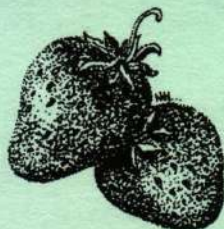
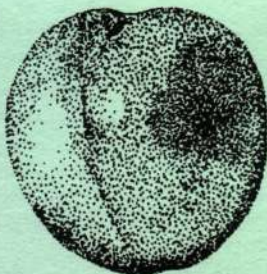
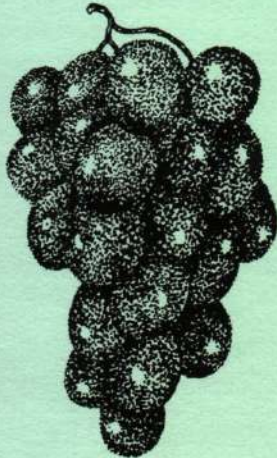
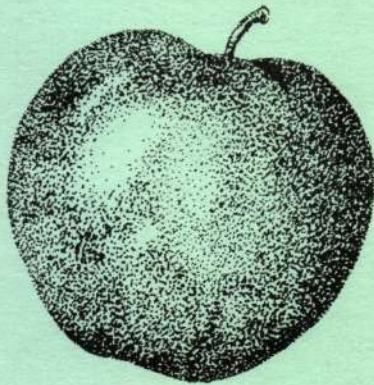




# BACKYARD FRUIT SPRAYS FOR INSECTS & DISEASES

*in Michigan*



**Authors**

**Richard L. Miller**  
Extension Entomologist  
The Ohio State University

**Michael A. Ellis**  
Plant Pathologist  
The Ohio State University and  
Ohio Agricultural Research and  
Development Center

**James D. Farley**  
Extension Plant Pathologist  
The Ohio State University

**Michigan State University Contacts:**  
Jerry Hull & Lee Taylor, Horticulture Dept.

**Michigan Spray Schedules**

**For The Control of Pests**

**In Backyard Fruits**

**NOTE:** For detailed information on specific insects, diseases and various aspects of fruit culture, obtain a copy of Bulletin 591, "Growing and Using Fruit at Home."

It is almost impossible to raise fruits today without having them attacked by one or more of a wide range of insect, mite, and disease pathogens. If you have fruit trees, or plan to plant them, you will need to plan a pest control program, too. The sprays and other control measures listed and described in this publication are intended to help the home fruit grower with small plantings to raise insect- and disease-free fruit.

The home gardener should neither plant nor keep more fruit trees and plants than he can properly care for. Unsprayed and uncared-for fruit plants make good breeding places for disease and insect pests and should be eliminated, if any care is being attempted on the rest of the planting.

If you have a large number of fruit trees, vines, bushes, or strawberry plants, or plan to raise some, ask your county agent for the latest commercial spray schedules (Bulletin E-154). These schedules are intended for experienced commercial fruit growers and some of the pesticides listed are very toxic to humans. Safe, economic control of pests in commercial plantings requires the use of large specialized equipment, including special safety clothing and a spray mask.

**Table of Contents**

	Page No.
How to protect yourself when using pesticides .....	2
Storage life of pesticides .....	3
Spray equipment for home fruit growers .....	3
Cleaning spray equipment .....	3
How to spray .....	3
How long pesticides last .....	3
Preparation of sprays .....	4
Quantity of insecticides, miticides, and fungicides to use in preparing sprays (Table 1) .....	4
Approximate amount of spray required for fruit trees of different sizes (Table 2) .....	4
Days-waiting-time (treatment to harvest, Table 3) .....	4
The Pesticide Label—Know its contents .....	5
Insecticides and Miticides .....	5
Fungicides .....	6
All-purpose sprays or do-it-yourself combination sprays .....	6
Detection devices for insects .....	6
Spray schedules for apple, crabapple, quince and pear (Table 4) .....	7
Spray schedules for peach, apricot, nectarine, cherry and plum (Table 5) .....	8
Spray schedule for blackberries and raspberries (Table 6) .	9
Spray schedule for strawberry (Table 7) .....	9
Spray schedule for grape (Table 8) .....	10
Spray schedule for blueberry (Table 9) .....	11
Control of specific pests not covered in spray schedules ..	11
Spray Record Sheet .....	12

**How to Protect Yourself  
When Using Pesticides**

Pesticides are used to kill insects and disease pathogens. Handle these chemicals carefully to prevent injury to yourself, other people, or to pets. Although the pesticides suggested for use in this bulletin are among the safest discovered to date, certain precautions are still necessary.

1. Before using any pesticide, carefully read the label. Give special attention to sections on various precautions to be followed when using a specific product.

2. Avoid spilling pesticides on yourself or in the immediate area where you are working; but if this happens, wash yourself immediately with plenty of water to remove all traces of the pesticide. Do not get any pesticide in your eyes, nose, or mouth.

3. Do not smoke or eat while you are applying pesticides. Thoroughly wash immediately after applying a pesticide.

4. When applying a pesticide, do not permit material to blow back on you or on other people or pets. Adjust your treating direction according to the wind direction.

If it is too windy, stop treatment and finish when the wind dies down. Remember, you are responsible for pesticide spray drift.

5. Do not permit empty pesticide containers to lie around; bury them promptly in a safe, out-of-the-way place, or wrap in paper and put them in the trash can. Punch holes in the empty containers. Do not burn such containers in a backyard trash burner.

