EXTENSION BULLETIN 154

1961 FRUIT SPRAYING CALENDAR

By A. E. MITCHELL, ALFRED C. DOWDY, and EDWARD J. KLOS

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY
EAST LANSING

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1P-1:61—25M—SH

COMPATIBILITY CHART*

	Lead Arsenate	Nicotine	DDT, DDD, TDE	Methoxychlor	BHC, Lindane	Dieldrin	Kelthane	Ovex, Genite EM 923	Chlorobenzilate	Parathion, Ethion	Systox (demeton)	Malathion, Trithion	Diazinon, Guthion	Captan	Glyodin	Phygon XL (dichlone)	Mercuries	Bordeaux	Fixed Copper	Lime-sulfur	Elemental sulfur	Ferbam, Thiram	Ziram, Zineb	Niacide A and M	Lime	Karathane	Rotenone	Ryania	Actidione	Sevin	Tedion, Mitox	Cyprex
Lead Arsenate		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	±	+	+	+	+	+	+	+	+	+	+	+
Nicotine	+		+	+	Q	+	+	+	+	+	+	+	Q	+	Q	+	Q	+	±	±	Q	+	+	+	±	+	+	+	+	Q	Q	+
DDT, DDD, TDE	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Q	+	+	+	±	+	+	+	+	+	+	+
Methoxychlor	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Q	+	+	+	±	+	+	+	+	+	+	+
BHC, Lindane	+	Q	+	+		+	+	+	+	+	+	+	+	+	+	+	+	N	N	N	+	+	+	+	N	+	+	+	+	+	+	+
Dieldrin	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Kelthane	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	N	N	N	+	+	+	+	N	+	+	+	+	+	Q	+
Ovex, Genite EM 923	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Q	+	Q
Chlorobenzilate	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	N	N	Q	+	+	+	+	N	+	+	+	+	Q	+	Q
Parathion, Ethion	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	Q	±	±	±	+	+	+	+	±	+	+	+	+	+	+	+
Systox (demeton)	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	Q	Q	Q	Q	+	+	+	+	±	+	+	+	+	+	Q	+
Malathion, Trithion	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	Q	±	±	±	+	+	+	+	±	Q	+	+	+	+	+	+
Diazinon, Guthion	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	Q	Q	Q	Q	+	+	+	+	N	+	+	+	Q	+	+	+
Captan	+	Q	+	+	+	+	+	+	+	+	+	+	+		+	+	N	N	N	N	+	+	+	+	N	+	+	+	+	+	+	+
Glyodin	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	Q	+	+	+	Q	+	
Phygon XL (dichlone)	+	Q	+	+	+	+	+	+	+	+	+	+	+	+	+		+	Q	Q	Q	+	+	+	+	Q	+	+	+	+	Q	+	
Mercuries	+	+	+	+	+	+	+	+	Q	Q	Q	Q	+	+	+	+		Q	Q	N	+	+	+	+	Q	+	+	+	Q	N	+	+
Bordeaux	+	±	+	+	N	+	N	+	N	±	Q	±	Q	N	+	Q	Q		+	N	+	Q	Q	Q	+	Q	N	+	N	N	Q	N
Fixed Copper	+	±	+	+	N	+	N	+	N	±	Q	±	Q	N	+	Q	Q	+		N	+	Q	Q	Q	+	Q	N	+	N	+	Q	N
Lime-sulfur	±	Q	Q	Q	N	+	N	+	Q	±	Q	±	Q	N	+	Q	N	N	N		+	Q	Q	Q	+	Q	N	+	N	N	+	N
Elemental sulfur	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
Ferbam, Thiram	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Q	Q	Q	Q	+		+	+	N	+	+	+	+	+	+	+
Ziram, Zineb	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Q	Q	Q	Q	+	+		+	N	+	+	+	+	Q	+	
Niacide A and M	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	Q	Q	Q	Q	+	+	+		N	+	+	+	+	Q	+	+
Lime	+	±	±	Q	N	+	N	+	N	±	±	±	N	N	+	Q	Q	+	+	+	+	N	N	N		Q	N	+	N	N	Q	N
Karathane	+	+	+	+	+	+	+	+	+	+	Q	+	+	+	+	Q	Q	Q	+	+	+	Q		+	+		+	+	+	+	+	+
Rotenone	+	+	+	+	+	+	+	+	+	+	+	+	Q	+	+	N	N	N	+	+	+	N	+		+	+		Q	Q	+		
Ryania	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	Q	+	+
Actidione	+	+	+	+	+	+	+	Q	Q	+	+	+	Q	+	+	+	Q	N	N	N	+	+	+	+	N	+	+	+		Q	Q	+
Sevin	+	Q	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	N	+	N	+	+	+	Q	N	+	Q	Q	Q		Q	+
Tedion, Mitox	+	Q	+	+	+	+	Q	Q	Q	+	Q	+	+	+	+	Q	Q	+	Q	Q	+	+	+	Q	+	Q	+	Q	+	Q		+	
Cyprex	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	N	N	N	+	+	+	+	+	N	+	+	+	+	+	+	

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.

Streptomycin is most favorably applied as a separate application.

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.

1961 FRUIT SPRAYING CALENDAR[1]

By A. E. MITCHELL,[2] ALFRED C. DOWDY,[3] and EDWARD J. KLOS[4]

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 spray 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, three extension publications dealing with fruit pests have been written by members of the Departments of Entomology and Botany and Plant Pathology at Michigan State University. They have the following titles and bulletin numbers:

1. Tree Fruit Diseases in Michigan by E. J. Klos, Extension Bulletin E-361.

2. Small Fruit Diseases in Michigan by R. H. Fulton, Extension Bulletin E-370.

3. Fruit Insects in Michigan by A. C. Dowdy, Extension Bulletin E-372.

The pest control schedules in this publication (pages 39-58) 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 the 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 3 on page 60.

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[1]The help and suggestions received from the district horticultural agents, the county agricultural agents, and the Extension and Research personnel in the Departments of Horticulture, Entomology, and Botany and Plant Pathology in preparing this publication have been very valuable and are gratefully acknowledged.

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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 if and when poisoning symptoms occur. Early symptoms include weakness, headache, nausea, vomiting, and tightness in the chest. Never take atropine before symptoms occur; nor is it safe to give tablets by mouth to an unconscious person.

ALL AGRICULTURAL CHEMICALS

The National Agricultural Chemicals 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 sprays or dusts. Note warnings and cautions each time before opening the container.
2. Keep sprays and dusts 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 sprays and dusts in original containers and keep them tightly closed. Never keep them in anything but the original container.
4. Never smoke while spraying or dusting.
5. Avoid inhaling sprays or dusts. When directed on the label, wear protective clothing and masks.
6. Do not spill 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.

City	Name of center and street address	Telephone	Name of director
Adrian	Poison Control Center Emma L. Bixby Hospital	Colfax 5-6161	William H. Hewes, M.D.
Ann Arbor	Poison Control Center University Hospital 1313 E. Ann Street	Normandy 3-1531 Ext. 589	George H. Lowery, M.D.
Battle Creek	Poison Control Center Community Hospital 200 Tomkins Street	Woodward 3-5521	Sterling L. Butterfield, R. Ph., Director
Bay City	Poison Treatment Center Bay City Osteopathic Hospital		
Coldwater	Poison Control Center Community Health Center of Branch County 274 E. Chicago St.	Broadway 9-9501	John C. Heffelfinger, M.D.
Detroit	Poison Treatment Center Saratoga General Hospital 15000 Gratiot Ave.	Lakeview 6-5100	Mr. Wm. B. Hennessey, Chief Pharmacist
Detroit	Poison Information Center Registrar's Office Herman Kiefer Hospital 1151 Taylor Ave.	Trinity 2-3334	Paul T. Salchow, M.D. William G. Fredrick, Sc.D.
Detroit	Poison Control Center Children's Hospital 5224 St. Antoine St.	Temple 3-1000	Paul V. Wooley, Jr., M.D.
Flint	Poison Control Center Hurley Hospital 6th Ave. and Begole	Cedar 2-1161	Mr. Douglas L. Vivian, R. Ph.
Grand Rapids	Poison Control Center Butterworth Hospital 300 Bostwick, N.E.	Glendale 1-3591	Mark W. Dick, M.D.
Grand Rapids	Poison Control Center Blodgett Memorial Hospital 1800 Wealthy, S.E.	Glendale 6-5301	John Montgomery, M.D.

City	Name of center and street address	Telephone	Name of director
Grand Rapids	Poison Control Center St. Mary's Hospital 250 Cherry, S.E.	Glendale 9-3131	Craig E. Booher, M.D.
Jackson	Poison Treatment Center Foote Memorial Hospital		Ethan Stone, M.D.
Lansing	Poison Treatment Center Edward W. Sparrow Hospital 1215 E. Michigan Avenue	IVanhoe 4-7721	Harry C. George, M.D.
Lansing	Poison Treatment Center St. Lawrence Hospital 1210 W. Saginaw Street	IVanhoe 7-5451	Robert F. Thimmig, M.D.
Lansing	Poison Treatment Center Lansing General Hospital 2800 Devonshire Ave.	IVanhoe 5-4311	Agnes Taft, Chief Pharmacist
Lincoln Park	Poison Control Center Outer Drive Hospital 26400 Outer Drive	Dunkirk 6-2000	W. S. Wheeler
Marquette	Poison Control Center St. Luke's Hospital West College Ave.	Canal 6-3511	R. Mick, Pharmacist
Midland	Poison Control Center Midland Hospital 4005 Orchard Drive	TE 5-6771	B.E. Lorimer
Petoskey	Poison Control Center Little Traverse Hospital	Diamond 7-2551	Norbert R. Wegemer, Chief Pharmacist
Pontiac	Poison Control Center St. Joseph Mercy Hospital 900 Woodward Ave.	Federal 4-3511	Robert J. Mason, M.D.
Port Huron	Poison Control Center Mercy Hospital	Yukon 5-9531	Robert Lugg, M.D.
Saginaw	Poison Control Center Saginaw General Hospital	Pleasant 5-3491	William G. Mason, M.D. Chairman
Saginaw	Poison Treatment Center Saginaw Osteopathic Hospital 1447 N. Harrison Road		
Wayne	Poison Treatment Center Annapolis Hospital		
Ypsilanti	Poison Treatment Center Beyers Hospital		

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 is responsible. Administer artificial respiration when necessary.

4. *For poisons that have been swallowed,* induce vomiting as soon as possible. To do this, 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. When the physician arrives, he 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.

CONCENTRATE SPRAYING

The term "concentrate spraying" is used principally when referring to the spraying of fruit trees. It simply means the use of a greater amount of a given chemical per 100 gallons than is used in dilute (conventional) spraying and the application of a correspondingly less quantity of spray mixture per tree.

The dilutions employed in concentrate spraying are referred to as 2x, 3x, 4x, etc. This means that 2, 3, or 4 times the amount of chemicals is used per 100 gallons than is suggested for dilute spraying, and that only one-half, one-third, or one-fourth the amount of spray mixture is applied per tree as is suggested for conventional spraying.

How to Convert to Concentrate Spraying

Before setting up a sprayer for concentrate spraying, you must know the following: (1) The gallons of spray you applied per tree by conventional methods, (2) the average spread of the trees in feet, (3) the rate of travel to be used while spraying, and (4) the new concentration to be used. By applying a simple formula to these figures, you can figure the gallons per minute to be delivered by one side of the sprayer which will deposit the same amount of chemicals on the tree

as when you used conventional spraying. This formula, along with an example of its use, is given below:

$$A = \frac{B \times C}{D \times E \times F}$$

A = The new spray delivery rate for one side of the sprayer in gallons per minute, to be determined.

B = The amount of spray per tree used in dilute spraying. We will assume this to be 12 gallons per tree.

C = The rate of travel you wish to use while spraying. Assume this to be 3 miles per hour or 264 feet per minute. (88 feet per minute = 1 mile per hour. 88 x 3 = 264 feet per minute.)

D = Always is 2. Only one-half the tree is sprayed when passing.

E = The grower wishes to use "4x" concentration, thus E = 4.

F = Average spread of the trees to be sprayed; assume this to be 30 feet.

Thus, the formula will be as follows:

$$A = \frac{12 \times 264}{2 \times 4 \times 30} = \frac{3168}{240} = 13.2 \text{ gallons per minute}$$

The delivery rate for one side of the sprayer should be 13.2 gallons per minute. For two-way spraying, each side of the sprayer should deliver 13.2 gallons per minute. This would make a total delivery of 26.4 gallons per minute, using the banks of nozzles on both sides of the sprayer.

If you plan to use concentrate spraying, be prepared to do some night spraying, since best results from spraying are obtained when air movement is less than 7 miles per hour.

CHEMICAL THINNING OF APPLES AND PEACHES

WARNING: As of February 1, 1961, the following fruit thinning agents have been cleared by the Food and Drug Administration for use on fruit: naphthaleneacetamide (Amid-Thin) for apples and N-1-naphthylphthalamic acid (Nip-A-Thin) for peaches. It is hoped that naphthaleneacetic acid compounds (NAA) will be cleared also by March 5, 1961. If not cleared, fruits from trees thinned with NAA will be subject to seizure and examination for NAA residue.

The continued demand for apples of certain varieties with a minimum size of not less than 2½ inches has made blossom and fruit thinning a "must" in Michigan. High labor costs 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 chemicals.

The two chemicals currently suggested for use in Michigan are 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 tradenames as Fruitone, and Stafast.

Thinning with NAA (If cleared)

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

Under Michigan conditions, Amid-Thin is suggested for use at 60 parts per million at *Petal Fall.* 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. When this happens, there is nothing but 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 all 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.

Evaluation of Chemical Thinning

Fruits *affected* by the thinning spray (NAA or Amid-Thin) 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 difference in fruit size is very apparent 7 to 10 days after application. This makes it possible for you to determine the results of the thinning spray and 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 to 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.
- 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 *Pre Pink* and before applying the thinning sprays, NAA may cause excessive thinning. Reduce the concentration 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 when too high concentrations are used. When conditions exist which might result in injury or loss of

crop from overthinning with NAA, Amid-Thin is safer for widespread use. These decisions have to be made by the grower.

Suggestions for 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 as you would use in conventional spraying (see Concentrate Spraying, page 7).

If higher concentrations are tried, a good starting point is a 3x concentration – applying only one-fourth the amount of spray per tree 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.

Sevin as a Thinning Agent

Sevin has been used as an insecticide on apples in Michigan since 1957 and it was not until 1959 that a reduction in crop yield was noted when this chemical was used throughout the season, beginning at *Petal Fall.* Studies in 1959 revealed that it was only the use of Sevin during the period, *Petal Fall* through *Second Cover,* which caused the reduced yield and that applications at other times in the growing season had no adverse effect. Further studies in 1960 substantiated that Sevin caused fruit drop when used at *Petal Fall* through *First Cover.* However, the reduction in the number of apple fruits when Sevin was used during this critical period in 1960 was not consistent and not sufficient to influence significantly either size or yield.

At this time Sevin does not offer a desirable degree of reliability as a thinning agent. However, work will be continued in evaluating its possibilities for thinning purposes.

CHEMICAL THINNING OF 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 sold as Peach-Thin 322 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. The material should be used according to the directions on the label.

MOUSE CONTROL IN ORCHARDS

There are many different methods for controlling meadow mice in orchards. The most widely used include: wire guards around the base of the trees, baiting trails with zinc phosphide-treated cracked corn or apple slices, broadcasting zinc phosphide-treated cracked corn either from the ground or by aircraft, or spraying the orchard floor with endrin in the fall after harvest. The use of wire guards is generally restricted for use on young trees while the other procedures apply for plantings of all ages. No type of fruit tree is immune to injury by mice. Protection is an annual procedure. Each procedure will be discussed separately.

