Midwest Fruit Pest Management Guide 2021-2022

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About This Guide

The ***Midwest Fruit Pest Management Guide*** 2021-2022 was developed by the Midwest Fruit Workers Group.

Members of the Midwest Fruit Workers Group are in the process of changing the format of this publication. We hope the new versions (for apples and grapes) make it easier for producers to find the accurate information they need for managing pests in fruit crops. ***We believe this new format provides readers with information that is concise and easy to understand. We are working to transition the rest of the guide to this format. We welcome your comments, criticisms and suggestions. The print copy guide of the guide will be revised every other year. Updated version of the guide can be found at: https://ag.purdue.edu/hla/Hort/Documents/ID-465.pdf***

Printed copies of this publication are available from the Purdue Extension Education Store, www.edustore. purdue. edu. A free PDF download also is available from the Education Store or from your state's cooperative extension service.

The group wishes to acknowledge the organization abilities of Lina Rodriguez-Salamanca and Joseph Hannan in converting files into database format. Table layout and database development was supported by the USDA National Institute of Food and Agriculture, Crop Protection and Pest Management Program through the North Central IPM Center (2018-70006-28883). This was a monumental undertaking that we hope will improve the updating and accuracy of this guide. Fungicide efficacy tables for all crops were compiled by Megan Heller-Haas and Janna Beckerman. This work was supported by the United States Department of Agriculture, National Institutes of Food and Agriculture (USDA-NIFA) grant number 2017-70006-27140/IND11460G4-1013877.

The Midwest Fruit Workers Group also publishes companions to this guide, including the *Midwest Small Fruit Pest Management Handbook* and *Midwest Tree Fruit Pest Management Handbook*. Contact your state Cooperative Extension office for information about these publications.

Midwest Small Fruit Pest Management Handbook

The *Midwest Small Fruit Pest Management Handbook* is a companion publication to this guide. It contains additional information about control strategies for small fruit diseases, insect pests, and weeds. Pesticide safety, sprayer calibration, plant nutrition, and weed identification are also covered. Copies of the publication (Ohio State University Extension Bulletin 861) may be available from your state Extension office or from Ohio State University Extension Publications, 385 Kottman Hall, 2021 Coffey Road, Columbus, OH 43210-1044, 614-292-1607. You can also order it from Ohioline, ohioline.osu.edu.

Midwest Tree Fruit Pest Management Handbook

The *Midwest Tree Fruit Pest Management Handbook* also is a companion to this guide. It contains additional information about pesticide safety, sprayer calibration, tree fruit diseases, insect pests, and weeds, pesticide characteristics, growth regulators, spray adjuvants, and other related topics. Copies are available from your state Extension service.

Legal Responsibilities for Pesticide Use

The pesticides suggested in this publication have been registered by the Pesticides Regulation Division of the Environmental Protection Agency. At the time of printing, these pesticides were registered for use as indicated on the individual product labels. These registrations can change at any time.

To keep informed of the latest updates on pesticide registrations, the Web version of this publication is updated regularly. It is available from the Purdue Extension Education Store, https://ag.purdue.edu/hla/Hort/Documents/ID-465.pdf

Your responsibility as a pesticide user is to read and follow all current label directions for the specific pesticide being used. Strictly observe the legal limitations on the use of these pesticides to prevent excessive residues in or on harvested fruit. All growers should read product labels, follow directions carefully, and observe pre-harvest intervals and application rates. Pesticide labels are available on the following sites:
CDMS.net/label-Database; Agrian.com; and through many suppliers' websites.

Not all products listed in this guide are registered in every state. To be sure a product is registered in your state, check the National Pesticide Information Retrieval Service: npirspublic.ceris.purdue.edu.

Some of the pesticides suggested in this publication are on the EPA Restricted Use List, and users must be certified private applicators to purchase and apply these materials. Record-keeping requirements are more stringent for restricted use pesticides.

Remember: The pesticide label is a legal document.

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Foreword

Commercial fruit production has become a highly skilled, technical profession. Concerns about pesticide residues, operator risks, and the environment dictate that all fruit growers exercise extreme caution in the use of all pesticides, and indeed, all chemicals. The Environmental Protection Agency (EPA) has designated a number of fruit pesticides as "restricted use." Growers who plan to use these restricted materials must be certified as private applicators.

Certification requires that applicators understand the following: labels and labeling, safety factors, potential environmental concerns, identification of common pests encountered, pesticides and their use, proper equipment use, application techniques, and applicable state and federal regulations. Training programs are offered to help you in certification. Contact your county Extension office for information.

The pest management recommendations in this guide have been formulated to provide you with up-to-date information about pesticides and their applicability to your problem. We suggest that you use this information to set up your own spray program. You should keep accurate records of materials used, application dates, areas treated, growth stages, and weather conditions. Sample record sheets are on pages 224-225. In case of questions, nothing beats a good set of records. The EPA requires records for restricted use pesticide applications. Some states may require records for general use pesticides (e.g., Kentucky has this requirement).

Handling Pesticides

1. Know the pesticide toxicity and act accordingly.
2. When mixing pesticides do not breathe the dust, powder, or vapor. Always mix outdoors.
3. Do not use tobacco, eat, or drink when handling or applying pesticides.
4. Stay out of drift from spray or dust.
5. Rinse liquid containers with water at least three times and pour rinsate into spray tank as it is being filled. Punch holes in metal and plastic containers and crush. Dispose of these and all other pesticide containers where no contamination of crops or

water supply can occur. Do not reuse pesticide containers.

6. Use an adequate respirator and protective clothing, especially when mixing pesticides. Necessary protective equipment is listed on pesticide labels.
7. Have a "buddy" around when using acutely toxic organophosphates, just in case.
8. For maximum safety, get an appropriate blood test before the season starts and test periodically during the season.
9. Consult a doctor immediately if you develop unusual symptoms during or after spraying. Symptoms such as blurred vision, nausea, headaches, chest pains, weakness, diarrhea, or cramps indicate possible pesticide poisoning.
10. Wash hands thoroughly before eating, drinking, chewing gum, using tobacco, or using the toilet.
11. Bathe and change clothes daily, and wash contaminated clothing separate from other laundry.
12. Always store a pesticide in its original container, never in an unmarked container. Never trust your memory.
13. Always store pesticides under lock and key, and keep them away from children.
14. Always use an anti-siphon device when filling the spray tank from a domestic water source.
15. The label is the law. Read and follow all label instructions carefully.

Management Tips for Safety

1. Maintain accurate spray records. Show application rates, pesticides used, total gallonage, area treated, stage of plant development, and weather data.
2. Be prepared to show your records to the EPA or state regulatory officials if necessary.
3. Do not contaminate forage crops or pastures.
4. Do not allow animals to graze fruit plantings.
5. Prevent excess drift.
6. Maintain equipment in top condition.
7. Protect children, pets, livestock, and the environment from pesticide contamination.
8. Follow all label instructions on re-entry times for pesticides. Regulations mandate re-entry times for all pesticides. Sprayed areas must be posted so workers will not enter before the re-entry time without the required protective clothing. Re-entry times and the required protective clothing are listed on product labels and in tables in this guide.
9. Inform all workers of re-entry restrictions and information on safe pesticide use and/or training to meet OSHA requirements.
10. Comply with the Right-To-Know law. Have complete product labels readily available for workers to see. Have the Material Safety Data Sheet (MSDS) for each product you use available for workers to see and for rescue or fire personnel to use in case of emergency.
11. Provide pesticide safety training for pesticide handlers and other workers to comply with Worker Protection Standards (WPS).
12. Regularly inspect and maintain personal protective equipment used when applying pesticides.