6. Store insecticides in tightly closed, well-labeled, original containers away from children or pets—never under the sink, in the pantry, or in the medicine cabinet. Store in a cool, dry place. Mark the storage cabinet or storage area "POISON STORAGE." It is best to keep them under lock and key.

7. Keep children and pets away from areas where you are mixing or applying pesticides.

### Storage Life of Pesticides

Although most pesticides, when properly stored, retain sufficient strength for use a second or third season, it is best to buy only enough for one season's use. Most pesticides gradually lose their effectiveness when exposed to moisture, air, light, and high temperatures. Prolonged low or freezing temperatures frequently cause liquid formulations to separate, making them unsafe for further use.

### Spray Equipment for Home Fruit Growers

To adequately control pests, thoroughly cover fruit plants with pesticide sprays according to the "timing" in the spray schedule. Use a sprayer that is powerful enough to reach all parts of the plant with the spray (e.g. tops of trees), easy to clean, and slow to wear out. Suitable sprayers come in various types and sizes.

**Compressed air sprayers** are metal tanks which vary in size from one to three gallons. Air is pumped into them by means of a built-in hand pump. The spray is delivered through an attached hose with a hand shut-off valve and a nozzle tip.

**Knapsack sprayers** are compressed air sprayers which vary in size from three to five gallons and are strapped onto one's back. These sprayers, also equipped with hand shut-off valves, have a hand pump that must be pumped slowly but continuously. The pumping builds up pressure in the tank and forces the spray through a hose and nozzle tip at an even, steady rate.

The compressed air and knapsack sprayers are satisfactory for a few small fruit trees, vines, bushes, or strawberry plants. They do not have the capacity to spray mature standard-sized trees.

**Trombone or slide-type sprayers** consist basically of two small-diameter tubes. One slides within the other, compresses the liquids, and forces the pesticide solution through a small hole in the end of one tube. These sprayers can deliver the spray to the tops of most fruit trees and are suitable for plantings of a few trees, as well as small fruits.

**Wheelbarrow sprayers** can be used on plantings of up to about 10 trees.

For larger plantings of fruit or a number of large-sized trees, it is best to use some type of **power sprayer**.

**Garden hose sprayers**, which are attached to the end of a garden hose, are not too good for fruit spraying, because wettable powder pesticides often plug the nozzle. Also, the pesticides do not mix uniformly with the water.

**Accessory equipment.** There are two other pieces of equipment which the home fruit grower needs. These are (1) a one-quart graduated measuring cup and (2) a set of measuring spoons. Keep this equipment separate from that used in the home. Mark it for pesticide measurements only and store with the pesticides. Measuring equipment is necessary to accurately measure the required amounts of pesticides, thus ensuring the best control results and the least possibility of plant injury.

### Cleaning Spray Equipment

After spraying, flush tank several times with clean water and force the water through spray wand and nozzle until clear. Dump excess in an area away from children, pets, and wildlife. To prevent corrosion, suspend tank upside down with lid removed to permit drainage and drying.

### How to Spray

The key to successful pest control is thorough and proper coverage at the right time with the proper dosage and materials. These points are extremely critical, and lack of attention to them accounts for more than 90 percent of the poor quality fruit produced.

Thorough coverage of all above-ground parts of plants is necessary to control fruit insects and diseases. Direct the spray onto both the top and bottom sides of leaves until the spray begins to drip off the leaves.

The goal of spraying is to place a thin layer of pesticide over all the exposed surfaces of each plant so that no matter where an insect may eat or crawl on that plant or where a disease pathogen may be, each will be exposed to a lethal amount of pesticide before damaging the plant. Unless the spray is thoroughly applied to all parts of the plant, pests can escape contact with the chemical. Thus, damage can occur on untreated areas.

If pest control results are poor after using the spray schedule, be sure to check these important points: (1) Did the plants receive thorough spray coverage at the recommended dosage? (2) Were any of the recommended sprays omitted? (3) Was the *timing* according to schedule?

Prepare a fresh spray mixture each time an application is made. Pesticides left standing in water soon lose their strength and may harm sprayer parts.

Wettable powder sprays tend to settle to the bottom of the tank unless the sprayer has a mechanical or automatic agitator. When applying sprays without an agitator, stir or shake the mixture often during application.

### How Long Pesticides Last

Many pesticides volatilize or lose their effectiveness in a matter of days or weeks after being applied. Factors such as temperature, humidity, wind, and sunlight affect the life of pesticides. The greater the extremes of these factors, the quicker the pesticides lose their toxicity.

Rain, to some degree, physically removes pesticides from plant foliage. In general, a pesticide is less likely to be washed off if it has had an opportunity to dry thoroughly on the foliage before a rain. Most materials should be reapplied the day after a heavy rain. Strong sunlight and driving winds also shorten the effective life of pesticides.

Another factor of importance is new growth early in the season that exposes unsprayed and thus unprotected plant parts.

The above items, together with the fact that pest populations are continuously moving, and/or multiplying are reasons repeat spray applications are needed.

### Preparation of Sprays

Preparation of different sprays recommended in the spray schedules can be made by mixing the exact quantities of the appropriate chemicals with the amount of water designated in Table 1. Care should be taken not to breathe or inhale any chemicals which arise from measuring or mixing with the water.