Protective Wire Guards

The placement of ½-inch or smaller mesh galvanized wire guards around the base of newly planted fruit trees is usually effective in protecting against mouse injury for 5 to 7 years after planting. However, it is possible for the mice to burrow under the guards or go over the guards when there is deep snow. The use of protective guards plus ground baiting is the safest procedure. The wire mesh should be cut 18 inches high and 18 to 24 inches wide so that there will be space between the guard and the tree. In this way even with the expansion of the tree the guard will be effective for 5 to 7 years. The wire should be embedded in the ground one to two inches so that the mice will have difficulty burrowing under it.

Baiting Stations or Trail Baiting

Baiting stations may be created by placing either bales of hay or straw, a forkful of hay, an 18 x 18-inch piece of tar paper, or a wooden slab close to the drip line of each tree late in the summer. The mice make runways under these different covers into which bait may be dropped in early fall or winter by carefully lifting the ground cover exposing the runways. Cracked corn, ⅜-inch squares of apple or carrot treated with zinc phosphide, or strychnine-treated oats, may be placed in the runways of the baiting stations. The absence of runways under the bait stations is an indication of no mouse activity in that area.

Broadcasting Bait

A 2% zinc phosphide-treated cracked corn and oats or cracked corn alone broadcast by airplane or with a whirligig fertilizer spreader has been a very effective and easy means of mouse control. Use the material at the rate of 10 pounds per acre. Make the first application during the first or second week in October and follow with a second application two to three weeks later in areas of heavy mouse population or where the ground cover is dense. Do not forget to treat the border areas to prevent migration of mice into treated areas.

Ground Sprays with Endrin

The use of endrin as a ground spray to control mice is hazardous and very expensive, but it has been effective. This method of mouse control should *never* be used if even the slightest trace of endrin could drain into or be washed by rains into streams or lakes inhabited by fish. Even as little as 5 parts per billion will kill fish. Dropped fruit on the ground sprayed with endrin could be very poisonous to man or animal if eaten. *Thus, ground sprays of endrin should never be applied until after harvest and after all dropped fruit has been removed from the orchard.*

Endrin is used for mouse control at the rate of 350 gallons of spray mixture per acre using 0.5 to 0.6 pound of actual endrin per 100 gallons of spray. Either a boom no higher than 18 inches above the ground or a spray gun with a "driving" type of discharge should be used to make the application. An operating pressure of 500 to 600 pounds is necessary to drive the spray mixture through the grass cover into the runways. Usually a 5- to 6-foot swath sprayed on both sides of each row of trees and extending under the branches 2 to 3 feet is considered sufficient ground coverage for good protection.

Cautions

(a) Endrin is highly toxic—comparable to parathion. The person making the application should be extremely careful *not to come in contact* with the endrin spray mixture.

(b) Treated areas should be posted stating that the orchard has been treated with a poison spray.

(c) Unless properly applied, endrin is very ineffective in controlling mice.

(d) Because of the hazard to fish, do not wash containers or pails which have contained endrin or flush out a spray tank contaminated with endrin in an area that may drain into a stream or lake.

PESTICIDE CHEMICALS AND THEIR USE

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

Fungicides

COPPER FUNGICIDES

Copper fungicides are usually divided into two groups: (1) Bordeaux; (2) proprietary or low-soluble copper compounds.

Bordeaux is a tank-mix of copper sulfate (bluestone or blue vitriol), hydrated lime, and water. It is identified by a characteristic formula, an example of which is 4-6-100. The "4" means 4 pounds of copper sulfate; the "6" means 6 pounds of hydrated lime; and the "100" means that the total volume of spray mixture is 100 gallons.

There are various formulae for bordeaux mixtures, such as 1-6-100, 4-2-100, 4-4-100, etc. When bordeaux is suggested in the spraying schedules in this publication, the first figure always refers to the amount of copper sulfate in pounds, the second figure to the amount of hydrated lime in pounds, and the third figure to the quantity of spray mixture in gallons, with the liquid always water.

Copper sulfate can be obtained in several forms, based on size of particles. The rather fine, granular, and pulverized forms are easier to use in making tank-mix bordeaux. These forms are referred to by the trade as "powdered", "snow", "small crystals", and "large crystals". The powdered or snow forms are recommended for convenience.

Preparation of Bordeaux.—There are several methods for preparing bordeaux. The one most common is the "instant bordeaux" method. It is convenient to use and the mixture is entirely satisfactory. *One precaution should always be remembered in making bordeaux: Never mix concentrated solutions of copper sulfate and hydrated lime.* Such a mixture is coarse and does not adhere well to the fruit or foliage.

The "instant method" requires the use of copper sulfate in the

"powdered" or "snow" forms. The hydrated lime should be fresh (see page 34). Make "instant bordeaux" as follows:

1. Fill the spray tank almost full of water (12 to 14 inches from the top of the tank).
2. Dissolve the amount of copper sulfate to be used in the tank of spray in a pail of water, using a porcelain pail.
3. With the agitator running, pour the dissolved copper sulfate into the tank.
4. Remove the screen of the spray tank and, with the agitator running, slowly pour the required amount of hydrated lime into the tank.
5. Add any other chemicals to be included with the bordeaux.
6. Replace the screen in the spray tank and finish filling the tank with water.

Proprietary Copper Compounds are fungicides or bactericides containing copper in a low-soluble, slowly available form. They are sold under various trade names, such as Basicop, COCS, Spray-Cop, Tennessee 26, Copsoil and Tennessee 53.

In 1959 and 1960 tests, two proprietary copper compounds gave poor cherry leaf spot control. Growers experiencing similar results in 1960 should avoid using these proprietary copper compounds in 1961.

Because they vary in copper content, these compounds should be used at manufacturers' directions. To guard against possible injury from soluble copper, include 1 pound of fresh hydrated lime with each 0.24 to 0.26 of a pound of actual metallic copper used in the spray mixture.

SULFUR FUNGICIDES

Elemental Sulfur means sulfur in pure form. For disease control, the sulfur is reduced to extremely small particles by mechanical grinding or by other processes. Dry, powdered sulfur which is used for dusting contains an inert material to improve the flowing properties of the sulfur. Wettable powdered sulfur is elemental sulfur with a wetting agent added, so that the particles of sulfur can be wetted and dispersed in water. Sulfur pastes are finely divided sulfur particles, less than 5 microns, combined with enough water and wetting agent to make a paste. "Bentonite sulfur" is elemental sulfur fused chemically with bentonite clay; it is considered a form of wettable sulfur in this bulletin.

Proprietary sulfur products vary in particle size and in sulfur content. Thus, it is favorable to follow the recommendations of the manufacturer. In general, 4 to 8 pounds of wettable sulfur are used per 100 gallons of spray. "Flotation paste" contains 32 to 42 percent elemental sulfur, compared to 95 to 98 percent elemental sulfur for the common, dry wettable form. Flotation paste is generally used at the rate of 8 to 10 pounds of paste per 100 gallons of spray. A sulfur paste common in Michigan is Magnetic 70 Paste. This product contains 70 percent elemental sulfur and is used at the rates of 5 to 8 pounds per 100 gallons of spray.

The amount of sulfur paste or wettable sulfur used per 100 gallons of spray depends on the disease to be controlled and the season. The higher amounts are used early in the season for the control of apple scab, and for the control of brown rot on peach and plum. The lower amounts are used when diseases are more easily controlled, and during those periods favorable for sulfur burn.

The adhesiveness and fungicidal value of wettable and paste sulfurs depend, within limits, upon the size of the sulfur particles and the content of sulfur in the product. Sulfur, referred to as 325-mesh sulfur is coarse, with a maximum allowable particle size of 40 microns (A micron is equal to 1/25,000 of an inch). Paste sulfur and some of the wettable sulfurs have particles which range in size from 1 to 4 microns.

Wettable sulfurs and paste sulfurs are principally protective in their action against disease organisms. All parts of the fruit and foliage must be kept covered during infection periods.

Wettable and paste sulfurs are virtually noninjurious to apple fruit and foliage at cool temperatures. At temperatures above 85° F., sun scald may occur on the fruit and scorch on the foliage of apple trees. This is especially likely to happen in warm, humid, weather. However, wettable sulfurs and paste sulfurs are safe to use in all applications on peaches, plums, and cherries even under conditions injurious to apple.

Lime-sulfur is available in both the liquid and dry forms. In this bulletin, the term lime-sulfur refers to commercial concentrated solutions testing 32° to 33° Baume. Liquid lime-sulfur is a true solution consisting of caustic calcium polysulfides and thiosulfates as the toxic ingredients. The caustic action of the polysulfides kills certain fungous spores which are germinating or partly established, giving the material some eradicative as well as protective properties. Soon after being

exposed on the leaf surface, the polysulfides and thiosulfates break down into finely divided sulfur, which has a protective action similar to elemental sulfurs.

Lime-sulfur, because of its caustic property, is more injurious to fruit and foliage than elemental sulfurs and must be used with caution.

ORGANIC FUNGICIDES

Dithiocarbamates

Ferbam (ferric dimethyldithiocarbamate) is a black, bulky powder sold under such trade names as Fermate, Karbam, and Coromate. This material is suggested to control leaf spot on sour cherries, black rot on grapes, currant leaf spot, and is as effective as elemental sulfur in controlling scab on apples. It may be used also with glyodin and with actidione as a safening agent when these chemicals are used with lead arsenate. One-fourth pound of ferbam is required to safen one pound of lead arsenate.

Thiram (tetramethylthiuram disulfide) is sold under the name of Thylate. In Michigan it is suggested for the control of scab on apples, including Golden Delicious. In research plots, Thylate has given good control of strawberry fruit rots. Thylate is not a favorable safening agent for lead arsenate.

Zineb (zinc ethylenebisdithiocarbamate) is a formulated wettable powder sold under the tradenames Dithane Z-78 and Parzate. It may be used on apples as a protective fungicide to control scab. It is suggested also for the control of black rot on grapes.

Other Organic Fungicides

Actidione (B-[2-(3,5-dimethyl-2-oxocyclohexyl)-2-2 hydroxyethyl] glutarimide) is an exceptionally efficient antibiotic fungicide in killing established infections of cherry leaf spot fungus. This material is marketed in pill form, with one pill containing 0.38 of a gram or 380 milligrams of actidione. One pill in 100 gallons of spray mixture equals one part per million.

Actidione is suggested at rates of 1 to 2 parts per million to control cherry leaf spot. To avoid fruit injury, do not use it stronger than 1 part per million on bearing trees until the cherries are at least ⅜ of an inch in diameter, or 4 to 6 weeks after bloom. When lead arsenate is included with actidione, add one-fourth pound of ferbam for each pound of lead arsenate in the spray mixture to guard against possible arsenical injury.

Captan (N-tricholomethylmercapto-4-4 cyclohexene-1, 2-dicarboximide) is a 50% wettable powder sold as Orthocide 50 wettable and Stauffer's Captan Fungicide. This material has given good control of apple scab, cherry leaf spot on sweet cherries, brown rot on stone fruits and fruit rots on strawberries.

Captan is suggested specifically for use on Golden Delicious during the period *Pre-Pink* through *Second Cover* to aid in the development of good fruit finish. Captan has caused leaf injury on Delicious in some orchards when applications have been too heavy or when used with incompatible materials. It requires one-half pound of captan to safen one pound of lead arsenate.

Cyprex or dodine (n-dodecylquanidine acetate) has given very good control of scab on apples and leaf spot on sour cherries in experimental plots and grower trials in Michigan since 1956.

For apples, Cyprex is suggested at the rate of ½ pound per 100 gallons in a protective and/or eradicative sprayng schedule up to *First Cover. Second Cover* change to the ¼ pound rate.

Research work indicates that ¼ pound at weekly intervals controls scab during the primary period. It is suggested that growers try this schedule on a single tank trial basis in 1961.

Do not use Cyprex after *Delayed Dormant* on Golden Delicious or Rhode Island Greening to be sold to fresh fruit outlets, as it has caused unfavorable fruit russeting in Michigan.

Cyprex at the ½ pound rate has eradicated the apple scab fungus when used 30-36 hours after the start of a rain. This compound has been cleared for use on apples to within 7 days of harvest.

Cyprex is included in the Red Tart (sour) Cherry Spraying Schedule (page 46) for the control of leaf spot at the rate of ¼ to ½ pound per 100 gallons of spray.

In most cases, the ¼ pound rate will control leaf spot; however, in orchards where this disease has been difficult to control, the ½ pound rate is suggested. Cyprex is cleared for use to harvest on red tart cherries.

Dichlone or Phygon XL (2,3-dichloro-1, 4-naphthoquinone) Phygon XL is a trade name for dichlone, a naphthoquinone fungicide with both protective and eradicative properties. It is used against apple scab in cases where control has been difficult either alone or in combination with a protective fungicide. It is suggested in blossom sprays to control brown-rot blossom blight on peaches, plums, and cherries.

Phygon is a caustic, irritating chemical and should be handled carefully. Operators who are sensitive to this material can obtain special non-oily ointments to overcome skin irritation.

Glyodin (2-heptadecylglyoxalidine acetate) is a liquid fungicide sold as Crag Fruit Fungicide 341 for use as a protective fungicide on apples to control scab and on cherries to control leaf spot. It has resulted in good finish of apples of all varieties, except Golden Delicious. It should not be used on Golden Delicious during the period *Pre-Pink* through *Second Cover.* When lead arsenate is used with glyodin, include one-fourth pound of ferbam for each pound of lead arsenate in the spray mixture to guard against arsenical injury. The combination of glyodin plus ferbam has performed creditably on sour cherries for the control of leaf spot.

Glyoxide (heptadecylimadazoline) is a wettable powder closely related to the liquid fungicide *glyodin.* Studies to date indicate that these two fungicides may be used interchangeably. When lead arsenate is included with glyoxide, add ferbam to the spray mixture at the rate of ¼ pound of ferbam to 1 pound of lead arsenate. Ten ounces of glyoxide is equivalent in fungicidal strength to 1 quart of glyodin. The combination of glyoxide at 8 ounces plus ferbam at 8 ounces per 100 gallons has performed as favorably in controlling leaf spot on sour cherries in Michigan as the combination of glyodin and ferbam (see Red Tart (Sour) Cherry Spraying Schedule, page 46). As with glyodin, glyoxide should not be used on bearing Golden Delicious apple trees during the period of *Pre-Pink* through *Second Cover* because of possible danger of excessive fruit russeting.

Mercury Compounds—The phenyl mercurial compounds such as Tag 331, Puratized Apple Spray, Coromerc, and Phix are useful in eradicating newly established infections of apple scab. Sprays containing mercury at the rate of one-fourth to one-half pound, or one-fourth to one-half pint of 10 percent mercury are suggested for use on apples within 36 to 72 hours after an infection-producing rain, when protection from previously applied fungicides is questionable. Actually, these mercuries may have a longer period of action if temperatures remain low (below 50° F.) after the rain.

Some growers who have sufficient spray and dust equipment may wish to handle at least a portion of their apple scab control program on an eradication basis, rather than by using protective methods. To eradicate longstanding (2 to 3 yeeks) apple scab infection with mer-

curial compounds is a questionable practice; in some cases, heavy leaf drop has resulted. *Mercurial compounds should not be used after an application of ferbam unless ferbam is included with the mercury. Do not use them in hot weather.*

Mercury sprays are suggested as a dormant application on strawberries for eradicating the leaf blight (Dendrophoma) fungus. Mercury sprays may injure or kill old leaves, but these leaves are replaced by new leaves and will not be missed. Make the dormant application *before new growth is visible.* See Strawberry Spraying Schedule, page 53.

Niacide M (formerly Vancide M) is a mixture containing the following: 53.9 percent manganous dimethyldithiocarbamate, 10.9 percent thiram, 2.9 percent benzothiazyldisulfate, and 2.3 percent manganous benzothiazylmercaptide. It is suggested for use on apples any time throughout the growing season. In contrast to Niacide A, the "M" form is white or light gray in color, and leaves no undesirable visible residue on the harvested fruit. Niacide M has performed well throughout the season on Golden Delicious with no unfavorable russeting.