Pesticide Use and the Law

Pesticides are developed by manufacturers, registered with EPA, and sold to the public with the assumption that users read, understand, and follow instructions on product labels. Pesticide labels include specific information about use, personal protective equipment, environmental precautions, and storage and disposal. The label's purpose is to provide clear directions to allow maximum product benefit while minimizing risks to human health and the environment.

Every pesticide label includes the following statement: "It is a violation of federal law to use this product in a manner inconsistent with its labeling." This language obliges purchasers or users of any pesticide to assume all legal responsibilities for the product's use. Further, courts and regulators recognize that pesticide labels are binding contracts that require those using the products to do so exactly as directed. Terms such as "must," "shall," "do not," and "shall not" mean users are responsible for specific actions when applying or handling a given product; any departure from such directions is, in the eyes of the law, an illegal use of the pesticide.

"Use" means more than just applying the pesticide. Federal and state regulations define pesticide use to include handling, mixing, loading, storing, transporting, and disposing, as well as human and environmental exposure. This all-encompassing definition covers every activity that involves a pesticide — from purchase to container disposal.

The pesticide label is more than just a piece of paper. It serves a dual function: the label instructs users how to use the product safely and effectively, and it serves as a legal measuring stick. Many statements on the label result from rigorous scientific investigations and governmental regulatory decisions. Pesticide users should read, understand, and follow pesticide label directions to ensure effective pest control,

personal safety, environmental protection, and legal compliance.

Pesticide labels include two important statements:

Re-entry or restricted entry interval (REI) statements contain re-entry precautions and state a time interval during which entry into a pesticide-treated site is not allowed. The statement indicates the length of time that must elapse after the pesticide application before individuals may enter the treated area without personal protective clothing and equipment.

Pre-harvest interval (PHI) statements indicate the time interval that must elapse after the pesticide application before the crop may be harvested. Harvesting prior to the PHI may result in dangerous and illegal pesticide residues on the crop.

Pesticide Use in Greenhouses and High Tunnels

Fruit and vegetable production in greenhouses and high tunnels have increased dramatically in the Midwest in the past few years. Although greenhouse or high tunnel environments may change the composition of the pest complex growers may face, using pesticides is often necessary to maintain the adequate levels of control needed to produce a profitable and marketable crop.

Pesticide regulatory agencies in the Midwest vary in their interpretation of whether a high tunnel is a type of greenhouse. For example, Indiana considers a high tunnel to be a form of greenhouse. That means the pesticides one selects for high tunnel use must be appropriate for greenhouse use. Other states (not covered by this guide) consider high tunnels to be the same as fields when it comes to pesticide use. Still other states, like Missouri, take an intermediate approach: they call a high tunnel a greenhouse when the sides are closed, but call it a field when the sides are open.

It is important that you determine how your state views high tunnels. Pesticide labels address greenhouse applications in one of three ways:

- Pesticide labels can clearly state that the products may be used in greenhouses. These products may be used according to label directions. Pesticide labels that have different instructions for greenhouse use and in-field use also fall into this category. These products also may be used in high tunnels according to label instructions.
- Pesticide labels may clearly prohibit greenhouse use. Obviously, these products cannot be used in a greenhouse under any circumstances.
- Many pesticide labels don't specify whether the product can be used in a greenhouse or not. When labels don't expressly prohibit greenhouse use, most state regulatory agencies interpret that to mean the product can be used in a greenhouse as long as the treated crop is on the label and the product is used according to label directions.

Determining Spray Volume and Rate

Producers spray fruit plantings with insecticides, fungicides, growth regulators, and nutrient solutions in many different formulations and concentrations and at various stages of plant development. The principal targets in spraying may be the foliage, flowers, fruit, woody surfaces, or all these components. The equipment and methods you use for such a diverse spraying program must be versatile, and the equipment must be properly calibrated for each type of application to produce the desired results.

Dilute Spraying

The objective of spraying is to distribute the spray material uniformly over the plants or plant parts of particular concern. Pesticide recommendations are based on the amount of dilute spray needed to wet plants thoroughly, to the point of "runoff." In typical blueberry, raspberry, or grape plantings with plants 5 to 7 feet tall and 3 to 5 feet wide and set in rows 9 to 10 feet apart, and in most strawberry plantings, 100 gallons of water per acre has been established as a standard dilute spray volume for fungicide and insecticide application. This dilute rate is considered a 1x concentration

In a standard apple or pear orchard, with trees approximately 20 feet tall, 22 feet wide, and set on rows 35 feet apart, 400 gallons of water per acre is a standard dilute spray for fungicide and insecticide application. Recommendations may be made per 100 gallons or per acre. Dilute is considered 1x concentration. For cherry, peach, and plum, 300 gallons of water per acre is the standard dilute spray volume for full-size trees.

The Amount of Dilute Spray per Acre Required for Equivalent Coverage of Plants table lists the gallons of dilute spray per acre required to provide equivalent coverage for mature trees of different sizes and spacings.

Growth regulators may be applied by high-volume hand-gun or air-blast sprayers, in either dilute or low-volume applications. Low-volume application may be riskier because any mistakes in concentration are magnified. Read the growth regulator label for suggestions about application methods. Some labels suggest dilute sprays with full coverage, and others suggest a specific amount of chemical in a specific amount of water per acre.

Amount of Dilute Spray per Acre Required for Equivalent Coverage of Plants

Distance Between Rows (feet)	Plant Height (feet)	Plant Width (feet)	Maximum Plant Volume/ Acre (1000 cu ft[1])	Minimum Dilute Spray (gallons/acre[2])
30	20	15	436	300
26	16	12	354	225
24	14	10	254	180
22	14	10	272	200
20	12	10	261	185
18	10	10	242	175
16	8	8	174	125
14	6	6	149	105
12	6	6	131	90
10	6	4	105	74
10	4	4	70	49

[1]Maximum plant volume/acre = plant width x plant height x running feet or row per acre. Running feet of row per acre = 43,560 divided by the distance between rows.
[2]Minimum dilute gallons per acre = approximately 0.7 gallon /1,000 cubic feet of plant volume.

Low-volume Spraying

Low-volume, or concentrate, spraying is the practice of using less water per acre to apply pesticides. In low-volume spraying, the volume of water applied per acre is reduced in proportion to the increased concentration of pesticide used by 2x, 3x, 4x, or more. Thus, a 3x rate uses a 3x concentration of pesticide in only one-third the water per acre that would be used in dilute spraying.

You must apply low-volume sprays with air-assisted sprayers that use a high-velocity airstream to distribute the spray mixture. Most conventional air-assisted sprayers can be used to apply spray mixtures up to 6x concentration. Sprayers specifically designed for ultra-low-volume application should be used for applications up to 10x.

Using low-volume sprays requires less labor, less water, less time, and fewer refills than 1x or dilute mixtures. However, low volume sprays have disadvantages. Savings in gallonage and application costs decrease most rapidly down to about 50 gallons of water per acre (on tree fruit). Below that, the savings may not be worth the additional risk of improper application and problems with wind.

Here are some precautions to follow when making low-volume pesticide applications:

1. Use extreme care in calibrating the sprayer and maintaining a constant sprayer speed. As you decrease gallonage, errors become much more critical.
2. Choose calm but good drying conditions for spraying. This may mean spraying at night or early in the morning. Good coverage cannot be achieved in windy conditions (more than 5 mph).
3. Prune plants well to create an open canopy for spray penetration. Spray droplets will not penetrate dense foliage.
4. Choose pesticide formulations that will mix satisfactorily. Pay careful attention to increased operator hazards and drift problems.