**Table 1: Quantity of Insecticides, Miticides, and Fungicides to Use in Preparing Sprays**

Material	Amounts to Add in Water to Make:		
	100 gals.	10 gals.	1 gal.
captan 50% WP (fungicide)	2 lbs.	3 ozs.	2 Tbsp.*
Benlate 50% WP (fungicide)			
apples only	2-3 ozs.	2 Tbsps.	¼ Tbsp.
all other crops	12 ozs.	1 oz.	¾ Tbsp.
carbaryl (Sevin) 50% WP (insecticide)	2 lbs.	3 ozs.	2 Tbsp.
diazinon (Diazinon) 25% EC or (Kelthane) 18.5% EC (miticide)	1 qt.	6 Tbsp.	2 tsp.
dicofol (Kelthane) 35% WP	1 lb.	2 ozs.	1 Tbsp.
Dormant oil (miticide and insecticide)	2 gals.	1 qt.	5 Tbsp.
Ferbam 76% WP (fungicide)	2 lbs.	3 ozs.	2 Tbsp.
Imidan 50% WP (insecticide)	1 lb.	2 ozs.	1 Tbsp.
Lime-sulfur, dry (fungicide)	25 lbs.	2½ lbs.	8 Tbsp.
Lime-sulfur, liquid (fungicide)	10 gals.	1 gal.	1½ Cups
lindane 20% EC	1 qt.	13 Tbsp.	4 tsp.
malathion 57% EC (miticide and insecticide)	1½ pts.	2.4 ozs.	¾ Tbsp.
malathion 25% WP	3 lbs.	5 ozs.	3 Tbsp.
methoxychlor 50% (insecticide)	2 lbs.	4 ozs.	2 Tbsp.

Tbsp. = tablespoon, tsp. = teaspoon, lb. = pound, gal. = gallon, oz. = ounce, qt. = quart, pt. = pint.  
Use level Tbsp. or tsp.

### SPECIAL NOTE

Table 1 gives quantities of pesticides to use to prepare sprays. If the information on your spray container label differs from this table, follow the label.

**Table 2: Approximate Amount of Spray Required For Fruit Trees of Different Sizes**

Height in feet	Spread in feet	Gallons per tree per application*
4	3	up to 1
5 to 8	3 to 6	1 to 1½.
8 to 10	4 to 8	2 to 3
10 to 15	8 to 15	3 to 6
15 to 20	15 to 25	5 to 10

\*Use the greater amounts for trees in full foliage.

### Harvest Restrictions

#### Days To Wait After Spraying Until Picking

Pesticides are poisons, and one of the concerns that many backyard fruit growers have is the safety of eating fruits that have been sprayed with pesticides.

There will be no problem with excessive pesticide residues on your harvested fruits if you will do just two things.

1. Use only pesticides that list on their label the fruit you want to use them on. Use only the quantity suggested on the label.
2. Do not pick the fruit sooner than the number of days waiting period given on the label.

Every pesticide label provides harvest restrictions. If your pesticide and its label does not give this information, it probably is not intended for use on fruit and should not be used. Follow the suggestions on "days waiting time" from last spray until harvest and you will have no reason to fear that your fruit is harmful. Table 3 lists harvest restrictions.

**Table 3: Days-Waiting-Time—Last Application Until Harvest**

Fruit	Pesticides									
	Captan	Carbaryl (Sevin)	Diazinon (Diazinon)	Dicofol (Kelthane)	Ferbam	Imidan	Lindane	Malathion	Methoxychlor	Benomyl (Benlate)
Apples	NTL	1	14	7	7	7	...	3a	7	NTL
Blackberries	NTL	7	b	2	40	...	...	1	14	3
Blueberries	NTL	NTL	7	7-18a	40	...	...	1	14	21
Cherries	NTL	1	10	7a	NTL	7	...	3	7	NTL
Dewberries	NTL	7	a	2	40	...	...	...	14	3
Grapes	NTL	NTL	...	7	7	7	...	3	14	7
Nectarines	NTL	3	10	14	b	a	...	...	21	NTL
Quinces	7	...	a	7	7	...	...	3	...	...
Peaches	NTL	1	20	14	21	14	c	7	21	NTL
Pears	NTL	1	14	7	7	7	...	1	7	NTL
Plums	NTL	1	10	7a	7	7	...	3	7	NTL
Raspberries	NTL	7	b	2	40	...	...	1	14	3
Strawberries	NTL	1	5	2	14	...	...	3	14	NTL

Notes: NTL = no time limitation (pesticides can be applied up to time of harvest).  
 ... = not recommended on this crop in Michigan. Dormant oil and lime-sulfur should be applied only before bloom, as listed in schedules.  
 a = See label restrictions on use.  
 b = Do not use after fruit begins to form.  
 c = As a trunk spray only.

**\*\*READ THE LABEL\*\***

**\*\*READ THE LABEL\*\***

**\*\*READ THE LABEL\*\***

\*\*\*\*\*

# WHAT'S ON THE LABEL

## Pesticide Label—Know Its Contents

Mistakes involving pesticides are made frequently because the user was not familiar with the information given on the label. Using pesticides is serious business, and the user has an obligation to use them for and how

they were intended to be used. Take the time necessary to become familiar with the contents on the label. It's your insurance to safe and effective pest control.

To familiarize you with the key parts of the label and its contents, let's look at a typical label and locate them.

**10** Science

# SYSTEMIC INSECTICIDE GRANULES

ROSES  
SHRUBS  
FLOWERS  
TOMATOES  
OTHER VEGETABLES

Enters plants through roots. Kills sucking insects when they feed on plants.