Phybam S is a mixture of Phygon, ferbam, and sulfur containing 3 percent dichlone, 9.5 percent ferbam and 71 percent elemental sulfur. It is suggested for use on apples at 4 pounds per 100 gallons. At this strength, the spray will contain about one-eighth pound of actual dichlone (equivalent to one-fourth pound of Phygon XL), one-third pound of ferbam, and 3 pounds of sulfur. Phybam S is effective in controlling powdery mildew and as a protective fungicide against apple scab. Its value for the eradication of apple scab has not been clearly established.

POSSIBLE PROBLEM DISEASES IN 1961

GREEN RING MOTTLE ON SOUR CHERRIES

In the last 3 years, bearing Montmorency trees with *green ring mottle* symptoms have been found in several Michigan orchards.

The symptoms of this virus disease show up on Montmorency trees 4 to 5 weeks after "petal fall" as green rings, spots, or arcs over a yellow background. The infected leaves drop over a period of 10 to 14 days after the symptoms become visible.

In a few rare cases, pitted fruit has been found on trees infected with green ring mottle. This pitting is caused by the killing of fruit cells just under the skin. This results in slight depressions (about 1/32 inch across) on the surface of the fruit.

Any grower finding these fruit symptoms should contact his county agricultural agent to have the suspected trees diagnosed by a plant pathology specialist.

There is no control for *green ring mottle* on established trees. Buy disease-free trees for new plantings.

X-DISEASE OF SOUR CHERRY, PEACH AND CHOKECHERRY

Two Montmorency cherry orchards were found in Oceana County exhibiting X-disease symptoms on July 29th, 1959. In one orchard, 30 percent of the Montmorency trees neighboring a hedge-row with diseased chokecherries had symptoms. This virus disease is spread from diseased chokecherry to cultivated cherry or peach trees. There is some evidence that this virus is not transmitted from peach to peach or cherry to cherry, but only from diseased chokecherry to cultivated peach or cherry. The suspected vector is a leafhopper.

Infected Montmorency cherry trees on Mahaleb rootstock exhibit symptoms of wilt and decline which is frequently followed by death of certain trees. On diseased trees, immature fruit is often found among healthy fruit.

Mature peach trees with X-disease will have twigs or branches exhibiting symptoms scattered indiscriminately throughout the tree. The leaves of the infected twigs and branches have discolored (red and yellow) spots on the blade which are irregular in size and shape. These discolored areas drop out, giving the leaf a tattered appearance. Eventually most of the infected leaves drop off except the ones at the tip of the twigs. Mature trees may live indefinitely, but young trees will be killed by this virus.

On chokecherry, X-disease can be recognized by the brilliant color of the foliage in July and August. The foliage is yellow, orange or red during the first year of infection. In subsequent year, leaves take on a duller shade of these same colors and the growth is stunted on the infected trees. By the fourth year, most of the infected trees will die.

The *control* of X-disease is to eradicate the chokecherry with a brush-killer for a distance of 500 feet from peach or cherry orchards.

BACTERIAL SPOT OF PEACHES

By late summer in 1960, bacterial spot of peach started to build up in a number of orchards, particularly in southwestern Michigan. For details on the life cycle and symptoms of this disease, see page 42 in the Extension Bulletin 361, Tree Fruit Diseases in Michigan.

It is suggested that a bacterial spot spray program be followed on susceptible varieties in areas where this disease has been a problem in the past.

The only currently known means of control is the application of five or six sprays of monohydrate zinc sulfate and lime in the proportion of 6-8-100 beginning with *Petal Fall* and continuing at intervals of 10-14 days.

APPLE SCAB

Apple scab is the only serious fungous disease generally confronting the Michigan apple grower, and good control of scab is necessary for a profitable season. Scabby apples are culls. Also, the fungus, if not controlled, can cause early fruit and leaf drop which may seriously reduce yields.

TABLE 1—The approximate number of hours of continued wet foliage required for primary apple scab infection at different air temperature ranges

Air temperature range during wet period	Number of hours of continuous wet period required for primary apple scab infection
32°—40° F.	48 hours
40°—42° F.	30 hours
42°—45° F.	20 hours
45°—50° F.	14 hours
50°—53° F.	12 hours
53°—58° F.	10 hours
58°—76° F.	9 hours
76°—	11 hours

TABLE 2—The effect of temperature following primary apple scab infection on the length of time required for the development of conidia (summer spores)

Average temperature following primary apple scab infection	Approximate period of time required for conidia (summer spore) development following primary apple scab infection
30°—40° F.	18 days
41°—45° F.	16 days
46°—50° F.	14 days
51°—55° F.	13 days
56°—60° F.	12 days
61°—65° F.	10 days
66°—70° F.	8 days
71°—75° F.	7 days

The apple scab fungus develops during the winter and early spring in the old leaves on the ground that were infected the previous season. Ascospores, similar to small seeds, are produced and are usually ripe about the time the first green apple tissue is exposed in the spring. Rain is necessary for spore discharge, and enough rain to wet the surface of the leaves will cause some of the ascospores to be shot into the air. The air currents then carry these spores upward into adjoining trees; or the wind may carry the spores long distances. If they land on green apple foliage or fruit, they cause infection when they stay wet for a few hours. Ascospores may continue to be discharged as late as 2 to 4 weeks after *Petal Fall* in some seasons, but are usually all gone by *First Cover.*

The spores (ascospores or conidia) will germinate and penetrate into the green tissue – if the green tissue is wet, and if the spores on the green tissue remain wet long enough. The time required for the discharge ascospore to germinate and cause infection depends upon the temperature during the wet period. This relationship is shown in Table 1.

Primary apple scab infection is soon followed by the formation of secondary spores that are produced abundantly in established scabbed spots. Table 2 gives the time of expected appearance of the secondary spores (called conidia) after primary scab infection. Once primary infection is established, it is possible to have both ascospores and conidia present at the same time. The conidia or summer spores are not scattered by the wind, but are spread only by dropping or splashing water. Therefore, conidia reinfect only nearby fruit and foliage. Infection by conidia requires a wet period about 3 hours shorter than that given for ascospore infection in Table 1. The 3-hour lag in ascospore infections is based on the time the ascospores spend floating around in the air.

SUGGESTIONS FOR CONTROL

By knowing the temperature from the time the green tissue first becomes wet until it dries again, you can determine (from Table 1) if infection is likely and judge whether spray materials already applied are adequate for the control of scab. If weather predictions indicate that the wet period will extend beyond the time given for apple scab infection in Table 1, it is advisable to apply a protective cover before or during the wet period, or an eradication spray immediately after the wet period. Renewed protection or eradication is particularly necessary if the protective cover already present is questionable.

To protect against apple scab infection, protective fungicides such as sulfurs or ferbam must be on the foliage before infection occurs. However, eradicative fungicides — such as lime-sulfur or phenylmercury compounds — kill the fungus after it has entered and penetrated for some distance into the apple leaf or fruit tissue; at full strength, these materials are usually effective for about 72 hours after the infection has taken place. Phygon XL is an effective eradicative fungicide when used at one-fourth pound per 100 gallons within 30 to 36 hours from the beginning of an infection period and in combination with a protective fungicide.

The performance expected of the several types of fungicides for scab control is illustrated, for all practical purposes, in Fig. 1. In this diagram, the organic mercuries — such as Tag, Coromerc, Phix, and Puratized Apple Spray — are shown eradicating infections that were established during the 3 days previous, or about 72 hours before the time of application. These organic mercuries are not, however, considered reliable for much further continued protection.

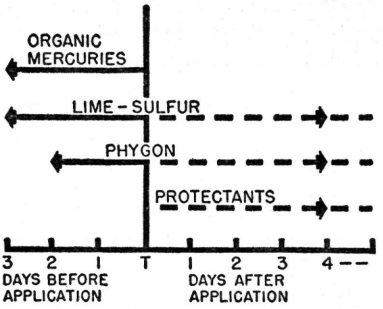

Fig. 1. Approximate periods of control of apple scab by different kinds of fungicides. (T = time of application.) The time to the left of the vertical line indicates the approximate period of eradicative action; that to the right indicates the approximate period of protective action.

Lime-sulfur has an eradicative action equal to that of the mercuries, but the eradicative action of Phygon is considered to be somewhat less — or about 36 hours when used at one-half pound per 100 gallons. In addition, lime-sulfur and Phygon leave protective fungicidal deposits. The fungicides, such as the wettable sulfurs, ferbam, and glyodin, are considered to be protective only, having rather limited or no eradicative properties. Captan is classed as a protectant, but does have eradicative action of 18 hours from the start of the wet period.

For a protective spray program to be effective, the developing fruit and leaves must be covered before an infection period of wet weather. The effective period of protection for the different fungicides is variable, depending on the amount of spray coating washed off by rains and the amount of new unprotected growth developed since the last spray. In general, a protectant spray coating in the prebloom period

should be considered insufficient after a period of not exceeding seven days, or after 1 inch of rainfall.

FIREBLIGHT

In 1960, this bacterial disease had been on the increase in Michigan. The key to control, in addition to bloom sprays, is by eradication of cankers and blighted tree parts.

DORMANT ERADICATION OF CANKERS

Winter is the best time to remove blighted twigs and branches. At this time, the bacteria are limited to the edge of the canker. Cut back 4 inches or more from the canker or back to the next lateral when possible.

To treat cankers in the main trunk, use a blacksmith's hoofing knife. Remove all the dead and discolored bark down to the wood and about 1 inch of the healthy bark at the sides and 3 inches at the ends. The edge of the healthy bark should be cut clean and brought to a point at both ends to promote rapid healing. Paint this treated area with a disinfectant.

SUMMER CUTTING AND BREAKING OUT

When practicing summer cutting of fireblight, keep in mind that the bacteria are in a very active state. Therefore take care to keep at least 12 to 14 inches back of the last symptoms of the disease before cutting. Disinfect tools after each cut of tree to avoid possible mechanical inoculation from contaminated tools.

Breaking out of infected twigs during late spring and early summer can reduce the inoculum and prevent the production of large cankers at the junction of a twig and a large limb. Again, the practice of cutting a foot or more below the last symptoms is recommended. This practice of removing infected twigs may be repeated several times in the growing season, depending on the severity of the disease.

Formula for disinfectant:

1 quart distilled *or* rain water
3 quarts commercial glycerin
¼ ounce cyanide of mercury (16 tablets)
¼ ounce bichloride of mercury (16 tablets)

Mark *poison* on outside of glass container and store in a safe place when not in use.

UNRELATED MATERIALS

Lead Arsenate was the standard stomach poison used in Michigan orchards before the introduction of DDT. Unless otherwise stated, lead arsenate referred to in this bulletin is the acid form.

Acid lead arsenate should not be used on peaches, cherries, plums, or after *Second Cover* on apples without a corrective. (See page 34.) Acid lead arsenate may be used safely with most pesticides. It should not be combined with weak concentrations of lime-sulfur (less than 1 gallon of lime-sulfur in 100 gallons of water, or less than 4 pounds of dry lime-sulfur) without the addition of hydrated lime, using equal amounts of lime and lead arsenate.

DN Compounds — Elgetol-318, and DN-289 — are effective against aphids, bud moth, and mineola moth as dormant applications. Follow the manufacturers' directions carefully. Foliar applications of DN compounds are now largely supplanted by other materials and are no longer generally suggested.

Dormant Oils can be used to control European red mite, scale insects, and pear psylla. In general, the amount of oil in a spray varies from 3 to 4 percent. Oils should be used at manufacturers' directions. Dormant oils should have a viscosity (Saybolt at 100° F.) of 90 to 120 seconds; a minimum viscosity index (Kinematic) of 65; a minimum gravity (A.P.I. degrees) of 28; a pour point not greater than 30° F., and an unsulfonated residue of above 78 percent. DN compounds should not be used in the same spray mixtures with 3 or 4 percent oil emulsions.

Some formulations of such phosphate chemicals as Trithion, Ethion, parathion and malathion are compatible with dormant oils. Pesticidal effectiveness is increased when oil-phosphate combinations are used.

At present, practically all insects that were once controlled by dormant oils can be controlled by foliar applications of newer insecticides.

Genite EM-923 (2,4-dichlorophenyl ester benzene sulfonic acid) is a specific miticide which may be used during *Pink* on apples to prevent a build-up of European red mites. In some orchards, Genite Em-923 has eliminated the need for a miticide later.

CHLORINATED HYDROCARBONS

BHC (benzene hexachloride) is a contact and stomach poison suggested in the Apple Schedule at the time of *Pre-Pink* and *Pink* to control aphids on apples. This material should not be used after *Pink* since it may create an off-flavor in the harvested fruit.

The active portion of BHC is the gamma isomer. Amounts of BHC suggested in this publication are based on 10 percent gamma isomer content.

Chlorobenzilate (ethyl-4, 4-dichlorobenzilate) is a specific miticide and has been labeled for use on apples and pears. It has been very effective against mites which show resistance to phosphate materials. Some states have reported fruit injury when Chlorobenzilate was used on Delicious and Jonathan.

DDT (dichlorodiphenyl trichloroethane) is used on fruits as a wettable powder and may be combined with other spray materials, except oils and strongly alkaline mixtures. DDT controls codling moth, oriental fruit moth, leafhoppers, grape berry moth, and cutworms.

Dieldrin (hexachloroepoxyoctahydrodimethanonaphthalene) has proved very effective against the plum curculio on tree fruits and spittlebug on strawberries. It has a persistent residue and should not be applied after *First Cover* spray on peaches, plums, or cherries nor after *Third Cover* on apples. Do not use Dieldrin after *Bloom* on strawberries.

Endrin (hexachloroepoxyoctahydro-endo, endodimethanonaphthalene), has been cleared for use on apples and pears with no allowable residue on harvested fruit. To avoid possible residue, Endrin must *not* be used later than *First Cover.* Endrin is considerably more toxic to humans and warm-blooded animals than other commonly used chlorinated hydrocarbons. Extreme care should be exercised in the use of this material. All safety precautions given on the label *must* be followed precisely. Fish are especially sensitive to minute amounts of this chemical. Thus, Endrin should *not* be used in orchards where run-off will contaminate waters inhabited by fish. In research and demonstration plots two applications of endrin have been far superior to one. Pests susceptible to endrin sprays include red-banded leaf roller, curculio and aphids.

Kelthane (1, 1-bis (chlorophenyl) trichloroethanol) is a specific miticide that has performed well in Michigan during the past five

years. The residual action of this material is sufficiently long to control mite infestations with one application in many instances. For best results, apply Kelthane when the average temperature is predicted to be above 70° F. for 5 to 7 days.

Methoxychlor (1, 1, 1-trichloro-2, 2-bis (paramethoxyphenyl) ethane), a close relative of DDT, is also sold under the trade-name Marlate. It exercises control against such pests as the plum curculio, codling moth, apple maggot, and cherry fruit fly. Methoxychlor is a relatively safe chemical and can be used closer to harvest than many other insecticides.

Mitox (p- chorbenzyl, p-chlorphenyl sulfide), a specific miticide, has proved effective for the control of European red mites in the *Pre Bloom* period. Its action is primarily against eggs and newly hatched mites. Mitox exhibits long residual effectiveness and is relatively non-toxic to humans.

Ovex (para-chlorophenyl para-chlorobenzenesulfonate) is a specific miticide sold under the trade name Ovotran. It is effective largely against eggs and young mites. Ovex is virtually non-toxic to warm blooded animals and may be used as late as 30 days before harvest on apples, pears, peaches, and plums.