Gallons of Spray per Acre (approximate) for Various Concentrates

	1x	2x	3x	4x	5x	6x
Apples	400	200	132	100	80	64
Peaches	300	150	100	75	60	50
Percent water savings over dilute		50%	67%	75%	80%	84%
		Greatest savings	Diminished savings			

Tree Row Volume Spraying

Tree row volume (TRV) is a method originally used with orchard crops to determine the dilute (1x) volume of spray solution necessary to cover the entire plant surface for any given fruit planting. TRV is an objective method for determining the spray volume required for plants of different sizes, and for changes in canopy size as plants develop during the season.

With the TRV method, you can easily calculate the volume of dilute spray needed per acre for each planting based on plant size and canopy density. To determine the TRV, you must accurately measure the between-row spacing, maximum plant height, and cross-row plant spread. See the step-by-step procedure below.

Calculate Tree Row Volume Gallonage

Step 1. Calculate feet of row/acre.

$$\frac{\text{43,560 sq. ft./acre}}{\text{between-row spacing (ft)}} = \text{feet of row/acre}$$

Step 2. Calculate cu. ft. of TRV/acre.
Feet of row/acre (from Step 1) x plant height (ft) x cross-row plant spread (ft) = cu ft of TRV/acre.

Step 3. Select density factor.
Select one of the following numbers that best indicates the canopy density of each separate planting.

0.70 gal./1,000 cu. ft.: Plants extremely open, light visible through entire canopy.

0.80 gal./1,000 cu. ft.: Plants well pruned, with moderate vigor, adequate light penetration into canopy, many holes in foliage where light can be seen through plant.

0.90 gal./1,000 cu. ft.: Plants pruned minimally, or with high vigor, poor light penetration into canopy, very few holes where light can be seen through plant.

1.00 gal./1,000 cu. ft.: Plants unpruned, extremely dense, no light visible anywhere through canopy

Step 4. Calculate TRV gallonage/acre.

$$\frac{\text{cu. ft. of TRV/acre (from Step 2)} \times \text{density (from Step 3)}}{1{,}000}$$

= gallons of dilute solution to be applied per acre

= TRV gal./acre

Example 1

A vineyard has rows spaced 10 feet apart, the canopy height is 6 feet, and the cross row spread is 4 feet at full canopy. The density factor is 0.90.

Step 1 43,560 sq. ft. ÷ 10 ft. = 4,356 ft. of row/acre

Step 2 4,356 x 6 ft. x 4 ft. = 104,544 cu. ft. TRV/acre

Step 3 Density has been chosen as 0.90.

Step 4 [104,544 x .90] ÷ 1,000 = 94 TRV gal./acre

Example 2

An apple orchard on dwarfing rootstock has rows spaced 15 feet apart, the canopy height is 12 feet, and the cross row spread is 8 feet at full canopy. The density factor is 0.90.

Step 1 43,560 sq. ft. ÷ 15 ft. = 2,904 ft. of row/acre

Step 2 2,904 x 12 ft. x 8 ft. = 278,784 cu. ft. TRV/acre

Step 3 Density has been chosen as 0.90.

Step 4 [278,784 x .90] ÷ 1,000 = 251 TRV gal./acre

For additional information about calculating TRV gal./acre refer to *Orchard Spray Rates: How to Determine the Amount of Pesticide and Water to Use in Your Orchard* (C. Welty, Ohio State Extension Bulletin 892, **ohioline.osu.edu**).

Spraying Small Volumes

In some cases you may wish to apply small volumes of pesticides with backpack or hand-held sprayers or wipers. The following table helps convert from the rate per 100 gallons to the rate per gallon. Take care to measure pesticide amounts accurately, because errors are magnified at small volumes. (See Approximate Dilutions for Small Volumes of Spray Mixes table on page 8).

Calibrating Single Nozzle and Boom Sprayers

Calibration is an essential step for using any application equipment. Early spring, right after you have reassembled the sprayer and are preparing it for early season operations, is a good time to calibrate. Be sure all fittings are tight and there are no leaks. Take the nozzles apart, clean them, and check for worn nozzle tips.

Using wettable powder sprays enlarges nozzle openings, so calibrating each nozzle is essential. Start the season with a calibrated sprayer, and depending on the number of gallons you spray, calibrate the sprayer again according to intervals specified in the owner's manual (or no later than halfway through the spray season). Follow the procedure below to calibrate a single nozzle boom sprayer.

Approximate Dilutions for Small Volumes of Spray Mixes

Equivalent rates for different quantities of water				
Formulation	**100 gallons**	**5 gallons**	**3 gallons**	**1 gallon**
Wettable Powder, Dry Flowable, etc.	5 pounds	15 tablespoons	9 tablespoons	3 tablespoons
	4 pounds	13 tablespoons	8 tablespoons	8 teaspoons
	3 pounds	10 tablespoons	6 tablespoons	2 tablespoons
	2 pounds	8 tablespoons	4 tablespoons	4 teaspoons
	1 pound	3 tablespoons	6 teaspoons	2 teaspoons
	1/2 pound (8 oz)	5 teaspoons	1 tablespoon	1 teaspoon
Emulsifiable Concentrate, Liquid	5 gallons	1 quart	1 1/4 pints	13 tablespoons
	4 gallons	1 1/2 pints	1 pint	10 tablespoons
	3 gallons	1 1/4 pints	3/4 pint	8 tablespoons
	2 gallons	3/4 pint	1/2 pint	5 tablespoons
	1 gallon	1/2 pint	8 tablespoons	3 tablespoons
	1 quart	3 tablespoons	2 tablespoons	2 teaspoons
	1 pint	5 teaspoons	1 tablespoon	1 teaspoon

These approximations are based on average weights of various pesticide products as described in Dry Pesticide Rates for Hand-held Sprayers (University of Kentucky Extension publication HO-83, www.ca.uky.edu/agcomm/pubs.asp).

Step 1. Check your tractor/sprayer speed.

Attach the sprayer to your tractor and make test runs to determine the tractor speeds (mph) in different gears. Run the tractor at PTO speed as you will when operating the sprayer. Travel a test course and record time needed to travel a measured distance. Run the test on the same type surface in the planting (for example, sod, not pavement or gravel)

Formula

$$\text{MPH} = \frac{\text{feet traveled}}{\text{seconds}} \times \frac{60}{88}$$

Your tractor sprayer speed

$$\text{MPH} = \frac{\text{feet traveled}}{\text{seconds}} \times \frac{60}{88} = \_\_\_\_\_$$

Note: *The recommended tractor speed for most applications with single nozzle boom sprayers is 2-3 mph. Traveling faster may lead to poor coverage. A convenient method is to set up a calibration course in multiples of 88 feet (88 feet per minute=1 mile per hour). Set markers at 176 feet or 264 feet to correspond to 2 mph and 3 mph when the tractor speed is adjusted (gear and rpm) to cover the distance in 60 seconds (1 minute).*

Step 2. Record the sprayer inputs.

	Your Figures	Example
Nozzle type on your sprayer (all nozzles should be identical)		110˚ 04 flat fan
Recommended application volume (from manufacturer's label)		20 GPA
Measured sprayer speed		3 mph
Nozzle spacing/band width (in inches)		20 inches

Step 3. Calculate the required nozzle output.