**1** Contains **DI-SYSTON**

**2** ACTIVE INGREDIENT  
O,O-Diethyl S-[2-ethylthio] ethyl] Phosphorodithioate\* 1%  
INERT INGREDIENTS 99%  
TOTAL 100%

**3** Net Weight: 1 1/4 lbs. (20 oz.)

**4** DIRECTIONS FOR USE

**FLOWERS**  
Controls aphids, lace bug, leafhoppers, mites, thrips, whiteflies on Ageratum, Calendula, Carnation, Chrysanthemum, Delphinium, Petunia, and other flowers.

**BEDS.** Apply 1 pound of this material evenly, before planting, over a 100 sq. ft. area and work into the soil. Or broadcast on soil after plants are established. Water thoroughly after application.

**IN THE ROW.** Apply two (2) rounded teaspoons this product per foot of row in the seed furrow. Work into the soil and water thoroughly. Established Plants. Apply 2 rounded teaspoons per foot of row in a narrow band near base of plants. Work into top soil and water thoroughly. Individual Plants. Apply 2 rounded teaspoons around base of plant, work into soil and water thoroughly.

**POTTED PLANTS.** Apply 2 rounded teaspoonsful per 6 inch pot. Mix thoroughly into top soil and drench soil with water.

Repeat applications at 4 to 6 week intervals if insects reappear.

**SHRUBS**  
Controls aphids, birch leaf miner, camellia scale, holly leaf miner, lace bug, leafhoppers, mimosa webworm, mites, pine tip moth, soft scale, tea scale, thrips, whiteflies on Azalea, Birch, Camellia, Euonymus, Pine, Rhododendron, Roses, Yew and other shrubs.

Apply 4 to 8 rounded tablespoons per foot of shrub height. Use lower rate for shrubs up to 3 feet; use higher rate for shrubs from 3 to 6 feet in height. Distribute the granules evenly from the base of shrub to the drip line on all sides of the plant. Work into top soil and water thoroughly. Repeat at 4 to 6 week intervals if necessary.

**VEGETABLES**  
**DO NOT ALLOW SEED TO COME IN CONTACT WITH GRANULES AT ANY TIME. DO NOT APPLY WITHIN THE NUMBER OF DAYS OF HARVEST SHOWN AFTER CROP NAME.**

**BEANS** (Snap, Green, Lima). Controls aphids, leafhoppers, Mexican bean beetle larvae, mites, thrips. In rows 24 inches apart. Use 7 oz. (20 tablespoons) per 50 feet of row. Apply at planting time only in a band on each side of the seed furrow.

**BRUSSELS SPROUTS** (30), **BROCCOLI** (14), **CABBAGE** (42), **CAULIFLOWER** (40). Controls aphids, flea beetle, leafhoppers, mites, thrips. Use 5 oz. (14 rounded tablespoons) per 50 feet of row. Apply as a band on each side of the seed furrow at planting time, or as a

**5** CONTAINER DISPOSAL. Do not re-use this container. Empty container. Crush empty container. Bury or burn it with water. Keep out of smoke.

**6** RESTRICTIONS. Do not apply broadcast applications to lawns. Food utensils such as a teaspoon or measuring cup should not be used for food purposes after use with insecticides.

**7** NOTICE. Seller makes no warranty of any kind, express or implied, concerning effects of use of this product other than those specified on this label. Buyer, or user, accepts all responsibility for results due to misuse of this product.

\*Di-SYSTON is a registered TM of Farbenfabriken Bayer AG.  
\*U. S. Patent No. 2,759,010, Canadian Patent No. 518,547

**8** EPA Reg. No. 2125-42-AA  
Distributed by

**9** **WARNING**  
Poisoning may result as a result of exposure. May be fatal if swallowed. May be absorbed through the skin. Do not get in eyes, on skin, or on clothing. Do not breathe dust. Wash thoroughly after handling.  
Apply only as specified on this label. Keep out of reach of children. Do not contaminate feed or food. Keep children and pets off treated areas until product is worked and watered into soil and treated areas have completely dried.  
This product is toxic to fish, wildlife and birds. Keep out of lakes, streams and ponds. Do not apply when weather conditions favor drift from areas treated. Do not apply where runoff is likely to occur. Do not contaminate water by cleaning of equipment or disposal of washwaters.

**10** **SCIENCE PRODUCTS COMPANY, Inc.**  
Chicago, Illinois

### 1. Trade Names

These are usually in large print. SEVIN and SPECTRACIDE are also examples of trade names.

### 2. Active and Inert Ingredients

They list what pesticides are contained in the product, the percentage of each, the chemical name, and the common name, if one is known. Malathion and Methoxychlor are common names.

### 3. Net Contents

Gives the weight of the contents.

### 4. Kind of Formulation

Granules, liquid concentrates, dusts, wettable powders, and baits are examples.

### 5. Storage and Disposal Precautions

Gives tips on how and how not to store and/or dispose of the product.

### 6. Name and Address of Chemical Company

### 7. EPA Registration Number

### 8. Recommendations for Use

Gives the pests and plants, instructions for applying the products, suggestions on how to get the best results, and precautions to be followed.

### 9. Hazard Statements

Insecticides are grouped into 4 categories based on how toxic they are:

- I. **Highly Toxic**—Danger, Poison, and a Skull & Crossbones are printed in red.
- II. **Moderately Toxic**—Warning is the keyword.
- III. **Slightly Toxic**—Most homeowner insecticides fit here.
- IV. **Relatively Non-Toxic**—Are as the name implies.

### 10. Type of Pesticide

Insecticide, miticide, fungicide, and herbicide are examples.