Tedion (2,4,5,4′-tetrachlorodiphenyl sulphone) a relatively new specific miticide, has given good results in research and demonstration plots during the past two years. Tedion offers long residual effectiveness and a high degree of safety to man and plants. It is most effective against eggs and young mites. At present Tedion may be used at the rate of 1 pound (25% wettable) after *First Cover* on apples and pears. One pound may also be used after *Shuck-Split* on stone fruits. Trials in Michigan have shown best control when applications of this type are made about 10 to 15 days after an earlier spray (around *Shuck-Split* or *First Cover*).

CHOLINESTERASE-INHIBITING COMPOUNDS INCLUDING ORGANIC PHOSPHATES

Demeton (O-(2-ethylmercapto) ethyl)-O, O-diethyl thiophosphate) commonly called Systox, is a systemic aphicide and miticide formulated as an emulsion concentrate. Do not use it more than three times during the growing season. At present, demeton has been cleared for use on apples, pears, peaches, grapes and strawberries. Like

parathion and certain other phosphates, this chemical is highly toxic to man and precautions on the label should be followed.

Diazinon (O, O-diethyl-O-(2-isoproyl-4-methyl-pyrimidyl (6) thiophosphate) is intermediate between parathion and malathion in toxicity to humans. It is effective against a wide range of insect pests, and has a residual action of 11 to 14 days. Diazinon is now cleared for use on apples, pears, cherries, peaches, plums, strawberries and grapes.

Ethion (0,0,0^1,0^1-Tetraethyl S, S^1-Methylene bisphosphorodithioate) is a relatively new phosphate chemical showing effectiveness against mites, codling moth, leafhoppers, pear psylla and certain other fruit pests. It has been cleared for use on apples, pears, grapes, plums, peaches, and strawberries. Dosage rates vary between 1 and 2 pounds of the 25% wettable powder depending upon the crop and pest situation. Considerable variation exists among crops regarding the time interval required between last application and harvest (see Table 3, page 60). Ethion is suggested only on a trial basis pending more experience on its performance under Michigan conditions.

Guthion (O, O-Dimethyl S-(4-oxo-1,2,3,-benzotriazinyl-3-methyl) phosphorodithioate) continued to give outstanding results in research plots and grower orchards in 1960. Almost all common fruit insects and mites were controlled with sprays applied at 14-day intervals.

Guthion has not performed well as a late clean-up material for mites, especially two-spotted mites.

Guthion has been cleared for use on apples, pears, peaches, cherries, plums, and strawberries. To avoid prohibitive residues, do not use more than 8 applications of Guthion per season and do not use it later than is indicated in Table 3 (page 60).

Experiences in Michigan to date have indicated a greater degree of fruit safety with the wettable powder than the emulsifiable formulation.

Guthion is similar to parathion in toxicity to humans.

Malathion (S-(1, 2-dicarbethoxyethyl) O, O-dimethyl dithiophosphate) is useful against many insect pests and is especially effective against many forms of aphids. Its period of effectiveness is only 2 to 3 days. Because of its short residual action, it can often be used to good advantage in late season sprays.

Parathion (O, diethyl O-p-nitrophenylthiophosphate) is highly toxic to man and animals. It has been widely used since 1949 and has given good control of aphids, bud moth, pear psylla, curculio, codling moth, oriental fruit moth, and grasshoppers. Some effectiveness is exhibited against mites and red-banded leaf roller. No injury from this material has been observed on peaches, plums, or cherries. Apples have been injured when parathion was used in amounts greater than the dosages suggested in the Apple Spraying Schedule. Parathion can be used often to good advantage in combination with other insecticides.

Phosdrin (alpha isomer of 2-carbomethoxy-1-methylvinyl dimethyl phosphate) continued to give excellent results as a clean-up material against red-banded leaf roller in 1960. Although phosdrin controls a wide range of pests, its effectiveness lasts only about 24 hours. From this standpoint, it is more useful as a clean-up material than as a protective insecticide. Phosdrin is now labeled for most Michigan fruits. Since it is highly toxic to humans, all safety precautions and a special mask are necessary when phosdrin is used. Information on suitable respirators may be obtained from:

1. The Shell Chemical Corp., Agricultural Chemical Sales Division, 460 Park Avenue, New York 22, N. Y.

2. Acme Protection Equipment Co., 1201 Kalamazoo Street, South Haven, Mich.

3. American Optical Co., Safety Division, Southbridge, Mass.

Tepp (tetraethylpyrophosphate) has been used commercially against certain pests for several years. Its main value is that it gives quick initial kill of mites and insects and can be combined with residual miticides and other materials advantageously. TEPP may be applied as late as 72 hours before harvest. This material is highly toxic to man and should be used with extreme caution.

Trithion (O, o-diethyl S-p-chlorophenylthiomethyl phosphorodithiate) is a relatively new phosphate material showing long residual effectiveness against certain pests. In experimental plots, aphids, scales, and mites have been controlled for periods longer than three weeks with one application. Research studies indicate that trithion is effective against other fruit pests, but the protection is for a shorter period of time—approximately 10 days. Trithion is cleared for use on most fruits. It is suggested for trial in apple and cherry orchards where serious aphid, scale, and European red mite problems exist.

However, Trithion has injured the leaves of Delicious and has russeted the fruit of Jonathan and Golden Delicious in Michigan when used after *Bloom*. Its present suggested usage on apples is in the *Dormant or Delayed Dormant periods*. Should growers wish to try Trithion after *Bloom* on apples, the following precautions are given:

- Repeat applications of Trithion should be spaced at least 30 days apart.
- Do not use Trithion on apples during the period of *Bloom* through *Second Cover*.

Sevin (1-naphthyl N-methylcarbamate), a relatively safe insecticide, controls a wide range of insects at dosage rates from 1 to 2 pounds of 50 percent wettable Sevin per 100 gallons. While not a phosphate, Sevin is considered a cholinesterase-inhibiting compound to a mild degree. Its effectiveness ranges from 10 to 14 days depending on the insects to control. Sevin is not effective against mites. It is compatible with most other pesticides. Sevin offers a high degree of safety to animals and plants and gives good control of certain pests resistant to other frequently used insecticides.

INSECTS CAUSING DIFFICULTY IN 1960

LATE SEASON WORMS IN FRUIT

Several worms, especially those causing damage near harvest, proved troublesome in 1960. These included oriental fruit moth, codling moth, grape berry moth, cherry fruitworm and apple maggot. Several factors combine to cause such problems.

Oriental fruit moth larvae often enter peaches nearing harvest through the stem. No readily visible entrance mark is left and no indication of injury is noted until the fruit is opened. Orchardists troubled with this problem should make certain continuous protection is provided from August 1 until harvest. Phosphate chemicals or a phosphate-Sevin combination usually work best during this period.

Extended periods of warm weather during August and early September magnify problems with late broods of the codling moth and the grape berry moth. Similar to the oriental fruit moth, these late season pests can usually be controlled best with a phosphate material labeled for use at this time. Sometimes the inclusion of Sevin (1 pound of 50% wettable powder) is advised. Sevin works largely against the small worm before it enters the fruit. Phosphate chemicals provide some fumigating action and help against eggs, some adults

and larvae just after they have entered the fruit, and other life stages. In choosing a phosphate consider the number of days protection is needed and the waiting period required between last application and harvest.

Cherry fruitworms continued to cause trouble in certain plantings. Growers who used phosphate chemicals and provided good coverage during **June** reported excellent control of cherry fruitworm in 1960. This seems to be the key to good results in orchards troubled with this pest.

Problems with apple maggot during the year arose largely in situations where late season sprays were omitted. In some years continuous protection is needed throughout the months of July and August. Sometimes adult flies are collected as late as early September. Lead arsenate, Sevin, phosphate chemicals and chlorinated hydrocarbons are all effective against apple maggot adults.

MITES

Both European red mites and two-spotted mites continued troublesome in orchards in 1960. Infestations varied considerably according to location, spray program and fruit varieties. Warm dry periods in July and August also contributed to mite increases.

Research and out-of-state reports indicate that mite resistance to phosphate and currently used specific miticide materials are problems which Michigan growers should be thinking about. To date Guthion and several other phosphate materials continue to be effective against certain mite stages. However, the more generally these materials are used the greater the chances become for resistance to develop.

In areas where resistance has become a major problem, a frequent change of materials and combinations of materials has provided some relief. For example, TEPP and specific miticides used together in combination worked well. Alternating applications of different specific miticides have given good results, also. Another program used with success was to combine two specific miticides and use each at one-half its usual dosage rate. Each of these methods should perform well in most Michigan orchards and help delay a build-up of pesticide resistance in specific orchard situations. *Good coverage* is a *must* in mite control with a possible exception occurring when systemic materials are used.

GREEN FRUITWORMS AND LEAF ROLLERS

More green fruit worms were seen in apple orchards during the spring of 1960 than in past years. These worms, measuring to one inch in length, damaged fruit by chewing on the external surface. Fortunately, common spray materials provided good control.

The red-banded leaf roller continued to cause considerable loss in some fruit plantings. Three major reasons for poor results were noted: *First,* control was neglected until worms were well grown. *Second,* poor coverage was evident because of improper adjustment of the sprayer or poor pruning practices. *Third,* weak dosage rate or ineffective materials were used. Any one or a combination of the above may be expected to lead to poor results in 1961. Guthion or DDD continue to be preferred materials against red-banded leaf roller, with Phosdrin available when a cleanup material is needed.

ACCESSORY MATERIALS

"Accessory materials" are those materials added to fungicides and insecticides 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 AGENTS OR SPREADERS

Years ago, experience indicated that the action of many orchard sprays was improved by the addition of wetting agents or spreaders. Common materials—such as dried milk, casein, eggs, dried blood, fish-oil soap, laundry soap, soybean flour and lime — were used for that purpose. In recent years, synthetic chemicals have replaced these older wetting agents.

At the same time, it has become common practice for the manufacturer to add wetting agents to the spray materials during the manufacturing process. At present, it is seldom necessary for the orchardist to add such materials in the field. Occasionally—if the water is unusually hard, if hard-to-wet plants such as plum fruits are involved, or if hard-to-wet insects such as waxy aphids are to be controlled—it may be helpful to add a small amount of wetting agent to the tank. Too much will cause excessive runoff.

Some materials act as spreaders (wetting agents) when wet, and as stickers after they dry. Such "sticker-spreaders" usually increase retention or adhesiveness more than they increase deposit.

Like wetting agents or spreaders, stickers are often included by the manufacturer in the formulation of the spray material. Occasionally the use of additional amounts of sticker-spreader is advised. Excessive use of stickers may cause *excessive* residues at harvest.

SPRAY LIME

There are several grades of hydrated lime — "mason's hydrate," "finishing hydrate," "agricultural lime," "chemical hydrate lime," and "spraying lime." The first three mentioned grades are nearly always undesirable for spraying purposes. Special spraying or chemical hydrate lime should be used.

Do not use old lime for spraying purposes. Lime that is freshly hydrated in the spring should be satisfactory for 10 to 12 weeks if stored in a dry place and not exposed to the air. Lime carried over from last season can more profitably be added to the soil than put in the spray tank. Brands of lime vary in fineness and physical properties.

Finely ground limes, with the least amount of grit or coarse material, are the best. Limes vary in their chemical composition as well as their physical properties. Lime made from limestone composed almost entirely of calcium carbonate is called "high-calcium lime"; lime made from limestone containing a mixture of calcium and magnesium carbonates is called "dolomitic lime." Both the "high calcium" and the "dolomitic" forms are satisfactory for spraying purposes.

CORRECTIVES FOR SPRAY INJURY

COPPER INJURY

When using copper sulfate (blue vitriol) or "fixed" copper as a fungicide or bactericide, add hydrated lime to the spray mixture to prevent injury to leaves and fruit from any soluble copper that may be in solution. By adding hydrated lime to spray mixtures of copper sulfate, the resulting product is bordeaux (see bordeaux, page 14). When using "fixed" copper, one pound of lime is added to the mixture for every 0.24 to 0.26 pound of *actual* copper. For example, when using 3 pounds of Tennessee 26 per 100 gallons (Tennessee 26 contains 0.26 pound of *actual* copper per pound), you would add also 3 pounds of hydrate lime per 100 gallons of spray.

ARSENICAL INJURY

Hydrated lime may be used with lead arsenate to safen against arsenical injury to leaves and fruit. (See lead arsenate, page 26.) How-

ever, organic fungicides which also safen against arsenical injury are replacing hydrated lime.

The following organic fungicides safen against arsenical injury when used in the same spray mixture with lead arsenate:

- 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-fourth pound of Cyprex will safen one pound of lead arsenate.
- One-half pound of Niacide M will safen one pound of lead arsenate.

Glyodin or Thylate will *not* safen lead arsenate. When using these two fungicides with lead arsenate, reduce the amount suggested per 100 gallons and add either ferbam, captan or Niacide M in quantities required to safen the lead arsenate being used. For example, if using glyodin at 1½ pints per 100 gallons with 2 pounds of lead arsenate, you could reduce the amount of glyodin to one pint and use with it one-half pound of ferbam as the arsenical safening agent.

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 is the period, *Pink* through *First Cover.* The opportunity for russeting is even more acute when cool, humid, rainy weather accompanies or follows the freezing temperatures, as in 1960.

Golden Delicious: — Ferbam, mercury, Cyprex, glyodin or glyoxide should *not* be used on this variety during the time *Pink* through *Second Cover.* Wettable sulfur or lime-sulfur may cause unfavorable russeting during the critical period if used when weather conditions are cool, humid and rainy. The most favorable hedge for good finish on Golden Delicious is to use captan beginning with *Pre-Pink* and continue its use through *Second Cover.* Experimental findings in Michigan have shown also that Niacide M and Thylate may be used safely on this variety in a protective schedule against scab. If "back action" is necessary against possible apple scab infection, Phygon XL at ¼ pound plus captan at 1 pound per 100 gallons may be used.

Remember, captan alone has "back action" of 18 hours or more against this organism. 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 russeting. 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* if possible and then use either methoxychlor, DDT or wettable Guthion. Do not use parathion at least until *Second Cover,* and from this time on, at no higher rate than ½ pound of 15% wettable or its equivalent per 100 gallons.

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.* 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 at or just after *Pink.* In years when the air temperature drops to 32° F. or lower at *Bloom* or shortly thereafter, use captan, Niacide M or Thylate through *Second Cover.* If back action beyond 25 hours is required to control scab, use mercury with half-strength protective fungicide providing tree development is no later than *Petal Fall.* After *Petal Fall* for "back action," use Phygon XL at ¼ 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* in 1960 caused undue stem cavity russeting. Delaying the use of insecticides until *First Cover* and using parathion at no higher concentration than ½ pound of the 15% wettable powder or its equivalent in the liquid form will insure less chance of russeting. Or, use wettable Guthion at *First Cover.* 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.

Delicious: – Many growers in Michigan experienced unfavorable russeting of Delicious in 1960. Evaluating the pesticide program, in every case these growers had used either wettable sulfur, sulfur paste, lime-sulfur or Phygon XL 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 Phygon XL will russet Delicious, including the

red sports. By avoiding the use of these above mentioned chemicals applied as a spray *in* or *after Bloom,* there will be no problem of russeting of Delicious in Michigan.