Formula

$$\text{GPM (per nozzle)} = \frac{\text{GPA x MPH x W}}{\text{5,940 (constant)}}$$

Where

GPM=required output per nozzle in gallons per minute.

GPA=desired total carrier volume in gallons per acre.

MPH=desired ground speed in miles per hour.

W=inches between nozzles (or band width if making band applications).

Example

$$GPM = \frac{20\ GPA \times 3\ MPH \times 20\ in}{5940} = \frac{1{,}200}{5{,}940} = 0.20\ GPM$$

Your figures

$$GPM = \frac{\qquad}{5{,}940} = \frac{\qquad}{5{,}940} = \_\_\_\ GPM$$

Step 4. Operate the sprayer.

Set the correct pressure at the gauge using the pressure-regulating valve. Note that recommendations for flat fan nozzles are 15-30 psi (not more than 40 psi for spraying weeds).

Collect and measure the output of each nozzle for one minute.

The output of each nozzle should be the approximately the same as calculated in Step 3 above. There are 128 fluid ounces in one gallon. If you calculate the output at 0.20 GPM, multiply 0.20 by 128, which equals 25.6 fluid ounces in one minute.

If the nozzle output is slightly off from what you want, change the pressure. If the nozzle output is significantly off, change the speed or nozzle size.

Compare nozzle output on multiple nozzle booms. Replace all nozzle tips that are more than 10 percent inaccurate. You will achieve a satisfactory spray pattern only if the output from individual nozzles does not differ by more than 10 percent.

Calibration of Air-blast Sprayers

Accurate calibration is the only way to ensure that a sprayer is applying the intended amount of chemical. You must know the amount of water that will be applied per unit of area to make a proper spray mix. Failing to calibrate the sprayer can injure the crop, create a hazardous situation, and waste money. Frequent calibration identifies worn nozzles and keeps you aware of factors that can affect the application rate, including travel speed, pressure, and type of nozzle in use.

Pre-calibration Check

Before calibrating, check the sprayer carefully. Be sure the nozzle tips are clean. Replace all worn or damaged nozzles. Check all hoses and fittings for leaks and aging. Make sure the pressure is constant and the tank is free of dirt and debris.

Determining Sprayer Speed

You can determine the speed you need to travel to properly distribute the spray within the canopy by placing water-sensitive spray paper at various locations within the canopy. For proper pesticide application, the air within the canopy must be completely replaced with spray-laden air from the sprayer. In general, a travel speed of 1 to 3 miles per hour has proved satisfactory, depending on the size and density of the canopy, and capacity of the sprayer.

Before you can calibrate your sprayer, you must determine the travel speed in miles per hour (mph). To determine the travel speed, load the sprayer with clear water and make a test run in the fruit planting. Always make the test run in the fruit planting or on similar ground, because tractor speeds change dramatically from soft to firm surfaces. Set the tractor throttle at a level sufficient to operate the sprayer (PTO speed) and select an appropriate gear. Remember or mark these settings.

Calculate your speed by measuring the time required to travel any measured distance. A good conversion factor to remember is that 1 mph=88 feet/min. A convenient test length is 176 feet because it is a multiple (2x) of 88. Use the following formula to determine travel speed:

$$Speed\ (mph) = \frac{distance\ (ft.) \times 60}{time\ (sec.) \times 88}$$

For example, if it requires 60 seconds to travel a measured distance of 176 feet, the travel speed is:

$$mph = \frac{176 \times 60}{60 \times 88} = \frac{10{,}560}{5{,}280} = 2\ mph$$

Determining Nozzle Flow Rate

To select the correct nozzle and whirlplate sizes, you must determine the total gallons per minute (gpm) of output for each particular application.

To determine gpm, you must know the travel speed of the sprayer (mph), the gallons per acre (gpa) to be applied, and the spacing (W) between the rows of plants. Once you have measured or selected these three variables, you can use a simple equation to calculate the gpm. This equation is for one side of the sprayer manifold only. Double the calculated answer if using both sides of the sprayer. Once you determine the nozzle and whirlplate combinations, place the same size nozzles and whirlplates in both sides of the sprayer if you are using both sides.

Step 1. Calculate the total gpm required per side:

$$\text{gpm (per side)} = \frac{\text{gpa x mph x W}}{1{,}000}$$

gpm = gallons per minute (per side)

gpa = gallons per acre

mph = speed (in miles per hour)

W = spacing between rows (in feet)

Example: You have decided to apply 70 gpa while traveling 2 mph, and the rows are spaced 10 feet apart. What is the gpm per side?

$$\text{gpm} = \frac{70 \text{ x } 2 \text{ x } 10}{1{,}000} = \frac{1{,}400}{1{,}000} = 1.4 \text{ gpm}$$

Step 2. Select the correct nozzle-whirlplate combination and operating pressure. Air-blast sprayers normally use disk-core-type cone spray tips. Select the correct size nozzles and whirlplates by using a table that indicates the nozzle size and gallons per minute output at various pressures using specific whirlplates. You can find these tables in the sprayer manufacturer's literature or in nozzle catalogs.

Arrange nozzles in the sprayer manifold so approximately *two-thirds of the total flow comes from nozzles in the upper half* of the manifold, and *one-third of the total flow comes from nozzles in the lower half*. Adjust nozzles this way to provide uniform coverage throughout the canopy. It should adequately penetrate to the top and center of the canopy while avoiding excess application in the lower outside areas.

Step 3. Install the nozzles in their proper outlets. Inspect and clean all nozzles and outlets and determine that the sprayer is operating correctly. Nozzles are an important part of the sprayer; if the nozzles show any defects or wear, replace them.

Step 4. Measure the total gpm from all the nozzles selected in Step 2. Fill the sprayer tank at least half full. Prime the sprayer system and check all the nozzles to make sure none are clogged or partially clogged. Record the exact level of water in the spray tank. Bring the sprayer up to the desired pressure and turn the nozzles on. Use a stopwatch to record how long the sprayer is running. You should operate the sprayer for at least three minutes. Record the new level in the tank or measure the amount of water needed to refill the tank to the original level.

Example: The spray tank is filled to the 100-gallon level. It was predetermined from the manufacturer's tables that the nozzles selected would give a total output of 4 gpm. The sprayer was operated for five minutes at 150 psi on the gauge. After the five minutes, the sight gauge read 75 gal. The actual output was:

100 gal. (start) - 75 gal. (stop) = 25 gal. per 5 min. = 5 gpm

The theoretical output from table information, however, was 4 gpm.

When actual output differs from the calculated output, make adjustments by changing the pressure (when the difference is small) or changing the nozzle sizes (when the difference is large). Experiment with the pressure to see if the output can be fine-tuned. Refer to manufacturer's tables for recommended operating pressures for nozzles. Never operate above or below recommended pressures.

Repeat these calibration procedures whenever you change the speed, gallons per acre, or row spacing. Periodically check the output from the nozzles during the spraying season. The effectiveness of the spray material directly depends on your skill as an operator.