## Insecticides and Miticides

Carbaryl (Sevin) is a carbamate chemical and is effective against codling moth, leafroller, aphids, apple maggot, periodical cicada, grape berry moth, Japanese

beetle, oriental fruit moth, and other fruit insects. Do not use carbaryl before the Second Cover spray on apples because it will cause thinning of crop. Carbaryl is especially toxic to honey bees.

**Diazinon** is a phosphate insecticide that has shown some activity against aphids, apple maggot, and many other fruit insects. Although it will suppress mites, it should not be considered a miticide.

**Dicofol** (Kelthane), for many years an outstanding miticide, is still effective in many orchards and on small fruits, but resistance has been reported in several areas.

**Dormant Oil** should not be applied to apple trees after the half-inch green stage (when new growth from buds is one-half inch long). Do not use dormant oil if the temperature is below 40° and predicted to drop below 40° within 24 hours.

**Imidan** (Phosmet) is a phosphate-based material that is very effective against many pests such as the codling moth, apple maggot, plum curculio, aphids, Oriental fruit moth, and leafrollers. It usually suppresses European red mites and twospotted mites when used in a seasonal program. It is moderately toxic to humans.

**Lindane** is a chlorinated hydrocarbon insecticide and in this bulletin is recommended as a trunk spray to control peach tree borer.

**Malathion** is a phosphate-based material that is relatively safe for general use and can be used up to a few days of harvest. It is less toxic to insects and so must be used at higher dosages where mites are resistant to parathion or other phosphate-based materials, malathion will not be effective.

**Methoxychlor** is a chlorinated hydrocarbon useful for control of codling moth on varieties (McIntosh, Macoun, Fameuse, Cortland) injured by phosphates.

## Fungicides

**Lime-sulfur**—Liquid lime-sulfur is a better fungicide than dry-lime sulfur. Both are likely to cause some leaf burn when applied under slow drying conditions.

**Captan** is formulated as 50 and 80% wettable powders and as dusts. It is one of the best general purpose fruit fungicides and is compatible with most other fungicides and insecticides. Captan is not compatible with oil, lime or other strongly alkaline materials. It is only partially effective as a preventive for lead arsenate injury.

**Ferbam** is a black, dry, wettable powder formulation with 76% active ingredient. It has a wide compatibility range and is very effective against the cedar rusts, grape black rot, and as a dormant spray for peach leaf curl. Also, it is effective for Brook's spot, frog-eye (black rot), fly speck, blotch, pear scab and pear fruit and leaf spots. It is only moderately effective for apple scab sooty blotch, cherry leaf spot and brown rot.

**Benlate** is formulated as 50% wettable powder. It is one of the best general purpose fruit fungicides and is compatible with most other fungicides and insecticides. Unlike many fungicides, benomyl is effective against the powdery mildew fungi. Use benomyl as directed in the spray schedules. Do not use benomyl alone. When used alone, some fungi may build up resistance to benomyl. The use of benomyl in combination with other fungicides should provide good disease control and reduce the possibility of fungi developing resistance to benomyl.

## Special Notice

### On Herbicides

Herbicides (weed killers) are designed to kill plants and are extremely hard to rinse out of sprayers. Therefore, use an entirely separate sprayer for pesticides discussed in this publication. Also, store herbicides in a different place or in such a way that they will not contaminate other spray materials. Avoid herbicide spray drift.

### On Sevin (Carbaryl) Insecticide

**Sevin (Carbaryl) Causes Fruit Dropping.** This insecticide can cause excessive fruit thinning (reduced numbers) on apples, if used at petal-fall followed by two more sprays at 10-14 day intervals (first & second cover sprays). Unless thinning of fruit is desired, do not use Sevin in the spray schedule until 4 to 5 weeks after the flower petals fall.

## All-Purpose Pesticide Mixtures

Insecticides and fungicides are often needed at the same time on a plant to protect it against attack by both insects and diseases. There are all-purpose fruit sprays on the market which contain a mixture of malathion, methoxychlor and captan: two insecticides and one fungicide. This mixture is safe but is not the most effective fruit pest control combination.

Most home orchardists find that three other pesticides — Kelthane, Imidan and Sevin — will give them better pest control results alone or in combination with the all-purpose fruit spray. We can mix the all-purpose fruit spray and additional pesticides, but there are some limitations which we must become familiar with. Kelthane and Imidan are liquid concentrates. When they are added to the wettable powder "all-purpose fruit spray" they may cause burnt spots on the leaves and fruit. This is due to the action of the oil in the liquid concentrates with the fungicide captan. This burning could be harmful to the foliage.

Here are some alternatives that you might consider:

1. Use only wettable powder or flowable type formulations in combination with the all-purpose mix.
2. Use only liquids together and not the all-purpose mix. Since captan is sold only as a wettable powder; another fungicide would need to be selected.
3. Use only the all-purpose fruit spray by itself.
4. Don't apply a liquid concentrate within 2 to 3 weeks of a captan spray.

If you are in doubt about spray combination injury, check the label, ask your county agent, or apply the mixture to a small portion of the tree and wait to see what happens. Spray burn should show up in 24 to 48 hours. If burn results, don't apply the combination.

## Detection Devices For Insects

The rate at which insects develop depends largely upon temperature. Since temperature varies from year to year, it is very difficult to accurately associate the presence of a pest throughout the entire season with a particular date or stage in the development of a fruit tree. Attempts have been made to associate pest development with the flowering of certain plants. This has been somewhat successful with a few pests and not so with others.