THE USE OF SURFACTANTS OR WETTING AGENTS

The use of wetting agents and adhesive agents on apples is a questionable practice because of the wide variation in chemical and physical properties of the pesticides presently available. Every commercial insecticide and fungicide has a wetting agent incorporated in its formulation except in special cases. Also when pesticides are used in concentrate spraying as in a 2X mixture, the amount of wetting agent is 2 times the amount present in a dilute mixture because 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 added to concentrated mixtures could result in chemical injury to apple leaves and fruit. The liquid pesticides such as liquid parathion and liquid Guthion have higher wetting properties than the wettable powder forms. Also, the pesticides glyodin, glyoxide and Cyprex are excellent wetting agents and no commercial surfactant (wetting agent) should be included in the same spray mixture with them. Furthermore, when using these fungicides on apples, it is desirable to select an insecticide in wettable powder form rather than the liquid to avoid possible chemical injury. This is particularly true from *Bloom* through *Second Cover* and from July 10 to harvest. The reverse is also worthy of consideration. When using a liquid insecticide, select a fungicide of wettable powder formulation that does not have the high wetting properties of glyodin, glyoxide and Cyprex. Remember too that chemicals with a narrow range of safety such Phygon XL and parathion which may cause injury to fruit or leaves of apple trees by too heavy applications will be more likely to cause injury when using the liquid formulations, when included with glyoxide, glyodin, or Cyprex, or when a commercial wetting agent is added to the spray mixture. Select pesticides carefully for each variety of apple 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.*

SPRAY CHEMICALS FOR THE CONTROL OF APPLE SCAB

Protective fungicides	*Eradicative fungicides*	*Fungicide mixtures with both eradicative and protective properties*
Lime-sulfur	Lime-sulfur	Sulfur, Ferbam, Glyodin, Glyoxide or Captan at half-strength combined with one-fourth pound of Phygon XL per 100 gallons.
Copper compounds	Mercurial compounds	
Wettable sulfur		
Sulfur paste	Phygon (dichlone)	
Ferbam	Cyprex (dodine)	
Glyodin		
Glyoxide		Sulfur, Glyodin, Glyoxide, Ferbam or Captan at half-strength combined with mercurial compounds.
Captan		
Phygon (dichlone)		
Cyprex (dodine)		

Precautions in Selecting Chemicals to Control Apple Scab

Newly-established apple scab infection can be eradicated effectively within 30 to 36 hours from the beginning of a wet period — using either ¼ pound of dichlone (Phygon XL) with a protective fungicide at half-strength — or within 72 hours from the beginning of an infection period, using full-strength mercury. When mercury is used at half-strength in combination with a protective fungicide, the effective period for eradication is usually reduced to 40 to 45 hours. However, the period of effective eradication may be somewhat longer for all concentrations of eradicative fungicides if the temperature during the time of infection is under 50° F. Remember also that liquid lime-sulfur has effective eradicative properties if used at 2 gallons per 100 gallons of spray within 72 hours from the beginning of the infection period.

In Michigan, mercurial compounds may be most valuable as an emergency measure after rains, when protection against possible apple scab infection is questionable. Use a protective fungicide with the mercury.

APPLE SPRAYING SCHEDULE—1961

(See Table 3, page 60, for Pesticide Residue Information)

Time	Materials per 100 gallons	To control
A dormant application of DN-289 or Elgetol-318 is suggested only when rosy aphids are a serious problem. Ordinarily aphids are readily controlled in the Pink application with such materials as BHC, malathion or Systox.		
FIRST sign of GREEN TISSUE *to* PRE-PINK	Lime-sulfur—2 gallons *or* Either keep covered with protective fungicides just before rains according to expanding growth, or use eradicative fungicides immediately after rains. (See Page 16)	Sepal and leaf scab
PRE-PINK *to* BLOOM	Protective fungicides applied before rains wettable sulfur—6 pounds, *or* ferbam—1½ pounds, *or* captan—2 pounds, *or* cyprex—½ pound, *or* glyodin—1 quart, *or* glyoxide—10 ounces *or* Eradicative fungicides applied after rain as follows: Mercury at half or full strength; Phygon XL at ¼ pound with half strength protective fungicide; *or* Cyprex at ½ pound. (See page 18)	Fruit and leaf scab

Powder Mildew has been present in certain orchards during the past 3 years. Of the varieties grown in Michigan, Jonathan, Cortland and Rome are the most susceptible to this disease. Either lime-sulfur or 3 pounds of wettable sulfur or sulfur paste per 100 gallons with half-strength organic fungicide from *Green Tip* through Petal Fall will control mildew on apples. If the spray mixture does not wet the fungus growth thoroughly, add a commercial wetting agent.

The use of half-strength wettable sulfur or sulfur paste as suggested above will not cause economic injury to fruit or foliage. Lime-sulfur throughout the period *Pre-Pink* through *Petal Fall* could be unfavorable physiologically, particularly on Northern Spy and Delicious, and could cause unfavorable fruit russeting of Delicious.

One application of BHC (10 percent gamma isomer) at 2 pounds per 100 gallons at the time of *Pink* helps control aphids. In orchards where both aphids and European red mites are a problem, the use of Systox (25 percent emulsion) at ¾ pint, or malathion (25 percent wettable) at 2 pounds per 100 gallons in the *Pink* stage may be favorable. When only European red mite is a problem, ovex, Genite-923, Mitox or Tedion at the manufacturer's directions may be included with the fungicide at the time of *Pink* to help prevent build-up of European red mites later in the season.

BHC is not compatible in the same spray tank with lime-sulphur. However, it can be used before and after applications of lime-sulfur.

Time	Materials per 100 gallons	To control
PERIOD OF BLOOM	Bordeaux 2-6-100, *or* Streptomycin—50 to 100 parts per million (when maximum temperature is above 65° F.)	Fire blight

For varieties susceptible to fire blight—First application of fire blight spray should be made as soon as the first blossoms open. Two or three sprays at 4-day intervals may be necessary, depending on weather conditions. Damp, rainy weather or high humidity favors

Apple Spraying Schedule (Continued from page 39)

development of fire blight. To avoid fruit russeting when bordeaux is used on bearing trees, spray during quick-drying conditions. Fog the spray into the trees; do not drench. Bordeaux is effective against scab infection. Streptomycin has no value for the control of scab and is suggested against fire blight only, use 100 p.p.m. when moderate to severe blight conditions occur.

In addition to spraying, a thorough job of pruning out the larger overwintering cankers in the dormant season is a MUST in control of fire blight on mature trees.

The use of bordeaux or fixed copper on Jonathan in the *Bloom Period* following freezing air temperatures (32° F. and below) occurring after early *Pre-Pink* may cause unfavorable fruit russeting.

Scab sprays with protective fungicides may be needed if wet weather occurs during bloom. Mercury should not be used during bloom because it is highly toxic to bees.

PETAL FALL (When three-fourths of the petals have fallen)	Protective fungicides applied before rains wettable sulfur—5 pounds, *or* ferbam—1½ pounds, *or* glyodin—1 quart, *or* captan—2 pounds, *or* glyoxide—10 ounces, *or* cyprex—½ pound Eradicative fungicides applied after rain as follows: Mercury at half or full strength; Phygon XL at ¼ pound with half strength protective fungicide; *or* Cyprex at ½ pound. (See page 18) *plus either* Dieldrin (50% wettable) ½ pound, *or* Parathion (15% wettable) ½ pound, *or* Methoxychlor (50% wettable) 2 pounds, *or* Guthion (25% wettable) 1 to 1¼ pounds	Fruit and leaf scab Curculio

Guthion or a combination of Parathion plus DDD may be favorable for orchards where curculio and red-banded leaf roller are a problem. Dieldrin and Guthion are effective for about 14 days while Parathion, methoxychlor and DDD are effective for about 7 days.

Endrin is cleared for use on apples and pears on a no residue basis. It is suggested for trial where curculio, red-banded leaf roller and aphids are a problem at the rate of ⅓ pound of 75% wettable per 100 gallons. When endrin is used, a second application in *First Cover* is usually necessary for good results. To avoid excessive residue, endrin *must not* be used later than *First Cover.*

Do not use mercury later than *Petal Fall* because of possible mercury residue on the fruit at harvest.

FIRST COVER (7 days after Petal Fall)	Same fungicides suggested as for Petal Fall except for mercury. *plus either* Effective for only 7 days parathion (15% wettable)—½ to ¾ pound, *or* methoxychlor (50% wettable)—2 pounds Effective for 14 days Guthion (25% wettable)—1 to 1¼ pounds	Scab Curculio, red-banded leaf roller

In orchards where parathion or methoxychlor is used, check for signs of red-handed leaf roller. If you find this pest, include DDD at 2 pounds per 100 gallons in the spray mixture. Endrin may be used at this time on a trial basis as suggested in *Petal Fall. Endrin must not be used later than First Cover.*

Apple Spraying Schedule (Continued from page 40)

Time	Materials per 100 gallons	To control
SECOND COVER (7 days after First Cover)	Protective fungicides only ferbam—1 to 1½ pounds, *or* glyodin—¾ to 1 quart, *or* captan—1½ to 2 pounds, *or* glyoxide—8 to 10 ounces, *or* cyprex—¼ pound *plus either*	Scab
	Parathion (15% wettable)—¾ pound+DDT (50% wettable)—1 pound, *or* Methoxychlor (50% wettable)—2 pounds	Codling moth, curculio

An insecticide is needed at this time only if parathion or methoxychlor was used in *First Cover*. If Guthion was used in *First Cover*, omit the insecticide at *Second Cover*. Single applications of Guthion give protection against insects for approximately 14 days.

If *mildew* starts building up on any variety, include 2 pounds of wettable sulfur (325 mesh) or Karathane at ½ pound per 100 gallons.

Continue checking orchard for signs of *red-banded leaf roller*. If this pest is present, substitute DDD for DDT.

If *green apple aphids* become excessive, add an aphicide to the spray mixture to keep them in check. *Green apple aphids* may continue to migrate into the planting, and a single application may fail to control them.

Time	Materials per 100 gallons	To control
THIRD COVER (7 days after Second Cover)	The same fungicides are suggested as for Second Cover *plus*	Apple scab
	DDT (50% wettable)—1 pound+parathion (15% wettable) ½ pound, *or* Dieldrin (50% wettable)—one-half pound+DDT (50% wettable)—2 pounds, *or* Methoxychlor (50% wettable)—2 pounds, *or* Diazinon (25% wettable)—2 pounds, *or* Guthion (25% wettable)—1 to 1¼ pounds, *or* Sevin (50% wettable)—1 pound	Codling moth, curculio

The use of parathion with DDT controls codling moth and curculio and tends to hold down a buildup of red-banded leaf roller, mites, aphids and other pests. Used alone, methoxychlor controls codling moth and late-emerging curculio. DDT alone controls only codling moth, while dieldrin alone controls only curculio. Diazinon and Guthion control all these pests with the exception that *Diazinon will not adequately control heavy infestations of curculio or leaf roller*. Sevin does not control mites and is not suggested where curculio has been a serious problem.

FOURTH COVER (10-14 days after Third Cover)	The same fungicides and insecticides are suggested as for Third Cover.	Apple scab, codling moth, curculio

Mites may be controlled with such materials as ovex, Kelthane, Tedion or Systox used at manufacturer's directions, when they start to build up.

Apple Spraying Schedule (Continued from page 41)

Time	Materials per 100 gallons	To control
FIFTH COVER (Time is announced during the period of June 25 and July 15)	Glyodin—1 pint, *or* Ferbam—¾ pound+liquid spreader, *or* Captan—1 pound, *or* Glyoxide—5 ounces, *or* Cyprex—¼ pound *plus either* Lead arsenate—2 pounds, *or* Parathion (15% wettable)—1 pound+DDT (50% wettable)—1 pound, *or* Diazinon (25% wettable)—2 pounds, *or* Guthion (25% wettable)—1 to 1¼ pounds	Apple scab Apple maggot

Timing for *apple maggot* and *second brook codling moth* spray is announced by your county agricultural agent.

When *glyodin* is used in July and August with *lead arsenate* for the control of *apple maggot*, include ½ pound of *ferbam* per 100 gallons of spray to correct against possible arsenical injury.

The period to protect against apple maggot injury extends for approximately 6 weeks. The insecticides listed above give protection for 12 to 14 days. Thus, repeat applications at 12- to 14-day intervals.

Sevin is effective against *apple maggot* but lasts only about 10 days against this pest. Use according to label.

SIXTH COVER (12-14 days after Fifth Cover)	The same fungicides and insecticides are suggested as for Fifth Cover.	Apple scab Apple maggot, codling moth

It is often favorable to alternate insecticides used during July and August based on the insects to be controlled at each 12- to 14-day interval.

Start looking for leaf rollers beginning with Sixth Cover. In orchards where leaf roller is serious, use Guthion or Sevin or include DDD with the other suggested insecticides.

In orchards heavily infested with mites, use a specific miticide, such as Kelthane, Tedion or ovex at manufacturer's directions. Systox controls both mites and aphids.

Parathion, Diazinon, and Guthion are only partially effective against mites, especially two-spotted mites. Lead arsenate and Sevin are ineffective against mites.

SEVENTH COVER (10-14 days after Sixth Cover)	The same fungicides and insecticides are suggested as for Fifth Cover.	Apple scab Apple maggot, codling moth
EIGHTH COVER (10-14 days after Seventh Cover)	The same fungicides and insecticides are suggested as for Fifth Cover.	Apple scab Apple maggot, codling moth

Sevin, Phosdrin and malathion can often be used to good advantage in late season applications.

Consult Table 3, page 60, for information on the number of days between last application and harvest for each material. Base your choice of materials on this information.

PEAR SPRAYING SCHEDULE—1961

(See Table 3, page 60, for Pesticide Residue Information)

Time	Materials per 100 gallons	To control
A dormant application of liquid lime sulfur at the rate of 6½ gallons per 100 gallons is suggested before buds swell in plantings where pear leaf blister mite is a problem.		
PRE-BLOOM (When buds of blossom clusters begin to separate)	Ferbam—1½ pounds, *or* Bordeaux 3-8-100	Pear scab, leaf spot
Additional fungicide sprays may be necessary before bloom if wet weather prevails.		
PERIOD OF BLOOM (Beginning when 25 percent of the blossoms are open)	Bordeaux 2-6-100, *or* Streptomycin—50 to 100 parts per million (when maximum temperature is above 65° F.)	Fire blight
Streptomycin may be used at 50 to 100 p.p.m. Use 100 p.p.m. when moderate to severe fire blight conditions occur. Apply first spray when the first blossoms open; make second application at the time of full bloom. In some years, three sprays at 3- to 4-day intervals may be necessary during the period of bloom if wet weather prevails. To avoid fruit russeting when using bordeaux on bearing trees, make the spray applications during quick-drying conditions and fog the spray into the trees rather than drench them. Streptomycin has no value for the control of pear scab. **In addition to spraying, a complete pruning out of overwintering cankers in the dormant season is a MUST in the control of fire blight.**		
PETAL FALL (When three-fourths of the petals have fallen)	Ferbam—1½ pounds, *or* Bordeaux 3-8-100 *plus* Parathion (15% wettable)—1 pound, *or* Guthion (25% wettable)—1 to 1¼ pounds	Pear scab, leaf spot Pear psylla, tarnished plant bug, curculio
Guthion is *not* compatible with bordeaux.		
FIRST COVER (12-14 days after Petal Fall)	The same materials are suggested as for Petal Fall	Pear scab, leaf spot Pear psylla, curculio
SECOND COVER (12-14 days after Petal Fall)	Ferbam—1½ pounds Bordeaux 2-6-100 *plus* Parathion (15% wettable)—1 pound+DDT (50% wettable)—1 pound, *or* Guthion (25% wettable)—1 to 1¼ pounds	Pear scab, leaf blight Pear psylla, codling moth
Guthion is *not* compatable with bordeaux.		
THIRD COVER (10-14 days after Second Cover)	The same materials are suggested as for Second Cover	Pear scab, leaf blight Pear psylla, codling moth

Pear Spraying Schedule (Continued from page 43)

Time	Materials per 100 gallons	To control
FOURTH COVER (10-14 days after Third Cover)	Ferbam—1½ pounds, *or* Bordeaux 2-6-100 *plus* DDT (50% wettable)—2 pounds, *or*	Leaf blight, pear scab Codling moth

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, based on second brood codling moth emergence)	The same fungicides are suggested as for Fourth Cover *plus* DDT (50% wettable)—2 pounds, *or* Diazinon (25% wettable)—2 pounds, *or* Guthion (25% wettable)—1 to 1¼ pounds	Leaf blight, pear scab Codling moth

Do not use DDT on pears later than 30 days before harvest.