Field test to confirm calculations:

$$\text{gpa (gallons per acre)} = \frac{\text{gal. sprayed x 43,560 ft.}^2}{\text{distance traveled (ft.)}}$$

Example: A field test is run in which 10 rows, each 200 feet long, were sprayed. Row spacing was 10 feet. It took 35 gallons to refill the sprayer to the original level. What was the gpa?

$$\frac{35 \text{ gal. x } 43{,}560 \text{ ft.}^2}{2{,}000 \text{ ft. x } 10 \text{ ft.}} = 76 \text{ gpa}$$

Spray Water pH

Several pesticides break down rapidly in alkaline water (pH above 7.0). Both well and pond water in the Midwest tend to be alkaline. In a matter of hours — or, in extreme instances, only minutes — 50 percent or more of the active ingredient may be hydrolyzed to yield a less active compound. Captan, Dimethoate, Imidan, and Malathion are examples of compounds especially vulnerable to alkaline hydrolysis.

To ensure the maximum effectiveness of pesticide applications, check the pH of spray mixes in the spray tank and add buffering agents if necessary to adjust the pH to neutral (7.0). Many commercial buffering agents are available, and the list is too long to include all of them. Most adjuvants (see definition in the

next section) are multipurpose adjuvants, serving as spreaders, activators, etc. Be sure to read the labels of both the pesticide and adjuvant before using them. Granulated food grade citric acid may be the most convenient and inexpensive acidifying material. Two ounces per 100 gallons has been shown to reduce the pH of tap water from 8.3 to 5.4. Convenient granulated food grade citric acid measures are:

per 100 gal. 1/4 cup, slightly rounded

per 300 gal. 3/4 cup, rounded

per 500 gal. 1 1/3 cups

Granulated food grade citric acid is available in 50-pound bags from suppliers that handle food grade chemicals. Do not try to acidify solutions containing phosphorous acid, Bordeaux mixture, fixed copper, or other copper compounds.

Spray Adjuvants

Several types of additives are available to improve the effectiveness of spray applications. Collectively, these products are called adjuvants. Here are some adjuvants and their functions:

Activators increase a pesticide's effect by increasing the penetration of a spray solution through leaf hairs or a waxy cuticle and into a leaf or fruit.

Acidifiers lower the pH of alkaline spray water to reduce the potential breakdown of certain pesticides in the spray tank.

Buffers change the pH of spray water, then hold it at the desired degree of acidity.

De-foamers, when added to the spray tank, break down or prevent the formation of foam.

Elasticizers or drift control agents reduce the breakup of spray droplets into very fine particles and thereby minimize drift.

Surfactants, spreaders, and wetting agents are different names for products that reduce the surface tension around a spray droplet, allowing it to spread out more evenly on the surface of a leaf or fruit. *Caution:* Some surfactants used in combination with certain pesticides can function as activators, which can injure plants. Consult labels or chemical suppliers for more information.

Stickers cause a pesticide to stick to the surface after the spray dries, thereby reducing the potential for loss from rain or overhead irrigation.

Spreader-stickers is a term commonly misused when referring to a surfactant or spreader. A true spreader-sticker combines the characteristics of a surfactant with that of a sticker.

Caution: Do not use an adjuvant with any pesticide without first consulting the specific pesticide label. Improper selection or use can injure crops or reduce effectiveness, particularly when you mix adjuvants with emulsifiable concentrates.

Pesticide Compatibility

Because of the complex nature of pest management in fruit crops, multiple fungicides and insecticides may need to be tank mixed together and applied at one time. Pesticide compatibility in the spray tank is usually not a problem with newer pesticides. The compatibility of some materials may depend on solvents and emulsifiers the manufacturer used. Emulsifiable concentrate formulations are more likely to cause compatibility problems than wettable powders. Mixing wettable powders with emulsifiable concentrates may result in incompatibility issues. Compatibility problems are often noted when applicators use lime, copper (Bordeaux), or oil products in a mix. Be aware of spray tank pH as noted above.

Read the comments section in this spray guide for notes about compatibility problems, and read pesticide labels before tank mixing products. Most pesticide labels give instructions for loading, tank mixes, etc., and we recommend that growers follow the label directions closely to avoid problems.

Making Tank Mixes

Adding the components of the mixture in the order the label specifies is critical; whether some pesticides are physically compatible or not depends on the order in which you add them to the tank. This is especially true for pesticides packaged in water-soluble packets. A mistake in mixing order could prevent the package from dissolving completely, thus preventing uniform distribution of the pesticide in the spray tank. The label provides mixing instructions for all registered tank mixes. Unless the label states otherwise, you cannot apply any pesticide in the mixture at a rate higher than the label allows for when the pesticide is used alone for the same purpose.

Some pesticide labels do not provide adequate mixing order directions. The usual method for tank mixing is as follows.

First, fill the tank one-quarter to one-half full with the carrier and begin agitation. If you need to add a compatibility, buffering or defoaming agent, these products should be added before the other products. If you are using a drift reduction additive, always consult the label; some are added very early, while others are added nearly last.

Next, slowly add and thoroughly mix the pesticide products, one at a time, beginning with those hardest to mix (such as suspension-forming formulations). Generally, wettable powder (WP) and dry flowable or water-dispersible granule (DF, WDG) products should be added first, followed by flowable (F, FL) and microencapsulated (ME) products. Add emulsifiable concentrates (EC) next, followed by any solution (S) or soluble powder (SP) products. Other spray modifiers (penetrants and surfactants) should be added last. Dry formulations should be preslurried (mixed with a little water) before adding them to the spray tank; this is also a good idea (even with ECs) if you are using liquid fertilizers as the carrier.

Finally, continue adding your carrier to the desired level.

To make certain you have a uniform spray mixture at all times, keep the mixture agitated during the entire application and until the tank is empty. Avoid letting the mixture stand overnight, if possible, without agitation. If you do end up with a physically incompatible spray mix, call the manufacturer of each product to see if you can rejuvenate the mix. Adding a compatibility agent may return the mix to a sprayable form. If you cannot rejuvenate the mix, treat it as pesticide waste.

Tank Mixing Order

1. Fill tank 1/4 to 1/2 full with carrier (water)
2. Begin agitation
3. Utility agents (if needed)
4. Suspension products
   a. Dry (Pre-mix): WP, DF, WDG,
   b. Wet F, FL, ME
5. Emulsifiable products (EC)
6. Solution products (S, SP)
7. Spray modifiers (if needed)
8. Finish filling the tank with carrier

From: Illinois Pesticide Applicator Training Manual SP39: General Standards. University of Illinois Extension Pesticide Safety Education Program. pp. 19-20.

Summary

Pesticide recommendations may seem confusing to the novice because there are so many options for materials to use for certain diseases or insect pests. For this reason, we strongly recommend that growers refer to the *Midwest Small Fruit Pest Management Handbook or Midwest Tree Fruit Pest Management Handbook* (see front inside cover/page 2) to develop a thorough understanding of pest management.

With fungicides in particular, a single material may control one or more diseases, but not all. So when several diseases threaten, you may need to combine materials to achieve control. Insect pests also may be a problem at the same time, so you may also need to apply insecticides. In most cases, you can tank mix multiple fungicides and insecticides together and apply at one time. However, not all pesticides are compatible, so you should test for compatibility before tank mixing any products.

Certain fungicides and insecticides may be phytotoxic (cause foliar damage) to certain crops and/or varieties. For example, many grape varieties are sensitive to sulfur or copper. The Relative Disease Susceptibility and Chemical Sensitivity among Grape Cultivars table on page 143 lists variety sensitivity to these materials. Additionally, some grape varieties are sensitive to certain strobilurin fungicides, and some strawberry varieties are sensitive to Sinbar herbicide. Several apple varieties are sensitive to azoxystrobin, the active ingredient in Abound, Quilt, and Quadris Top fungicides. Always read the comments associated with the materials in this guide.