In fruit, we are dealing with many pests over a long period of time, so many of these techniques, though helpful, break down and pesticides must be used. If a home orchardist could follow the development of fruit

pests throughout the growing season, the vulnerable stage of the pest could be determined and an appropriate pesticide could be applied. Home orchardists do not have the time nor the knowledge for this technique.

Commercial growers make weekly inspections of their orchards to detect pests. They, or a fieldman, frequently collect plant parts and examine them in the laboratory for certain pests. Bait-lure traps have been

successfully used to detect cherry fruit fly, apple maggot or blueberry maggot. Pheromone or sex-lure traps are often used for some of the more serious moth pests of apple and peach.

All of these devices are useful, but they are costly and require constant monitoring to be useful. In most cases they are too costly and too complicated a technique for an amateur grower.

**Table 4: Spray schedules for pest control on apple, crabapple, quince and pears**

Time to Spray	Materials to Use (rates listed in Table 1)		Insects and diseases most likely to be a problem at the specific time (First Column) during growing season
	Apple Crabapple Quince	Pear	
Dormant Early spring before buds swell	Dormant oil  Note: Do not spray when temperature is below 40°F (5°C), or likely to drop below 40° F within 24 hours. The dormant oil is a special, highly refined oil prepared for fruit tree spraying.	Dormant oil	Oil for scale insects, mites pear psylla, and pear leaf blister mite
Half-inch green When blossom buds show ½-inch green	Captan + Benlate	No spray needed	Fungicide for control of scab Last chance to apply dormant oil on apples, if not applied in dormant spray
Pre-pink When blossoms first show pink	Captan + Benlate + Malation or all purpose spray	No spray needed	Fungicide for control of scab and black rot Insecticide for European red mite and aphids
Pink Just before blooms open	Same as pre-pink spray.	Captan	Same as pre-pink
Bloom when 90% blossoms are open	Note: to protect bees— do not use insecticide during bloom. During bloom is the most critical time to protect trees from infection by fire blight. For recommendations on fireblight control refer to "control of specific pests not covered in spray schedules" of this publication.		
Petal fall When last petals are falling	Captan + Benlate + Malathion or Imidan or all purpose spray	Captan + Imidan, or Sevin or all purpose spray	Fungicide for control of scab, black rot, calyx rots and blotch. Insecticide for codling moth, Plum curculio, pear psylla and plant bugs.
First Cover Seven days after petal fall spray	Captan + Imidan or all purpose spray	Captan + Imidan, or all purpose spray	Fungicide for control of scab, black rot, calyx rots and blotch. Insecticide for codling moth and plum curculio
Second cover Two weeks after first cover spray	Captan + Imidan or Sevin or all purpose spray	Captan + Imidan or Sevin or all purpose spray	Fungicide for control of scab, fruit rots, blotches and leaf spots. Insecticides for codling moth, plum curculio and mites
Third cover Two weeks after second cover	Captan + Imidan or Sevin or all purpose spray	Sevin + Imidan or all purpose spray	Fungicide for control of scab, fruit rots and blotches. Insecticides for codling moth, apple maggot and pear psylla
Remaining covers Spray every two weeks	Captan + Imidan or Sevin or all purpose spray. Continue sprays to within two weeks of harvest or August 30, which ever comes first	Captan + Imidan or Sevin or all purpose spray. Apply two more sprays as above	Fungicide for control of scab, fruit rots and blotches. Insecticide for codling moth, apple maggot, leafhoppers and pear psylla

**Table 5: Spray schedules for pest control on peaches, nectarines, apricots, cherries and plums**

Time to Spray	Materials to Use (rates listed in Table 1)			Insects and diseases most likely to be a problem at the specific time (First Column) during growing season
	Peaches Nectarines Apricots	Plums	Cherries	
Dormant for peaches, nectarines and apricots Early spring before buds swell Delayed Dormant for plums and cherries just before the buds break open	Ferbam	Captan or all purpose fruit spray	If black Knot is a problem, use captan or multi-purpose fruit spray. If black knot is not a problem, no spray needed.	This is the only spray that controls peach leaf curl, plum pockets, and black knot of plum and cherries. For black knot control this spray should be repeated for two successive years.
	Note: Do not spray when temperature is below 40°F (5°C), or likely to drop below 40°F within 24 hours.			
Half-inch green When blossom buds show ½-inch green	No spray needed	Dormant oil	Dormant oil	Oil for control of scale insects, European red mites and aphids.
	Note: Use precaution as listed in Dormant. The dormant oil is a special, highly refined oil prepared for fruit tree spray.			
Pink Just before blooms open	Captan	Captan	No spray needed	Fungicide for control of brown rot.
Bloom When 90% blossoms open	Captan	Captan	Captan	Same as Pink
	Note: To protect bees—do not use insecticide during bloom			
Petal-fall When last petals are falling	Captan + Imidan or Sevin, or all-purpose spray	Captan + Imidan or Sevin, or all-purpose spray	Captan + Imidan or Sevin, or all-purpose spray	Insecticide for control of plum curculio, codling moth, European red mite, Oriental fruit moth, plant bugs, stink bugs and rust mite. Fungicide for scab, and brown rot.
First cover Seven days after petal fall spray	Same as petal fall	Same as petal fall	Same as petal fall	Insecticide for control of same pest as above. Fungicide for control of scab, brown rot and cherry leaf spot.
Remaining covers Continue spraying at 10-to -14 day intervals	Same as petal fall	Same as petal fall	After a second spray no further spray needed	Insecticide for control of same pests as above. Fungicide for scab, brown rot, cherry leaf spot.
Final spray Within one week of harvest	Captan alone	Captan alone	No spray needed	For control of brown rot.