Consult Table 3, page 60 for information on the number of days between last application and harvest for each material. Base your choice of materials on this information. Where codling moth has been a problem in pears for processing, use a preharvest application of malathion (25% wettable) at 2 pounds or Sevin (50% wettable) at 1 pound per 100 gallons 3 to 7 days before picking.

PEACH SPRAYING SCHEDULE—1961

(See Table 3, page 60, for Pesticide Residue Information)

Time	Materials per 100 gallons	To control
DORMANT (In the *fall* after leaf drop, or in the *spring* before buds swell)	Use either in fall or spring Ferbam—1½ to 2 pounds, *or* Bordeaux 6-6-100 *or* In spring only Lime-sulfur—5 gallons	Peach leaf curl
BLOOM (Beginning with balloon pink and continuing through bloom)	At time of balloon pink Lime sulfur—2 gallons, *or* Phygon (dichlone)—½ pound, *or* sulfur paste—6 pounds, *or* wettable sulfur—5 pounds	Brown rot (blossom blight)

Continue applications through Bloom at 2- to 4-day intervals when wet, rainy weather prevails Use either:

	Phygon (dichlone)—½ pound, *or* sulfur paste—6 pounds, *or* wettable sulfur—5 pounds	Brown rot (blossom blight)

Lime-sulfur at 2 gallons per 100 gallons of spray may be used through bloom when heavy fruit set is expected. Its use throughout bloom may injure some blossoms, but it has not reduced the final crop in Michigan tests. Dusting or spraying with elemental sulfur fungicides in the early stages (first 10 hours) of each rain during the period of bloom has given good results.

Peach Spraying Schedule (Continued from page 44)

Time	Materials per 100 gallons	To control
PETAL FALL (When three-fourths of the petals have fallen)	Parathion (15% wettable)—1½ pounds, *or* DDT (50% wettable)—1½ pounds	Curculio, oriental fruit moth, tarnished plant bug
DDT controls only tarnished plant bug and oriental fruit moth. If brown rot blossom blight has not been controlled, *include:*		
	Sulfur paste—6 pounds, *or* Wettable sulfur—5 pounds	
SHUCK SPLIT (Usually 10 to 12 days after Petal Fall)	Dieldrin (50% wettable)—½ pound *plus* DDT (50% wettable)—1½ pounds, *or* Parathion (15% wettable)—1½ pounds	Curculio Oriental fruit moth
If brown rot blossom blight has not been controlled, *include:*		
	Sulfur paste—6 pounds, *or* Wettable sulfur—5 pounds	Brown rot
FIRST COVER (10 to 12 days after Shuck Split)	Sulfur paste—6 pounds, or Wettable sulfur—5 pounds *plus* Dieldrin (50% wettable)—one-half pound *plus* DDT (50% wettable)—1½ pounds, *or* Parathion (15% wettable)—1½ pounds, *or* Guthion (25% wettable)—1 to 1¼ pounds, *or* DDT (50% wettable)—1 pound+parathion (15% wettable)—1 pound	Peach scab, brown rot Curculio Oriental fruit moth
SECOND COVER (14 days after First Cover)	DDT (50% wettable)—1½ pounds, *or* Parathion (15% wettable)—1½ pounds, *or* DDT (50% wettable)—1 pound+parathion (15% wettable)—1 pound, *or* Guthion (15% wettable)—1 to 1¼ pounds	Oriental fruit moth

Certain sprays are needed to control one or more of the following pests each year throughout Michigan:

To control *peach tree borer*, spray trunks of trees (from just below crotches to ground line) with a gun and reduced pressure, using either DDT (50 percent wettable) at 3 pounds, or parathion (15 percent wettable) at 2 pounds per 100 gallons, on or about July 12. Follow with a second spraying in 12 to 14 days.

To control *lesser peach borer*, spray crotches and cankers on branches with a gun, using parathion (15 percent wettable) at 2 pounds per 100 gallons. Make three applications at 12- to14-day intervals starting on or near July 1. (Note—You can also control the peach tree borer with these sprays. Direct some of the material near the ground during the later sprayings.)

To control *lecanium scale*, spray infested areas with parathion (15 percent wettable) at 1½ pounds per 100 gallons when the scales are in the crawler stage. Apply once when 70 percent of the eggs have hatched (usually June 25 to July 15). Apply again 10 to 12 days later if there are many crawlers left.

Experience to date indicates that peach tree borer, lesser peach borer and lecanium scale may be controlled without a specific application when Guthion is used every two weeks against oriental fruit moth.

Maximum dosage rates must be used for borer control and nozzles must be adjusted to thoroughly cover cankered areas, especially those at the ground level. BORER CONTROL DEPENDS UPON GOOD SPRAY COVERAGE.

Peach Spraying Schedule (Continued from page 45)

Time	Materials per 100 gallons	To control
THIRD COVER (Usually July 15-25)	Wettable sulfur—5 pounds, *or* Sulfur paste—6 pounds, *or* Captan—2 pounds	Brown rot
	plus	
	DDT (50% wettable)—1½ pounds, *or* Parathion (15% wettable)—1½ pounds, *or* DDT (50% wettable)—1 pound+parathion (15% wettable)—1 pound, *or* Guthion (25% wettable))—1 to 1¼ pounds	Oriental fruit moth

Do not make more than one application of DDT within 6 weeks of harvest. *Because of possible excessive DDT residue,* do not use DDT on peaches within 30 days of harvest if they are to be sold as fresh fruit or are to be transported outside the State of Michigan.

FOURTH COVER (7-10 days after Third Cover)	Wettable sulfur—5 pounds, *or* Sulfur paste—6 pounds, *or* Captan—2 pounds, *or* Lime-sulfur—2 quarts with wettable sulfur—3 pounds	Brown rot
	plus	
	Parathion (15% wettable)—1½ pounds, or Guthion (25% wettable)—1 to 1¼ pounds	Oriental fruit moth

Both DDT and parathion may be used as late as 7 days before harvest on Amber Gem and other varieties grown for processing *if* the peaches are not transported outside Michigan to be processed.

PRE-HARVEST COVERS (7 to 10 days after Fourth Cover and continuing at 7-to 10-day intervals until harvest)	Captan—2 pounds, *or* Lime-sulfur—2 quarts+wettable sulfur—3 pounds, *or* Wettable sulfur—5 pounds, or Sulfur paste—6 pounds	Brown rot
	plus	
	A wetting agent used at manufacturers' directions	
	plus	
	Parathion (15% wettable)—1½ pounds, *or* Malathion (25% wettable)—2 pounds	Oriental fruit moth

See note under Fourth Cover if peaches are being grown for the processing market. Consult Table 3, page 60 for information on the number of days between last application and harvest for each material. Base your choice of materials on this information.

RED TART (SOUR) CHERRY SPRAYING SCHEDULE—1961

(See Table 3, page 60, for Pesticide Residue Information)

Time	Materials per 100 gallons	To control
DORMANT	For orchards in Manistee County and farther north, when necessary— DN-289—2 quarts, *or* Elgetol 318—2 quarts	Case-bearers, mineola moth, bud moth, peach twig borer

For orchards north of Ottawa County along Lake Michigan following seasons in which European brown rot has been injurious, use the following about 1 to 2 weeks before buds break dormancy:

Monocalcium arsenite—3 pounds	European brown rot

Red Tart Cherries Spraying Schedule (Continued from page 46)

If it is necessary to control both European brown rot and insects, monocalcium arsenite and DN compounds may be applied together in the same spray mixture. However, the *application* should be *timed* to control European brown rot and the trees should be *strictly dormant.*

For orchards in southwestern Michigan where Forbes scale is serious, use a dormant 1 to 3 percent oil emulsion spray plus Trithion at manufacturer's directions.

Time	Materials per 100 gallons	To control
EARLY BLOOM THROUGH BLOOM (Beginning when first blossoms open)	In orchards with a European brown rot history, use— Bordeaux 4-6-100	European brown rot
	In orchards with a common brown rot blossom blight history, use either—	
	Phygon XL—½ pound, *or*	Leaf spot and common brown rot blossom blight
	Sulfur paste—6 pounds, *or* Wettable sulfur—5 pounds	Common brown rot blossom blight
	If weather is wet during bloom, more than one application of Phygon XL, sulfur paste, or wettable sulfur may be necessary. Phygon or sulfur dusts are also effective for the control of brown rot blossom blight during bloom. Phygon XL controls both brown rot and leaf spot.	
PETAL FALL (When three-fourths of the petals have fallen *or* when first leaves unfold)	Fixed copper to give 0.75 of a pound *actual copper*+hydrated lime—3 pounds (See page 14), *or* Glyodin—1½ pints+ferbam—½ pound, *or* Glyoxide—½ pound+ferbam—½ pound, *or* Cyprex—¼ to ½ pound *plus* Parathion (15% wettable)—1½ pounds, *or* Dieldrin (50% wettable)—½ pound	Leaf spot Curculio
	In orchards troubled with cherry fruit worms, mineola moth, case-bearers, bud moth, or peach twig borer in 1960, use parathion, Guthion or Diazinon in the *Petal Fall, First* and *Second Cover* applications. Dieldrin controls only curculio.	
FIRST COVER (10 days after Petal Fall)	The same materials are suggested as for Petal Fall	Leaf spot, curculio
SECOND COVER (10 days after First Cover. The time of this application usually coincides with cherry fruit fly emergence)	Fixed copper to give 0.75 of a pound *actual copper*+hydrated lime—3 pounds, *or* Glyodin—1½ pints+ferbam—½ pound, *or* Glyoxide—½ pound+ferbam—½ pound, *or* Actidione—1 part per million, *or* Cyprex—½ pound *plus* Lead arsenate—2 pounds, *or* Diazinon (25% wettable)—2 pounds, *or* Guthion (25% wettable)—1 to 1¼ lb.	Leaf spot Cherry fruit fly, curculio
	The emergence of cherry fruit flies will be announced by your county agricultural agent. When lead arsenate is used with actidione or Cyprex at ¼ pound, include ½ pound of ferbam to safen against possible arsenical injury. In orchards troubled with cherry fruit worm, add one pound of parathion to the mixture if lead arsenate is used. *Do not use actidione* at more than 1 part per million *until* the fruit is ⅜ inch in diameter or *until* the announcement of the cherry fruit fly spray, because of possible injury to the fruit.	

Red Tart Cherries Spraying Schedule (Continued from page 47)

Time	Materials per 100 gallons	To control
THIRD COVER (10 to 14 days after Second Cover)	The same materials are suggested as for Second Cover.	Leaf spot, Cherry fruit fly

If leaf spot threatens, actidione may be used at one to two p.p.m. up to 4 days before harvest. See note under *Second Cover* regarding use of actidione with lead arsenate. Do not use lead arsenate on cherries within 30 days of harvest if they are to be sold on the fresh market or to be transported outside Michigan, because of possible excessive lead arsenate residue. However, lead arsenate may be used on cherries to be processed in Michigan as late as 14 days before harvest. Fruit sprayed with lead arsenate as late as 30 days before harvest may require washing to be within the established tolerance if it is to be sold as fresh fruit.

Consult Table 3, page 60 for information on the number of days between last application and harvest for each material used on cherries for the fresh market. Base your choice of materials on this information.

AFTER-HARVEST COVER (Immediately after harvest)	Bordeaux 4-6-100, *or* Fixed copper to give 0.75 of a pound *actual* copper with hydrated lime at 3 pounds, *or* Actidione—2 parts per million, *or* Cyprex—¼ to ½ pound	Leaf spot

SWEET CHERRY SPRAYING SCHEDULE—1961

(See Table 3, page 60, for Pesticide Residue Information)

Time	Materials per 100 gallons	To control
The dormant application is usually not necessary as black cherry aphids are readily controlled with either parathion at one pound *or* malathion (25% wettable) at 2 pounds per 100 gallons, when they first appear. When necessary use DN-289 or Elgetol-318 at 2 quarts per 100 gallons while trees are dormant.		
PRE-BLOSSOM THROUGH BLOOM	Use any *one* of the following: 4-6-100 bordeaux, *or* Phygon at one-half pound, or wettable sulfur at 5 pounds, *or* sulfur paste at 6 pounds per 100 gallons when first blossoms open. Follow by one or more applications of Phygon (dichlone) at one-half pound, *or* sulfur paste at 6 pounds, *or* wettable sulfur at 5 pounds per 100 gallons *during bloom* when wet weather prevails. Both Phygon (dichlone) and elemental sulfur materials may be applied either as a dust or a spray.	Brown rot (common form blossom blight)
PETAL FALL (When three-fourths of the petals have fallen)	Ferbam—1 pound+wettable sulfur—3 pounds, *or* Captan—2 pounds *plus* Dieldrin (50% wettable)—½ pound, *or* Parathion (15% wettable)—1½ pounds	Leaf spot, brown rot Curculio

Dieldrin has an effective period against curculio of about 14 days, compared to about 7 days for parathion. Thus, parathion must be applied more often to give control equal to dieldrin. If black aphids, red-banded leaf roller or insects other than curculio are present when using dieldrin, include parathion at 1 pound per 100 gallons in the spray mixture.

Sweet Cherries Spraying Schedule (Continued from page 48)

Time	Materials per 100 gallons	To control
FIRST COVER (14 days after Petal Fall)	The same materials are suggested as for Petal Fall.	Brown rot, leaf spot Curculio
SECOND COVER (14 days after First Cover)	The same materials are suggested as for Petal Fall, except do not use dieldrin later than First Cover.	Brown rot, leaf spot Curculio
THIRD COVER (Timing based on cherry fruit fly emergence)	Captan—2 pounds, *or* Ferbam—1 pound+wettable sulfur—3 pounds, *or* Wettable sulfur—5 pounds, *or* Sulfur paste—6 pounds *plus* Lead arsenate—2 pounds *with corrective*, *or* Guthion (25% wettable)—1¼ pounds, *or* Methoxychlor (50% wettable)—3 pounds, *or* Diazinon (25% wettable)—2 pounds	Brown rot, leaf spot Brown rot Cherry fruit fly

When lead arsenate is used with wettable sulfur and sulfur paste, include equal parts of hydrated lime and lead arsenate. *No arsenical corrective is needed when using captan or ferbam.*

The emergence of cherry fruit flies will be announced by the department of entomology, Michigan State University, and the timing of the spray applications will be announced by your county agricultural agent.

Methoxychlor gives effective protection against *cherry fruit fly* for about 7 days. Lead arsenate, Guthion and Diazinon are effective for 14 days. Thus, two applications of methoxychlor are necessary to give protection equal to one application of lead arsenate, Guthion or Diazinon.

FOURTH COVER (12 to 14 days after Third Cover)	The same materials are suggested as for Third Cover	Brown rot, leaf spot Cherry fruit fly

Do not use lead arsenate within 30 days, Guthion within 15 days, or Diazinon within 10 days of harvest if cherries are to be sold on the fresh market or are to be transported outside the State of Michigan, because of possible excessive residue. Cherries to be processed in Michigan may be sprayed with lead arsenate as late as 14 days before harvest. If it is necessary to control cherry fruit fly as late as 7 days before harvest on fruit for fresh market, use methoxychlor (50%wettable) at 3 pounds, or malathion (25% wettable) at 2 pounds per 100 gallons.

Consult Table 3, page 60, for information on the number of days between last application and harvest for each material. Base your choice of materials on this information.