Pesticide choices can be limited by variety, disease or insect pressure, and other factors. Your preference, experience with materials, and price often influence decisions as well. Pest management in fruit crops is relatively easy as long as you understand the pests, critical periods for control, proper selection of control materials, and proper application procedures.

Always read the entire pesticide label. If you have any questions about the proper use of a pesticide, refer to other sources, such as the *Midwest Small Fruit Pest Management Handbook or Midwest Tree Fruit Pest Management Handbook*. If you still have questions, contact the manufacturer or your state Extension specialist for clarification.

APPLE

Apple Insect Pests

Compiled by K. Athey; edited by C. Welty, E. Long, R. Bessin, C. Guedot and D. Lewis

The shaded boxes represent the crop stages where common pests in the Midwest are active and action (scouting and preventative sprays) may be necessary/recommended. Weather and degree day accumulation will impact the exact timing of pest appearance in the orchard.

View this table in color at the website, qrco.de/Applebugs

Stage									
Dormant	Green Tip	Half-inch Green	Tight Cluster	Pink	Bloom	Petal Fall	First and Second Cover	Third Cover	Summer Cover
					CM-MD		codling moth (CM)		
			OFM-MD			oriental fruit moth (OFM)			
						plum curculio			
								apple maggot	
								brown marmorated stink bug	
	European red mite								
									Japanese beetle
		rosy apple aphid							
San Jose scale							San Jose scale		
									woolly apple aphid
							periodical cicada		
							potato leafhopper		
					dogwood borer – MD		dogwood borer		
							green apple aphid		
						leafrollers			
				tarnished plant bug					
		spotted tentiform leafminer – adults		spotted tentiform leafminer – larvae		spotted tentiform leafminer – larvae			spotted tentiform leafminer
		ambrosia beetles							

Major	Present in most orchards in most years and usually causing economic damage if not managed. MD: Mating Disruption
Minor	Often present but not causing economic damage and not requiring management. MD: Mating Disruption

Apple Spray Schedule

Entomology Lead: K. Athey
Pathology Lead: J. Beckerman, M. Lewis-Ivey, and L. Rodriguez-Salamanca
Horticulture Lead: J. Strang

Please give us your feedback on the new table.
qrco.de/FruitSpray

How to read the spray schedule tables
Every apple growth stage has important notes on disease or insect management. In some cases, the reader will be directed to the special problems section at the end of the section or chapter. Please make sure to read thoroughly and contact your state Extension specialist with any specific questions.

Key to tables
E = excellent control
G = good control
F = fair control
[r] = fungicide/Insecticide resistance possible
s = suppression only
i = ineffective
u = unknown efficacy
x = pest not on the label

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state.

[2] F/IRAC code represents the mode of action of the fungicide/insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides/insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.

Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/acre/year.

[6] Max app refers to the product's maximum number of applications per year.

Notes on disease management

The fungi that cause apple scab, powdery mildew, and cedar apple rust attack newly emerged leaves to a greater degree than older leaves. The fungi that cause summer rots attack newly developed fruit, even though symptoms may not appear until harvest.

To protect leaves and fruit, starting fungicide applications early to protect new growth is essential. That said, successful growers understand the limits of what fungicides can do, and they consider pesticide cost and the risk of disease when deciding which fungicide to use and when to use it.

With proper timing and application, captan, mancozeb, Syllit plus mancozeb or captan, or captan plus mancozeb ("captozeb") can provide very good to excellent scab control from green tip until pink, at a lower cost, and little risk of fungicide resistance. As always, the goal is to keep the number of primary scab lesions low to improve fruit protection later in the season. This is more difficult in cooler, wet years, which may require more frequent spraying.

At tight cluster through first cover (when the risk of powdery mildew, scab, and rust are highest), incorporate the broad-acting, systemic fungicides with the FRAC codes of 3, 7, 11, to improve management and best utilize these fungicides' systemic nature.

Apple Dormant to Silver Tip – Diseases

Apply before growth starts in spring and when temperatures are above 45°F.

- If fire blight was severe last year, make fixed copper applications at silver tip. Do not apply copper after 1/4-inch green leaf stage or when drying conditions are cool and slow, because that may cause severe injury. Many fixed copper fungicides/bactericides are registered for use on apple. Fixed coppers can be mixed with oil. However, never combine copper sulfate alone with dormant oil. Using copper at this stage does not eliminate the need of streptomycin at bloom. Use of copper at this stage has been shown to aid in the management of apple scab, particularly in orchards that had a high incidence of the disease the previous season.
- Apply Ridomil to soil in early spring before growth starts.
- The suggested urea application rate is 40 lb. of agricultural grade urea (46-0-0) per 100 gal. of water. See Sanitation Methods to Aid in Apple Scab Control, page 51.

Effectiveness of Fungicides for Control of Apple Diseases – Dormant through Silver Tip[1]

Product and formulation Active ingredient	FRAC[2]	Fire Blight	Phytophthora Crown and Collar Rot	Scab	PHI[3] REI[4]	Max amt[5] Max app[6]
Bordeaux mixture, 8-8-10	M	8 lb.	x	x	NA	NA
					24h	NA
Cuprofix Ultra 40 Disperss	M	5-7.5 lb.	x	x	NA	40 lb.
copper sulfate					48h	NA
Kocide 3000	M	3.5-7 lb.	x	x	NA	53.3 lb.
copper hydroxide					48h	NA
Ridomil Gold SL (SC)	4	x	2 qt./A (2.0) or 1.5 fl. oz./1,000 sq. ft. (see note above)	x	NA	NA
mefenoxam			E		48h	NA
urea (46-0-0)	NA	x	x	44 lb. (see note above)	0	50 lb.

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Phytophthora collar, crown and root rot of apple

Ridomil Gold SL is labeled for use on bearing apple trees. Make applications before symptoms appear, especially in areas of the orchard with poor water drainage. Ridomil Gold SL will not revitalize trees showing moderate to severe crown rot symptoms.

Mix 0.5 pint of Ridomil Gold SL with 100 gallons of water. Around the trunk of the tree, apply the amount of diluted mixture indicated in the table below. Make applications in early spring before growth starts and in the fall after harvest and before the ground freezes. On new plantings, delay the first application until 2 weeks after planting.

To determine trunk diameter, measure the trunk 12 inches above soil line.

Amount of Ridomil Gold SL (diluted) to Apply for Crown Rot Control

Trunk Diameter	Quarts of Diluted Mixture/Tree
< 1 inch	1 quart
1-3 inches	3 quarts
> 5 inches	4 quarts

Do not dip tree roots or spray bare roots with solutions containing Ridomil Gold SL. Do not graze in or feed cover crops from treated orchards. Illegal residues may occur.

Phosphorous Acid (Phosphonates and Phosphites)

A number of phosphorous acid products are registered as fungicides to control root and collar rot (caused by *Phytophthora* spp.) on apple, pear, and stone fruit. Brand names for these products include but are not limited to Agri-Fos, ProPhyt, Phostrol, and Rampart. Their active ingredient, phosphorous acid, is essentially the same active ingredient as in the fungicide Aliette, which has been registered for use on tree fruit for many years, however these are not generic versions of Aliette or each other. Care must be taken in following the label. In some instances, products are labeled for control of other diseases, although the data is complex and inconsistent.

These materials are applied as foliar sprays. The active ingredient is highly systemic and moves down the tree from the leaves into the crown and roots. See the label for current use recommendations. Although labeled, these products are not recommended for managing apple scab or fire blight in the Midwest.