**Table 6: Spray schedules for pest control on brambles (blackberries and raspberries)**

<b>Time to Spray</b>	<b>Materials to Use (Rates listed in Table 1)</b>	<b>Insects and diseases most likely to be a problem at the specific time (First Column) during growing season</b>
Delayed dormant When buds begin to break and show silver	Liquid lime-sulfur Note: This spray is critical for good disease control.	Lime-sulfur for rose scale, anthracnose, cane blight and spur blight.
New cane spray When new canes are 6-12 in high	Captan or Ferbam	Fungicide for control of anthracnose, cane blight, spur blight, and septoria leaf spot.
Pre-bloom Just before blossoms open	Captan + Benlate + Malathion or Imidan	Fungicide for control of anthracnose, cane blight, spur blight, fruit rots, septoria leaf spot, and powdery mildew. Insecticide for raspberry fruit worm, cane borer, thrips and strawberry weevil.
After bloom	Captan and Benlate + Sevin	Fungicide for anthracnose, septoria leaf spot, powdery mildew, and fruit rots. Insecticide for Japanese beetle.
Pre-harvest As fruit begin to color	Captan and Benlate + Malathion	Fungicide for anthracnose, septoria leaf spot, powdery mildew and fruit rots. Insecticide for sap beetle.
Post-harvest	Captan + Sevin	Fungicide for anthracnose, cane blight, septoria leaf spot, powdery mildew, and spur blight. Insecticide for Japanese beetle.

**Table 7: Spray schedules for pest control on strawberries**

<b>Time to Spray</b>	<b>Materials to Use (Rates listed in Table 1)</b>	<b>Insects and diseases most likely to be a problem at the specific time (First Column) during growing season</b>
Pre-bloom When blossom buds are visible in the crown	Captan + Benlate + Malathion or Kelthane	Fungicide for control of fruit rots and leaf spots. Insecticide for spider mites, leaf aphids, weevil and spittlebug.
Early bloom When blossoms stems have pushed out of crown	Same as pre-bloom	Same as pre-bloom
Full bloom	Captan + Benlate Note: No insecticide should be used during bloom.	Fungicide for fruit rots.
Post bloom Begin 10 days after full bloom spray and continue spray every seven days until harvest	Captan + Benlate + Sevin and Malathion or all-purpose fruit spray. Kelthane if mites are a problem.	Fungicide for fruit rots, and leaf spots. Insecticide for aphids, leaf roller, spittlebug and plant bugs.
Post harvest Apply one or more times after renovation to protect the new foliage for next years crop	Captan + Sevin or Diazinon	Fungicide for leaf spot. Insecticide for strawberry leafroller, and leafhoppers.

**Table 8: Spray schedules for pest control on grape**

<b>Time to Spray</b>	<b>Materials to Use (Rates listed in Table 1)</b>	<b>Insects and diseases most likely to be a problem at the specific time (First Column) during growing season</b>
New growth 2 to 4 inches long	Captan or Ferbam + Methoxychlor and Sevin Note: If powdery mildew is a problem, a fungicide (listed) plus Benlate may be used.	Fungicides for control of black rot. Insecticide for flea beetles and climbing cutworms. Methoxychlor or Sevin may be needed just before buds show green for flea beetles.
New growth 10-15 inches long	Same as above	Same as above
Pre-bloom Just before first blossoms open	Ferbam (See note above on use of Benlate)	Fungicides for control of black rot and powdery mildew.
Bloom When the first few blossoms open	Ferbam (See note above on use of Benlate)	Same as above
Post-bloom After all blossoms have fallen	Ferbam + Imidan or Sevin or Methoxychlor (See note above on use of Benlate) Note: In wet weather, do not wait until all blossoms have fallen, especially if black rot is a problem. Spray every 7 to 10 days.	Fungicide for black rot, downy mildew and powdery mildew. Insecticides for mites, grape berry-moth, leafhoppers, rose chafer and grape rootworm.
First cover 10 days after post blossom	Captan or Ferbam + Sevin or methoxychlor + Imidan Note: If black rot is present on leaves or berries, use Ferbam.	Fungicides for control of black rot, powdery mildew and downy mildew. Insecticides for control of mites, grape berry-moth, leafhoppers, rose chafer and grape rootworm.
Second cover 12-14 days after post blossom	Same as first cover	Same as first cover
Third cover 12-14 days after second cover	Captan + Benlate + Imidan or Sevin or methoxychlor	Fungicide for control of powdery mildew and downy mildew Insecticide for grape berry-moth, grape rootworm and leafroller
Fourth cover 12-14 days after third cover	Same as third cover	Same as third cover

MICHIGAN STATE UNIVERSITY



MSU is an Affirmative Action/Equal Opportunity Institution. Michigan 4-H — Youth educational programs and all other Cooperative Extension programs are available to all without regard to race, color, national origin, or sex.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Gordon E. Guyer, Director, Cooperative Extension Service, Michigan State University, East Lansing, MI 48824.

This information is for educational purposes only. Reference to commercial products or trade names does not imply endorsement by the Cooperative Extension Service or bias against those not mentioned. This bulletin becomes public property upon publication and may be reprinted verbatim as a separate or within another publication with credit to MSU. Reprint cannot be used to endorse or advertise a commercial product or company.