AFTER-HARVEST APPLICATION	Fixed copper—0.37 pounds *actual* copper+fresh hydrated lime—3 pounds+wettable sulfur—3 pounds, *or* Ferbam—1½ pounds, *or* Captan—2 pounds, *or* Actidione at 1-2 parts per million, *or* Cyprex—½ pound	Leaf spot

PLUM SPRAYING SCHEDULE—1961
(See Table 3, page 60, for Pesticide Residue Information)

Time	Materials per 100 gallons	To control
GREEN-TIP	Lime-sulfur—10 gallons	Black-knot

Plum Spraying Schedule (Continued from page 49)

This spray is suggested only for plantings in which black-knot is a problem. To be of value, it must be accompanied by the pruning out and burning all of the "*knot*".

Time	Materials per 100 gallons	To control
BLOOM (Beginning with balloon stage and continuing through bloom)	Lime-sulfur—2 gallons *or* Phygon (dichlone)—½ pound, *or* Sulfur paste—6 pounds, *or* Wettable sulfur—5 pounds	Black-knot, brown rot (blossom blight)
Continue applications through Bloom at 2- to 4-day intervals when wet weather prevails. Use either:	Phygon (dichlone)—½ pound, *or* Sulfur paste—6 pounds, *or* Wettable sulfur—5 pounds	Brown rot (Blossom blight)
PETAL FALL (When three-fourths of the petals have fallen)	Ferbam—1 pound+wettable sulfur—3 pounds *plus* Dieldrin (50% wettable)—½ pound, *or* Parathion (15% wettable)—1½ pounds	Brown rot, leaf spot Curculio
SHUCK SPLIT (Usually 10 to 14 days after Petal Fall)	Ferbam—1½ pounds, *or* Ferbam—1 pound+wettable sulfur—3 pounds *or*	Leaf spot, brown rot
If black-knot and/or brown rot blossom blight has not been controlled, use—	Lime-sulfur—2 gallons *plus* Dieldrin (50% wettable)—½ pound, *or* Parathion (15% wettable)—1½ pounds	Brown rot, black-knot Curculio
FIRST COVER (10 days after Shuck Split)	The same materials are suggested as for Shuck Split.	Leaf spot, curculio
SECOND COVER (14 days after First (Cover)	Ferbam—1½ pounds *plus* DDT (50% wettable)—1½ pounds	Leaf spot Leafhopper

The inclusion of ovex, Tedion or Kelthane is suggested at *Shuck-Split* and *First Cover* in order to suppress mite populations in orchards where these pests have been troublesome before. Or, Guthion may be used to control both curculio and mites.

Specific sprays are needed to control one or both of the following pests in many orchards throughout Michigan:

To control *peach tree borer* on plum trees with peach seedling roots, spray trunks of trees (from just below crotches to ground line) with a gun and reduced pressure, using either DDT (50 percent wettable) at 3 pounds, or parathion (15 percent wettable) at 2 pounds per 100 gallons on or about July 12. Apply again in 12 to 14 days.

To control *lecanium scale*, spray infested areas with parathion (15 percent wettable) at 1½ pounds per 100 gallons when the scales are in the crawler stage. Make one application when 70 percent of the eggs have hatched (usually June 25 to July 15). Apply again 10 to

Plum Spraying Schedule (Continued from page 50)

12 days later if crawlers are still numerous. This parathion application also controls leafhoppers, aids in the control of mites and aphids, and may be substituted for DDT. Research has indicated that Guthion is also effective against peach borers, scale crawlers, mites, aphids, leaf rollers, and apple maggot.

Time	Materials per 100 gallons	To control
Special apple maggot sprays	Ferbam—1½ pounds *plus* Lead arsenate—2 pounds, *or* Guthion (25% wettable)—1 to 1¼ pounds	Leaf spot Apple maggot

Apple maggot has been found in plums in some orchards in Michigan in the past few years. Where growers feel they need to protect against this pest, time of adult apple maggot emergence and timing of applications are the same as in the Apple Spraying Schedule page 39.

THIRD COVER (About 1 month before harvest)	Captan—2 pounds, Sulfur paste—6 pounds, *or* Wettable sulfur—5 pounds, *or* Lime-sulfur—2 quarts+wettable sulfur—3 pounds	Brown rot, leaf spot Brown rot

Sulfur compounds control only brown rot.

If mites, leaf rollers or maggots need control, include with fungicide a material such as Kelthane or Guthion as suggested by the manufacturer. Note—Refer to the compatibility chart, page 2, when mixing materials with lime-sulfur.

FOURTH COVER (10 to 14 days before harvest)	Captan—2 pounds, *or* Sulfur paste—6 pounds, *or* Wettable sulfur—5 pounds, *or* Lime-sulfur—2 quarts+wettable sulfur—3 pounds	Brown rot, leaf spot Brown rot

Consult Table 3, page 60, for information on the number of days between last application and harvest for each material. Base your choice of materials on this information.

GRAPE SPRAYING SCHEDULE—1961

(See Table 3, page 60, for Pesticide Residue Information)

Economic control of grape pests depends on good coverage. At least 100 gallons of spray per acre should be used through First Cover, and a minimum of 150 gallons of spray per acre should be used beginning with Second Cover.

Caution: Do not use spray machinery that has previously been used to apply the weed control chemicals, 2,4-D or 2,4,5-T. Leaf distortion, delayed ripening, small berries, and possible death of the vine may occur. If sprayer has been used to apply Karmex-W or Karmex-DW, clean thoroughly, including strainer, before spraying grapes.

Time	Materials per 100 gallons	To control
Just before and as buds start to swell	DDT (50% wettable)—2 pounds	Grape flea beetle, Climbing cutworm

Grape flea-bettles and climbing cutworms begin to work before and at the time buds start to swell. Check the vineyard daily to determine the presence of these insects and the need for spraying

Grape Spraying Schedule (Continued from page 51)

DEAD ARM disease is present in Michigan vineyards. To reduce *current shoot infection*, identified as dark, elongated spots on the basal areas of new shoot growth, apply captan 2 pounds per 100 gallons when shoot growth is 1 to 2 inches and 4 to 6 inches.

Time	Materials per 100 gallons	To control
FIRST COVER (When shoots are 4 to 8 inches long)	Ferbam—1½ pounds, *or* Zineb—1½ pounds *plus* DDT (50% wettable)—1½ pounds	Black rot Berry moth

In vineyards where *black rot* has been a serious problem, apply the first protective spray when the shoots are 2 to 3 inches long, rather than delaying until the shoots have grown 4 to 8 inches in length. Follow with an additional spray 10 days later. The use of ferbam or zineb will not only give excellent control of *black rot*, but will increase yeilds over the use of copper fungicides. In vineyards *free* of black rot carryover, you can omit this cover.

SECOND COVER (Just as blossoms are opening)	Ferbam—1½ pounds, *or* Zineb—1½ pounds, *or* Fixed copper (1½ pounds actual copper) with 6 pounds hydrated lime, *or* 4-4-100 bordeaux *plus* DDT (50% wettable) at 1½ pounds when ferbam or zineb is used; increase DDT to 2 pounds when fixed copper or bordeaux is used.	Black rot Berry moth, rose chafer
THIRD COVER (Immediately after Bloom)	Ferbam—1½ pounds, *or* Zineb—1½ pounds, *or* Fixed copper (1½ pound *actual* copper) with 6 pounds of hydrated lime, *or* 4-4-100 bordeaux *plus* The same insecticide as suggested for Second Cover.	Black rot Black rot, powdery mildew, downy mildew Berry moth, leafhopper, rose chafer

The Third Cover is considered the *most critical* for the control of black rot, powdery mildew, and downy mildew. The Concord and Niagara varieties are very susceptible to powdery mildew. The Fredonia, Niagara, and Delaware varieties are highly susceptible to downy mildew. Black rot is generally a problem on all varieties, except Delaware.

Powdery mildew infection may be identified as superficial whitish-grey patches on the upper surface of the leaves, leaf petioles, tendrils, berry stems, and peduncles.

Growers using ferbam or zineb for the control of black rot should substitute fixed copper or bordeaux sprays in place of ferbam or zineb as soon as they observe downy or powdery mildew. Powdery mildew has been appearing on the Concord variety in certain Michigan vineyards.

FOURTH COVER (10 to 14 days after Third Cover)	The same chemicals are suggested as for Third Cover.	Black rot, powdery mildew, downy mildew, berry moth, leafhopper, rose chafer

For the control of mildews, see note under Third Cover.
Do not use a sticker with DDT or DDD after grapes are the size of buckshot.

Grape Spraying Schedule (Continued from page 52)

Time	Materials per 100 gallons	To control
FIFTH COVER (Just before the berries begin to touch in clusters)	The same fungicides are suggested as for Third Cover, *plus* DDT (50% wettable)—2 pounds, *or* Guthion (25% wettable)—1¼ pounds *or* DDT (50% wettable)—1 pound *plus* Parathion (15% wettable)—1 pound.	Black rot, powdery mildew, downy mildew, berry moth, leafhopper

Research indicates that an insecticidal spray around August 6 against berry moth is *a necessity* for most vineyards. DDT (50% wettable) 2 pounds, Guthion (25% wettable) 1¼ pounds, *or* DDT (50% wettable) 1 pound plus parathion (15% wettable) 1 pound are preferred materials for this application. One additional spray for berry moth (around August 20) is often advisable, especially if high night temperatures prevail during mid-August. DDT cannot be used for this application and fungicide compatibility with other materials may be a problem. Choose materials late in the season on the basis of pests to be controlled, compatibility and time between last application and harvest. Materials effective against berry moth include methoxychlor, parathion, Sevin, Diazinon and malathion.

For the control of mildews, see note under *Third Cover.*

Parathion and Guthion are especially hazardous in vineyards. (See page 4.) Use Chemicals safely.

Consult Table 3, page 60, for information on the number of days between last application and harvest for each material. Base your choice of materials on this information.

STRAWBERRY SPRAYING SCHEDULE—1961

(See Table 3, page 60, for Pesticide Residue Information)

To reduce white grub and root weevil injury in strawberry plantings—Just before planting, treat the upper 3 inches of soil with aldrin, chlordane or dieldrin, at the rate of 5 pounds *actual* aldrin dieldrin, or 10 pounds *actual* chlordane per acre. These insecticides may be applied as dusts, sprays, granular formulations or insecticide-fertilizer mixtures. The chemical should be broadcast (sprayed, dusted or drilled) and thoroughly mixed with the soil immediately after the application is made. About 40 percent of the effectiveness may be lost in 5 hours if the chemical is allowed to remain exposed on the surface of the soil. This treatment is effective against white grub and root weevil for about 3 years.

To avoid root aphid injury—When the soil is not treated with chlordane, dip roots and crowns of plants in a solution of nicotine sulfate (40 percent) using one-half pint of nicotine sulfate in 25 gallons of water, just before setting the plants in the field.

Time	Materials per 100 gallons	To control
Fall—(When plants are completely dormant and before applying mulch)	To eradicate Use a mercury fungicide at strength given on label to control apple scab.	Stem-end fruit rot, leaf blight

Thorough coverage is essential. A rate of 300 gallons of spray per acre should give good control.

When a fall application of mercury is used, a spring application is not necessary.

Varieties susceptible to stem-end rot—Dunlap, Fairland, Jerseybelle, Redcrop, Redglow, Robinson, and Sparkle (Paymaster).

Strawberry Spraying Schedule (Continued from page 53)

Time	Materials per 100 gallons	To control
Spring—(As plants begin to break dormancy and new growth is just visible in crown)	Unmulched plantings only—To eradicate— Use a mercury fungicide at strength given on label to control apple scab.	Stem-end fruit rot, leaf blight, leaf spot
FIRST COVER (When new leaves are fully expanded and blossom buds are visible)	Fixed copper—1½ pounds *actual* copper with hydrated lime—6 pounds, *or* Captan—2 pounds *plus* Guthion (25% wettable)—1¼ pounds, *or* DDD (50% wettable)—2 pounds + Dieldrin (50% wettable)—½ pound	Stem-end fruit rot, leaf blight, leaf spot Spittlebug, tarnished plantbug, leafroller

If two-spotted mites are a problem, use Kelthane (18.5% wettable) at 2 pounds per 100 gallons.

A protective spray using 200 gallons per acre during this early, succulent stage of growth further *reduces primary infection* of leaf diseases as well as stem-end fruit rot on the sepals of the blossom buds. Copper fungicides *applied after this period* may result in stunting and reddening of the leaves, and reddening of the caps of the berries.

SECOND COVER (4 to 5 days after first spittlebug hatch)	Captan—2 pounds, *or* Thylate—2 pounds *plus* Parathion (15% wettable) 1 pound, *or* Guthion (25% wettable)—1¼ pounds, *or* Diazinon (25% wettable)—2 pounds, *or* Sevin (50% wettable)—2 pounds	Gray mold, leaf blight Gray mold Spittlebug, tarnished plant bug, leafroller

MINIMUM COVERAGE NECESSARY: 200 gallons per acre.

An insecticide is needed in Second Cover only if insects were not adequately controlled in First Cover.

A fungicide included at this time prevents leaf blight and reduces gray mold buildup. Gray mold is generally confined to the fruit. However, in wet seasons, it may attack the blossoms, flower stalks and leaves, turning them brown. The infected parts soon become covered with gray mold spores which may cause extensive fruit infection prior to and during harvest.

Frost control during the bloom period is very important in the control of gray mold. The fungus quickly invades plant tissue which has been damaged by frost increasing the spore load in the field.

THIRD COVER (When berries are one-third grown)	Captan—2 pounds, *or* Thylate—2 pounds	Gray mold, leaf diseases Gray mold

This application is suggested especially for 2- and 3-year-old bearing fields due to the carryover of disease of the previous seasons.

MINIMUM COVERAGE NECESSARY: 200 gallons per acre

PRE-HARVEST COVER (At least 10 days before harvest)	Captan—2 pounds, *or* Captan dust (7.5% captan) at a rate of 40 pounds per acre, *or* Thylate—2 pounds, *or* Thylate dust (7.5% Thylate) at a rate of 40 pounds per acre	Gray mold fruit rot, leaf diseases Gray mold fruit rot

Strawberry Spraying Schedule (Continued from page 54)

To attain effective control of gray mold fruit rot from this period to harvest, it is necessary that the *protective sprays* or *dusts be applied before predicted rains.*

If insects are present in troublesome numbers include Diazinon (25% wettable) at 2 pounds per 100 gallons in this application.

Time	Materials per 100 gallons	To control
PRIOR TO HARVEST	The same materials as suggested for Pre-Harvest Cover. Read below.	Gray mold fruit rot, leaf diseases

If Thylate is applied within 3 days of harvest residues must be removed by washing. Captan can be used up to harvest.

This application is suggested because rainy periods conducive to development of gray mold, Fruit rot generally occur during harvest.

Consult Table 3, page 60, for information on the number of days between last application and harvest for each material. Base your choice of materials on this information.

AFTER-HARVEST (immediately after harvest)	Parathion (15% wettable)—2 pounds, *or* Guthion (25% wettable)—1¼ pounds.	Root weevil, leaf roller

The need for an After-Harvest application is determined by observation. If leaf roller is the only pest present, DDD (50 percent wettable) can be used at 2 pounds per 100 gallons in place of parathion, or Guthion.

BRAMBLE SPRAYING SCHEDULE—1961

RED RASPBERRIES, BLACK RASPBERRIES, DEWBERRIES AND BLACKBERRIES

(See Table 3, page 60, for Pesticide Residue Information)

Time	Materials per 100 gallons	To control
DELAYED DORMANT (When leaves are exposed one-half to three-fourths inch)	Lime-sulfur—10 gallons	Anthracnose
or (When a few leaves have unfolded from the buds.)	*OR* Lime-sulfur—5 gallons	Anthracnose

Caution: If unable to apply the first-mentioned eradicative spray for anthracnose when the leaves are exposed one-half to three-fourths of an inch, a lime-sulfur spray at 5 gallons per 100 when a few leaves have unfolded from buds will give effective control.

There is a greater risk of lime-sulfur burn, however, by spraying at this later time.