For spring and summer Phytophthora collar, crown and root rot control on tree fruit: Under moderate disease pressure, apply products as indicated on the label on a 30-60-day spray interval. Make the first application in the spring after sufficient foliage is present to absorb the chemical.

Do not apply within 2-3 weeks of leaf color change in the fall. Foliage must be green and living for the roots to take up and transport Aliette.

Do not apply Aliette if you have applied copper-based fungicides within two weeks to avoid possible phytotoxic reactions.

Apple Green Tip through Half-Inch Green – Diseases

Begin fungicide sprays at green tip and repeat every 5-7 days through second cover.

Notes on disease management

- **Initiate** applications at green tip or when environmental conditions are favorable for primary scab development. Continue applications through the duration of primary scab on a 7-10 day interval.
- Captan 80WG PLUS Mancozeb 75D F is a highly recommended tank mix (often called "captozeb") and can be used up to 8 times, limited by the 77-day PHI for mancozeb. See Note About Mancozeb and Polyram (EBDC Products), page 50.
- If your orchard has a long history of Syllit (Cyprex) use, fungicide resistance may be a problem. Tank mix Syllit with Captan 80WDG or a mancozeb-based product.
- Sulfur is formulated as dusts, liquids, and wettable powders (e.g., wettable sulfur, Microthiol Disperss, Cosavet, Microfine Kumulus, Liquid Sulfur Six, and Dusting Sulfur). Formulations can vary from 80% to 95% elemental sulfur. Formulations with finer particles are more effective. Sulfur is effective against plant-feeding mites but can damage predatory mite populations. Do not use within 10 days of applying oil or captan or when temperatures exceed 85°F. Certain apple varieties are sensitive to sulfur sprays under certain conditions. Do not apply unless the varieties are known to be sulfur tolerant.
- Vangard 75WG is most effective at temperatures below 70°F.

Effectiveness of Fungicides for Control of Apple Diseases – Green Tip through Half-Inch Green[1]

Product and formulation Active ingredient	FRAC[2]	Powdery mildew	Scab	REI[3] PHI[4]	Max amt[5] Max app[6]
Captan 80 WDG	M3	x	G	24h	40 lb
captan				0d	NA
Cuprofix Ultra 40 Disperss	M	x	G-F	12h	NA
copper hydroxide				NA	NA
Ferbam Granulfo (76WDG)	M	x	F	24h	NA
ferbam				NA	3
Kocide 3000	M	x	G-F	48h	53.3 lb.
copper hydroxide				0d	NA
Microthiol Disperss	M	G	i-F	24h	NA
sulfur				0d	NA
Polyram 80 DF	M3	x	G	24h	21 lb.
metiran				77d	7
Roper DF rainshield	M	i	G	24h	21 lb.
mancozeb				77d	6
Scala SC	9	x	E-G	12h	40 fl. oz.
pyrimethanil				72d	NA
Vangard WG	9	x	G	12h	30 oz.
cyprodinil				0d	2
Ziram 76DF	M3	x	G	48h	42.4 lb.
ziram				14d	7

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Apple Green Tip Through Half-Inch Green – Insects

Notes on insect management

- **Superior oil:** Apply oil when temperature is above 32°F (for at least 24 hours before and after the application); never during freezing weather. Check label for fungicide/oil compatibility. Oil is most effective when sprayed dilute under calm conditions to ensure thorough coverage of all woody tissue. Delaying oil application until half-inch green controls **European red mite eggs** better than earlier applications.
- Where **San Jose scale** is a main target of oil sprays, the best application timing is at green tip. Wait until half-inch green or pink if your primary target is European red mite or rosy apple aphid. Although Lorsban and Diazinon are labeled for use with oil to increase scale control, trials have shown that oil alone results in greater than 98 percent control of scales if coverage is thorough. Adding an insecticide does improve aphid control.
- Where **spotted tentiform leafminer** is a problem, deploy pheromone traps now.
- Esteem 35WP controls scale anytime between half-inch green and second cover. At half-inch green it also controls **rosy apple aphid**. When used at pink it also controls **leafminer**. The minimum rate is effective when used pre-bloom, but the maximum rate is necessary if application is delayed until the crawler stage in early summer.

Effectiveness of Insecticides for Control of Apple Insects – Green Tip through Half-Inch Green[1]

Product and formulation Active ingredient	IRAC[2]	European red mite	Rosy apple aphid	San Jose scale	REI[4] PHI[3]	Max amt[5] Max app[6]
Acramite 50WS	20	1 lb.	x	x	12h	NA
bifenazate		G	x	x	7d	1
Actara (25WDG)	4A	x	4.5 oz.	x	12h	16.5 oz.
thiamethoxam		x	E	x	See label	NA
Admire Pro (4.6F)	4A	x	7-10.5 fl. oz.	x	12h	10.5-14.0 fl. oz.
imidacloprid		x	E	x	7d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	2.25-4.25 fl. oz.	x	x	12h	8.5 fl. oz.
abamectin		G	x	x	28d	2
Apollo SC (1SC)	10A	4-8 oz.	x	x	12h	NA
clofentezine		E	x	x	45d	NA
Asana XL (0.66EC) **(RUP)**	3A	x	17-21 fl. oz.	x	12h	101.5 fl. oz.
esfenvalerate		x	G	x	21d	NA
Assail 30SG	4A	x	4.8-14.5 fl. oz.	x	12h	32 oz.
acetamiprid		x	E	x	7d	4
Azera 0.21EC	UN+3A	x	32 fl. oz.	x	12h	NA
azadirachtin + pyrethrins		x	u	x	0d	10
Belay (2.13SC)	4A	x	4-6 fl. oz.	x	12h	12 fl. oz.
clothianidin		x	E	x	7d	NA
Beleaf 50SG	29	x	2-2.8 oz.	x	12h	8.4 oz.
flonicamid		x	G	x	21d	3
Closer SC (2SC)	4C	x	1.5-2.75 fl. oz.	x	12h	17 fl. oz.
sulfoxaflor		x	E	x	7d	4
Danitol 2.4EC **(RUP)**	3A	16-21.3 fl. oz.	10.6-21.3 fl. oz.	x	24h	42.7 fl. oz.
fenpropathrin		F	F	x	14d	NA
Esteem 35WP	7C	x	3-5 oz.	x	12h	10 oz.
pyriproxyfen		x	E	x	45d	2

(continued)

Effectiveness of Insecticides for Control of Apple Insects – Green Tip through Half-Inch Green[1] *(continued)*