1P-5M-5:83-KMF-EP, Price 30¢

**Table 9: Spray schedules for pest control on blueberry**

Time to Spray	Materials to Use (Rates listed in Table 1)	Insects and diseases most likely to be a problem at the specific time (First Column) during growing season
Dormant Before bud break	Dormant oil Note: apply only if scale insects are a problem	Oil for control of scale insects.
Green tip Bud has ¼ in. of green	Ferbam + Benlate	Fungicide for control of mummy berry.
Pre-bloom Just before blossoms open	Same as green tip	Same as green tip.
Petal fall 75% petals have dropped	Ferbam or Captan + Sevin or Malathion or diazinon	Fungicide for mummy berry. Insecticide for fruitworms, tip borer, leafroller, leafhoppers and plum curculio.
After bloom Seven to 10 days after petal fall	Same as above	Same as above, plus blueberry maggot and Japanese beetle.

## Control of Specific Pests Not Covered In Spray Schedules

### Fireblight on Apples and Pears

Fireblight, like most plant bacterial diseases, is very hard to control but can be greatly reduced by planting the more resistant cultivars, using good sanitary practices and spraying properly. Although fireblight can and does occur on all common cultivars of apple and pear, it is most destructive to Jonathan, Rome Beauty, Wealthy, Transparent and Idared apples and Bartlett, Clapp Favorite, and Bosc pears. However, most of the more desirable pear cultivars are so susceptible that fireblight is a serious problem.

Sanitation consists of thoroughly examining the trees at least once a week from the time blossoms appear in the spring until early August, and immediately removing all blighted twigs, spurs, etc. Break or cut infected parts off 6 to 8 inches below the lowest point of visible infection. If removal is made by cuts, avoid spreading the bacteria by disinfecting the blade of the cutting tools by dipping them in 10 percent household bleach solution between each cut. Before moving on to something else, remove this diseased material from the vicinity of the trees and burn, bury, or otherwise dispose of it.

Use nitrogen fertilizers very sparingly around pears and susceptible apple cultivars.

Streptomycin, an antibiotic, is the most effective spray material. Use a spray of 50 to 100 parts per million. For the more susceptible apple cultivars 3 sprays of 50 parts per million applied in early bloom, full bloom and petal-fall are usually adequate. For pears, use 100 parts per million and apply the first spray when the first blossoms open. Apply additional sprays every 4 or 5 days through the bloom period.

### Control of Mites on Fruit Trees

For control of mites throughout the growing season, apply a dormant oil spray, as suggested in the spray schedule. Thereafter, spray when mites average 2-5 per leaf on apple, or when first seen on other fruit crops.

Use the miticide Kelthane. Very thorough coverage with two sprays spaced 8-10 days apart are necessary. Always use 2 sprays in succession, because Kelthane does not control eggs. Hatching eggs can result in a mite buildup in a very short period of time.

### Rust on Apples and Pears

If rust is a problem, apply either ferbam, zineb, Dikar or polyram. Four sprays should be applied 7 to 10 days apart starting at pink stage in early bloom. Follow label instructions.

### Control of Mites on Strawberries

There are two different species of mites that attack strawberries. Damage appears as distorted and discolored leaves and stunted fruits. Silken webs may also be found on the lower surface of the leaves. The two species of mites found on strawberries are the twospotted spidermite, which varies in color from pale greenish-yellow to dark crimson with two dark spots on its back, and the cyclamen mite, which is so tiny that it is scarcely visible to the naked eye. Both mites suck sap from the foliage and under heavy populations can cause serious damage to strawberry plantings.

Life cycles of both species are quite short during the summer and under ideal weather conditions they can buildup very rapidly if left uncontrolled.

Where mites are a problem it is suggested that Kelthane 18.5% EC be applied at the rate of 1½ pints per 100 gallons of water (1½ teaspoons per 1 gallon of water). Hot, dry weather favors rapid development of the twospotted spider mite, particularly in July and August. If mite populations reach 5 per leaflet before July 30, control measures must be applied. It has been found that populations of cyclamen mite begin to increase in late May when blossoming starts and reach a peak in early July during fruiting. A sharp decline generally occurs during July and August. Particular observations for cyclamen mite probably are best made before blossoms appear. Control measures should be applied at

the first sign of an infestation. For best mite control, it is advisable to apply two applications spaced 7 to 10 days apart and repeat this procedure as often as is needed. **Do not apply Kelthane within 2 days of harvest.**

### Special Control Instructions For Pear Psylla on Pears

Some time between the dormant and green tip stages of pear bud development, tiny pear psylla nymphs appear and commence sucking plant juices. They congregate beneath the leaves and if left unchecked, their feeding causes the leaves to turn brown and even drop in the summer. Leaves, twigs, and fruits are often covered with sticky honeydew (psylla droppings) on which a black sooty mold grows.

If pear psylla has been a problem, apply a dormant oil

spray (before buds open) followed by an application of Imidan at petal-fall and first cover sprays. Then wait 30 days and if psyllids are still present, make two more applications of Imidan 7 to 10 days apart.

### Control of Powdery Mildew On Fruit Crops

Most fruit crops grown in Michigan are susceptible to powdery mildew. Benomyl (fungicide) is effective against the powdery mildew fungi and can be used on all fruit crops mentioned in this publication. When benomyl is included in the recommended spray schedule, powdery mildew should not be a problem. If powdery mildew is a problem, use benomyl in combination with another fungicide that is recommended in the spray schedule. Follow instructions for rates given in Table 1.

### SPRAY RECORD SHEET

Date Applied	Pesticide And Formulation	Rate Used	Crop	Special Notes