PRE-BLOSSOM (When blossom buds are visible on fruiting canes or when new canes are 6-8 inches tall)	Captan—2 pounds *plus* DDD (50% wettable)—3 pounds	Anthracnose Leafroller, sawfly, fruit worm, cane borers

Bramble Spraying Schedule (Continued from page 55)

A fungicide application at this time aids greatly in reducing anthracnose infection on the tender flower parts and young canes. Time protective sprays on raspberries with plant development and *before* predicted rains.

To control *spur blight* (a disease common in northern areas) on red raspberries, use a 3-3-100 bordeaux at this time in place of captan. Follow with a second bordeaux spray 10 to 14 days later.

In plantings where cane borers are causing economic damage, the important times for control are at *Pre-Blossom* and *Pre-Harvest.*

Time	Materials per 100 gallons	To control
FIRST COVER Right after Petal Fall)	Captan—2 pounds *plus* Malathion (25% wettable)—2 pounds	Anthracnose Aphids, leafrollers cane borers

A fungicide at this time helps protect the developing fruits, spurs and new canes against anthracnose. The insecticide helps reduce aphids which are responsible for the spread of leaf curl, mosaic, and streak virus diseases in bramble plantings.

Where these problems exist, another Malathion spray (2 pounds of 25% wettable) 10 days after *First Cover* is suggested.

PRE-HARVEST (10 to 15 days before harvest)	Malathion (25% wettable)—2 pounds	Aphids, leafrollers, cane borers

The need of this application is determined by observation. Leafrollers, aphids and predators (lady beetle larvae) that feed on aphids are often troublesome at harvest time. The control of aphids reduces the predators. If leafrollers are a serious problem, include 1½ pounds of DDD per 100 gallons. Do not use DDD within 14 days of harvest.

Consult Table 3, page 60, for information on the number of days between last application and harvest for each material. Base your choice of materials on this information.

POST-HARVEST (5 to 10 days after harvest)	Parathion (15% wettable)—1½ pounds	Aphids, mites

The need for this application is determined by observation of pests. *Do not* use parathion on brambles at any other time.

Sprays at this time to control anthracnose are of no value.

CURRANT AND GOOSEBERRY SPRAYING SCHEDULE

(See Table 3, page 60, for Pesticide Residue Information)

Time	Materials per 100 gallons	To control
DORMANT (*For both currants and gooseberries*)	DN-289—1 quart, *or* Elgetol 318—1 quart	Aphids
GREEN TIP (*For gooseberries only*)	Eradicative application Lime-sulfur—5 gallons THOROUGH COVERAGE IS ESSENTIAL FOR GOOD CONTROL OF POWDERY MILDEW	Powdery mildew
FIRST COVER (As soon as the fruit has set) (*For gooseberries only*)	Eradicative and protective Lime sulfur—2½ gallons *plus* Parathion (15% wettable)—1½ pounds, *or* Malathion (25% wettable)—2 pounds	Powdery mildew Currantworm, aphid
SECOND COVER (2 to 3 weeks after bloom) (*For both currants and gooseberries*	Ferbam—2 pounds *plus* Malathion (25% wettable)—2 pounds	Leaf spot Currantworm, aphids

The timing of this spray 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.

Parathion cannot be applied safely to currants or gooseberries later than 30 days before harvest.

If leaf spot is present at harvest time, spray immediately after harvest with the fungicide suggested for *Second Cover*.

Consult Table 3, page 60, for information on the number of days between last application and harvest for each material. Base your choice of materials on this information.

BLUEBERRY SPRAYING SCHEDULE

(See Table 3, page 60, for Pesticide Residue Information)

Time	Materials per 100 gallons	To control
DORMANT (When buds are swelling)	Eradicative measures: Premerge—1½ quarts; *or* Rake and cultivate planting floor to cover the mummified berries: *or* Aero calcium cyanamid (57%) special grade, at a rate of 150-200 pounds per acre.	Mummy berry

Apply the premerge spray or aero calcium cyanamid dust to the entire ground area of the planting, and especially to the crowns of the plant.

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)	Methoxychlor (50% wettable) 3 pounds, or when ground equipment is used, parathion (15% wettable) at 1½ pounds per 100 gallons is effective against curculio, fruit worm and tip borer. Parathion cannot be used later than 14 days before harvest, (See page 30. *Use Phosphate Compounds Safely*)	Curculio

In plantings troubled with tip borer, use Malathion (25% wettable) at 3 pounds per 100 gallons in *First Cover* and again in *Second Cover.*

When using dust, apply 30 pounds of 5% methoxychlor dust per acre.

SECOND COVER (10 days after First Cover)	The same chemicals are suggested as for First Cover.	Curculio, fruit worm
THIRD COVER (10 days after Second Cover)	The same chemicals are suggested as for First Cover.	Fruit worm
FOURTH COVER (When fruit fly appears)	Malathion dust (4%) used at the rate of 25 pounds per acre, *or* rotenone dust (2½%)	Fruit fly

The time to make this application will be announced by your county agricultural agent. *Do not harvest berries* within 1 day after a malathion treatment.

When the lecanium scale is abundant, make two applications of malathion (25 percent wettable) at 2 pounds per 100 gallons, or a malathion dust (4 percent) at the rate of 35 pounds *per acre.* Make the first application when 70 percent of the eggs have hatched (late June or early July) follow with second application 7 days later. The need for a third application will depend on the presence of crawlers 14 days after the first treatment.

Consult Table 3, page 60, for information on the number of days between last application and harvest for each material. Base your choice of materials on this formation.

RESIDUE TOLERANCES 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 1. Do not increase dosage rates above those listed in Table 3.

Rule 2. Do not use materials on crops not listed in Table 3.

Rule 3. Do not use materials closer to harvest than is indicated in Table 3.

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 in Table 3 is up-to-date as of January 1, 1961. Minor changes may occur during the growing season. County agricultural agents will be notified when these occur.

Pesticides suggested for use in this table are grouped into the following chemical classes: Unrelated Materials, Chlorinated Hydrocarbons, Cholinesterase-Inhibiting Compounds, and Carbamate Compounds.

It is not safe to feed apple pomace treated with certain pesticides (especially chlorinated hydrocarbons) to livestock. DDT, Tedion, and Cyprex, for example, have definite label restrictions against this use.

POSSIBLE DANGERS FROM PESTICIDE DRIFT

There is possible danger of drift and injury to neighboring crops and premises from both airplane and conventional ground dust and spray applications. Hay and pasture crops, for example, grown near orchards treated with pesticides may contain illegal chemical residues. Since few chemicals have tolerances established for hay crops and there are *no tolerances* permitted in milk, extreme caution must be exercised in this regard. DDT and other chlorinated hydrocarbons are especially hazardous since they are stored in animal fat and are secreted in milk.

TABLE 3—RESIDUE TOLERANCES OF PESTICIDES ON FRUITS

Material (Common Formulation)	Tolerance (parts per million by weight) *	Maximum dosage rate per 100 gallons of spray†	Days between final spray and harvest	Crops	Remarks
Unrelated Materials					
Lead arsenate (97%).....	7	2 lb.	30	Apples, cherries, peaches, pears, plums	Fruit sprayed with lead arsenate may need washing to be within tolerance. Processors who remove residues may accept cherries that have been sprayed with lead arsenate up to 14 days before harvest.
Nicotine sulfate (40%).....	2	1 pt.	3	Apples, brambles, currants, gooseberries, cherries, grapes, plums, peaches, strawberries	
Rotenone (4% W.P.).....			1	Any fruit as needed	Rotenone and Ryania are exempt from the requirement of a tolerance, but should not be used within one day of harvest.
Ryania (50% W.P.).....			1	Apples	
Chlorinated Hydrocarbons					
Chlorobenzilate (25% W.P.)...	5	1½ lb.	14	Apples	
Chlorobenzilate (25% W.P.)...	5	1½ lb.	7	Pears	
DDD (50% W.P.).....	7	2 lb.	30	Apples, cherries, pears, plums, peaches	Do not use a sticker or spreader with DDD or DDT on grapes after the fruit is the size of buckshot.
DDD (50% W.P.).....	7	2 lb.	40	Grapes	
DDD (50% W.P.).....	7	2 lb.	5	Strawberries	
DDD (50% W.P.).....	7	2 lb.	14	Brambles, blueberries	
DDT (50% W.P.).....	7	2 lb.	30	Apples, cherries, pears, plums, peaches	If more than five applications of DDT are made on apples, reduce the dosage below 2 pounds and/or increase the interval between final spray and harvest.
DDT (50% W.P.).....	7	2 lb.	40	Grapes	
Dieldrin (50% W.P.).....	.25	½ lb.	30	Cherries	
Dieldrin (50% W.P.).....	.1	½ lb.	14	Grapes	
Dieldrin (50% W.P.).....	.25	½ lb.	35	Apples, pears	
Dieldrin (50% W.P.).....	.1	½ lb.	45	Peaches, plums	
Dieldrin (50% W.P.).....	.1	½ lb.	See note	Plums	Do not use dieldrin later than first cover (3 weeks after petal fall) on plums.

Endrin (75% W.P.)	N.R.	1/8 lb.	See note	Apples, pears	Do not use Endrin later than First Cover.
Kelthane (18.5% W.P.)	5	2 lb.	7	Apples, pears, cherries, plums, grapes	
Kelthane (18.5% W.P.)	10	2 lb.	14	Peaches, apricots	Do not repeat applications of Kelthane on cherries, plums, peaches, or apricots within 30 days of one another.
Kelthane (18.5% W.P.)	5	2 lb.	2	Strawberries, brambles	
Methoxychlor (50% W.P.)	14	3 lb.	3	Brambles	
Methoxychlor (50% W.P.)	14	3 lb.	7	Apples, cherries, pears, plums	
Methoxychlor (50% W.P.)	14	3 lb.	14	Blueberries, grapes, strawberries, currants, gooseberries	
Methoxychlor (50% W.P.)	14	3 lb.	21	Peaches, apricots	
Ovex (50% W.P.)	3	1/2 lb.	30	Apples, pears, peaches, plums	
Tedion (25% W.P.)	5	1 lb.	See note	Apples, cherries, peaches, pears, plums, grapes, apricots	In addition to applications made earlier, 1 lb. of Tedion 25% may be applied to apples and pears after 1st cover. A similar application may be made on stone fruits after shuck-split. On grapes one application may be after bloom. No waiting period is established between final application of Tedion and harvest.
Cholinesterase-Inhibiting Compounds					
Demeton or Systox (26% Em.)	.75	3/4 pt.	21	Apples, pears, strawberries	Do not use more than three applications of Demeton on apples, pears, or peaches.
Demeton or Systox (26% Em.)	1.25	3/4 pt.	21	Grapes	
Demeton or Systox (26%)	.75	1 pt.	30	Peaches	
Demeton or Systox (26%)	N.R.	1 pt.	See note	Cherries	Demeton may be used only once and not later than petal fall on cherries.
Diazinon (25% W.P.)	.75	2 lb.	5	Strawberries	
Diazinon (25% W.P.)	.75	2 lb.	10	Cherries, plums	
Diazinon (25% W.P.)	.75	2 lb.	14	Apples, pears	
Diazinon (25% W.P.)	.75	2 lb.	18	Grapes	
Diazinon (25% W.P.)	.75	2 lb.	20	Peaches	
EPN-300 (25% W.P.)	3	1 lb.	21	Apples, cherries, plums, peaches, pears, grapes	
Ethion (25% W.P.)	1	2	60	Apples, pears	Do not make more than three

TABLE 3—RESIDUE TOLERANCES OF PESTICIDES ON FRUITS—(Continued)

Material (Common Formulation)	Tolerance (parts per million by weight) *	Maximum dosage rate per 100 gallons of spray†	Days between final spray and harvest	Crops	Remarks
Ethion (25% W.P.)	1	1	60	Grapes	applications of Ethion on apples and pears nor more than two applications on peaches and plums.
Ethion (25% W.P.)	1	1	45	Plums	
Ethion (25% W.P.)	1	1	30	Peaches	
Ethion (25% W.P.)	1	2	7	Strawberries	
Guthion (25% W.P.)	2	1¼ lb.	5	Strawberries	
Guthion (25% W.P.)	2	1¼ lb.	15	Apples, pears, cherries, plums, apricots	Do not make more than 8 applications of Guthion per season.
Guthion (25% W.P.)	2	1¼ lb.	21	Peaches	
Guthion (25% W.P.)	2	1¼ lb.	28	Grapes	
Malathion (25% W.P.)	8	2 lb.	3	Apples, currants, gooseberries, cherries, grapes, plums, strawberries	
Malathion (25% W.P.)	8	2 lb.	7	Peaches, apricots	
Malathion (25% W.P.)	8	2 lb.	1	Blueberries, brambles, pears	
Parathion (15% W.P.)	1	2 lb.	14	Apples, cherries, pears, plums, strawberries, peaches, grapes, blueberries	
Parathion (15% W.P.)	1	2 lb.	30	Currants, gooseberries	
Phosdrin (20% Em.)	.5	1½ pt.	1	Apples, pears	
Phosdrin (20% Em.)	1	1½ pt.	1	Peaches, strawberries, plums	
Phosdrin (20% Em.)	N.R.	1 pt.	5	Grapes	
Tepp (40% Em.)	0	1 pt.	3	Any fruit as needed	
Trithion (25% W.P.	.8	1 lb.	30	Apples, pears, cherries, plums, peaches, grapes	Do not apply Trithion at intervals closer than 30 days.
Trithion (25% W.P.)	.8	2 lb.	3	Strawberries	
Sevin (50% W.P.)	10	2 lb.	1	Apples, pears, peaches, grapes, plums, cherries, strawberries	

Unrelated Compounds					
Actidione	N.R.	2 p.p.m.	4	Cherries	
Captan	100	2 lb.	0	Apples, pears, strawberries, brambles, cherries, plums, prunes, apricots	
Coppers			0	Any fruits as needed	Copper is exempt from the requirement of a tolerance.
Cyprex	5	½ lb.	0	Red tart cherries	
Cyprex	5	¾ lb.	7	Apples	Apple pomice from Cyprex sprayed trees cannot be used for animal feed.
Dichlone (Phygon XL)	3	½ lb.	1	Apples	
Dichlone (Phygon XL)	3	½ lb.	7	Peaches	
Dichlone (Phygon XL)	3	½ lb.	3	Cherries, plums, prunes	
Glyodin	5	1 qt.	0	Apples	
Glyodin	5	1½ pt.	7	Cherries (sour)	
Glyoxide	5	10 oz.	0	Apples	
Glyoxide	5	8 oz.	7	Cherries (sour)	
Karathane	N.R.	½ lb.	21	Apples	
Mercuries	N.R.		See Note	Apples, strawberries	Mercuries and streptomycin should not be used later than petal fall on apples. Mercury should not be applied to strawberries when fruit is present.
Streptomycin	N.R.	100 p.p.m.	See Note	Apples, pears	
Sulfur			0	Any fruit as needed	Sulfur is exempt from the requirement of a tolerance

Material	Tolerance (parts per million by weight) *	Maximum dosage rate per 100 gallons of spray†	Days between final spray and harvest	Crops	Remarks
Carbamate Compounds					
Ferbam	7	1½ lb.	7	Apples, cherries, pears, plums, prunes, grapes	
Ferbam	7	2 lb.	14	Currants, gooseberries	
Thiram (Thylate)	7	2 lb.	0	Apples	Remove residues of Thylate from strawberries by washing if application is made within 3 days of harvest.
Thiram (Thylate)	7	2 lb.	3	Strawberries	
Zineb	7	2 lb.	7	Grapes	

*N.R.—No residue remains on crop when the product is used precisely as directed. No tolerance established.

† These dosage rates refer to maximum allowable amounts for dilute spraying and are not necessarily suggested amounts. Refer to fruit spraying schedules and package labels for suggested amounts on specific crops.