIN DUST (5%)	40 pounds/acre	
	<i>or</i>	
METHOXYCHLOR DUST (5%)	40 pounds/acre	

*NOTE: Use PARATHION in First and Second Cover sprays for Tip Borer control.

Second Cover

(10 days after First Cover)

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

Same insecticides as for First Cover.

*NOTE: For the White Tussock Moth—Use SEVIN at 2 pounds per 100 gallons (4 pounds/acre) when the larvae are observed.

Third Cover

(10 days after Second Cover)

Cranberry Fruitworm

Same insecticides as for First Cover.

NOTE: If Lecanium Scale is a problem, use SEVIN at

rates suggested in First Cover. Apply when crawlers are first observed and repeat 10 days later.

Fourth and Subsequent Covers

(During Blueberry Maggot Fly emergence)

Blueberry Maggot

Same insecticides as for First Cover

NOTE: ROTENONE DUST (2½%) at 25 pounds/acre or 2% at 30 pounds can also be used.

The time to make the fourth cover application will be announced by your county agricultural agent. Additional applications of the same materials suggested for Fourth Cover should continue at 10-day intervals 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. The interval between applications should be reduced if rainfall occurs within a few days of the dust application. Guthion Dust (3%) at 20 pounds per acre may also be used. Only two applications of dust may be made in the 14-day period before harvest.

The insect known as the Blueberry Borer has recently been identified as the Dogwood Borer. Within the past few years, this insect has become a major problem in some south-west Michigan blueberry plantings. PARATHION (15% WP), 1½ pounds, or equivalent in flowable or EC formulations (0.23

pounds active ingredient) per 100 gallons applied at 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 or Dust and Harvest

Insecticides: GUTHION-3 and not more than 4 applications per season; MALATHION-0; METHOXYCHLOR-14; PARATHION-14; ROTENONE-1; SEVIN-0.

Guthion Dust (3%) at 20 pounds per acre - 4 hours of harvest and no more than twice per season when airplane applied. Otherwise 9 hours and total of 5 applications.

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		0(Sweet)j						
Captan.....	0	0	0j	0	0j	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			14		
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										
Benomyl (Benlate).....			0j	0j	0j						0j
Insecticides											
Gardona.....	7f										
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								
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						
Phosdrin.....	1	1	1	1	2	2	1	3			
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
Tedion.....	f	f	f	f	f	f	3f	f		f	f
Thiodan.....	30f	7f	30f	7f	21f	7	4f				30f
Zolone.....	14	14				14					
Galecron-Fundal.....	14f	28f	d								
Carzol.....	7f	7f									

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.

SPRAY RECORD SHEET

GROWER	YEAR
	19
CROP	HARVEST DATE

[illegible]

SPRAY RECORD SHEET

GROWER	YEAR
CROP	19 HARVEST DATE

[illegible]

fear out along this line

SPRAY RECORD SHEET

GROWER	YEAR
	19
CROP	HARVEST DATE

[illegible]

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: chlorobenzilate, 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.