Product and formulation Active ingredient	IRAC[2]	European red mite	Rosy apple aphid	San Jose scale	REI[4] PHI[3]	Max amt[5] Max app[6]
Exirel (0.83SE)	28	x	13.5-20.5 fl. oz.	x	12h	61.5 fl. oz.
cyantraniliprole		x	E	x	3d	3
Kanemite 15SC	20B	21-31 fl. oz.	x	x	12h	62 fl. oz.
acequinocyl		E	x	x	14d	2
Lannate LV (2.4WSL) **(RUP)**	1A	x	1.5-3 pt.	x	3d	15 pt.
methomyl		x	G	x	14d	5
Lorsban 75WG **(RUP)**	1B	x	2-2.67 lb.	x	4d	NA
chlorpyrifos		x	G	x	28d	NA
Lorsban Advanced	1B	x	1.5-4 pt.	x	4d	NA
chlorpyrifos		x	G	x	28d	NA
Magister SC (1.7SC)	21	32-36 fl. oz.	x	x	12h	36 fl. oz.
fenazaquin		E	x	x	7d	1
Movento (2SC)	23	6-9 fl. oz.	6-9 fl. oz.	x	24h	25 fl. oz.
spirotetramat		s	G	x	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	x	1.28-4 fl. oz.	x	12h	24 fl. oz.
zeta-cypermethrin		x	u	x	14d	NA
Nealta (1.67SC)	25	13.7 fl. oz.	x	x	12h	27.4 fl. oz.
cyflumetofen		E	x	x	7d	2
Neemix 4.5 (0.39L)	UN	x	5-7 fl. oz.	x	12h	NA
azadirachtin		x	F	x	0d	NA
Nexter (SC)	21A	11-17 fl. oz.	x	x	12h	NA
pyridaben		G	x	x	25d	1
Oil (superior)	UN	x	x	0.5-2%	NA	NA
mineral oil		x	x	G	NA	NA
Onager Optek (1EC)	10A	12-24 oz.	x	x	12h	24 oz.
hexythiazox		E	x	x	28d	1
Permethrin 25W	3A	x	6.4-16 oz.	x	12h	32 oz.
permethrin		x	G	x	See label	NA
Permethrin 3.2EC **(RUP)**	3A	x	4-16 fl. oz.	x	12h	20 fl. oz.
permethrin		x	G	x	See label	NA
Portal XLO (0.4EC)	21A	2 pt.	x	x	12h	2 pt.
fenpyroximate		E	x	x	14d	1
PQZ (1.87SC)	9B	x	2.4-3.2 fl. oz.	x	12h	4.8 fl. oz.
pyrifluquinazon		x	E	x	14d	2
Proaxis (0.5EC) **(RUP)**	3A	x	2.56-5.12 fl. oz.	x	24h	1.6 pt.
gamma-cyhalothrin		x	G	x	21d	NA
Savey 50DF	10A	3-6 oz.	x	x	12h	6 oz.
hexythiazox		E	x	x	28d	1

(continued)

Effectiveness of Insecticides for Control of Apple Insects – Green Tip through Half-Inch Green[1] *(continued)*

Product and formulation Active ingredient	IRAC[2]	European red mite	Rosy apple aphid	San Jose scale	REI[4] PHI[3]	Max amt[5] Max app[6]
Sevin XLR Plus	1A	x	1.5-3 qt.	x	12h	15 qt.
carbaryl		x	F	x	3d	8
Sivanto Prime (1.67SC)	4D	x	7-14 fl. oz.	x	4h	28 fl. oz.
flupyradifurone		x	G	x	14d	NA
Vendex 50WP **(RUP)**	12B	1-2 lb.	x	x	48h	4 lb.
fenbutatin-oxide		F	x	x	14d	2
Versys Inscalis (0.83DC)	9D	x	1.5 fl. oz.	x	12h	7 fl. oz.
afidopyropen		x	G	x	7d	NA
Vydate L (2L) **(RUP)**	1A	2-4 pt.	4-8 pt.	x	48h	8 pt.
oxamyl		G	G	x	14d	4
Warrior II (2.08CS) **(RUP)**	3A	x	1.28-2.56 fl. oz.	x	24h	12.8 fl. oz.
lambda-cyhalothrin		x	G	x	21d	NA
Zeal (72WP)	10B	2-3 oz.	x	x	12h	3 oz.
etoxazole		E	x	x	14d	1

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Apple Tight Cluster Through Pink – Diseases

7 days after half-inch green. Then 7-10 after tight cluster.

Notes on disease management

- Apple pink is a critical time for controlling scab, rust, and powdery mildew.
- See Note About Mancozeb and Polyram (EBDC Products), page 50.
- Scala 5SC and Vangard are most effective at temperatures below 70°F.
- Syllit FL Fungicide resistance may be a problem if your orchard has a long history of Syllit (Cyprex) use. Do not use after pink.
- Topguard Fungicide Specialty Crops: Do not confuse with Topguard EQ, which contains azoxystrobin, and is phytotoxic on many apple varieties.
- Apply Apogee at 1-3" growth and continue at 1 to 4 week intervals at the first sign of regrowth, to control shoot growth and reduce the risk of fire blight.

Fungicide Resistance Alert

- Mix FRAC 3, 7 and/or 11 fungicides with mancozeb or captan for resistance management.
- To limit the potential for fungicide resistance development, do not make more than four (4) applications of any fungicide within each group per season, and delay using them until pink (at the earliest) whenever possible.
- Do not make more than two sequential applications of any fungicide within each group without alternating to a fungicide from a different chemistry group.
- It is recommended that growers alternate between FRAC codes to reduce the risk of fungicide resistance. For example: one application of Sovran (FRAC 11), alternated with one application of Inspire Super MP (FRAC 3+9), alternated with one application of Fontelis (FRAC 7). See Fungicide Resistance Management, page 50.

Effectiveness of Fungicides for Control of Apple Diseases – Tight Cluster through Pink[1]

Product and formulation Active ingredient	FRAC[2]	Fire blight	Powdery mildew	Rust	Scab	REI[4] PHI[3]	Max amt[5] Max app[6]
Apogee (27.5W)	PGR	9-36 oz	x	x	x	12h	99 oz.
prohexadione calcium		E	x	x	x	45d	NA
Aprovia (EC)	7	x	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	12h	27.6 fl. oz.
benzovindiflupyr		x	F	u	E-G	30d	NA
Captan 80 WDG	M3	x	2.5-5 lb.	x	5 lb.	24h	40 lb.
captan		x	i	x	G	0d	NA
Cevya	3	x	3-5 fl. oz.	3-5 fl. oz	3-5 fl. oz.	12h	NA
mefentrifluconazole		x	G-E	E	E	0d	NA
Excalia (2.84 SC)	7	x	3-4 fl. oz.	3-4 fl. oz.	3-4 fl. oz.	12h	8 fl. oz.
inpyrfluxam		x	E-G	u	E	PF	2
Ferbam Granuflo (76 WDG)	M3	x	x	3.5 lb.	3.5 lb.	24h	NA
ferbam		x	x	G	F	NA	3
Flint Extra	11	x	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	12h	10.5 fl. oz.
trifloxystrobin		x	G [r]	F	E [r]	14d	NA
Fontelis (1.67 SC)	7	x	16-20 oz.	16-20 fl. oz.	16-20 fl. oz.	12h	61 fl. oz.
penthiopyrad		x	G	E	E	28d	NA
Indar 2F	3	x	6-8 oz.	6-8 fl. oz.	6-8 fl. oz.	12h	32 fl. oz.
fenbuconazole		x	E [r]	E	E [r]	14d	4
Inspire Super (EW)	3+9	x	12 fl. oz.	12 fl. oz.	12 fl. oz.	12h	60 fl. oz.
difenoconazole + cyprodinil		x	F	E	E	28d	NA
Kenja 400SC	7	x	12.5 oz	x	12.5 oz	12h	NA
isofetamid		x	s	x	F	20d	NA
Luna Privilege (SC)	7	x	2.4-6.8 fl. oz.	x	4-6.8 fl. oz.	NA	NA
fluopyram		x	G	x	G-E	NA	NA
Luna Sensation (SC)	7+11	x	5-5.8 fl. oz.	4-5.8 fl. oz.	4-5.8 fl. oz.	12h	21 fl. oz.
fluopyram + trifloxystrobin		x	G [r]	F	E [r]	14d	4
Luna Tranquility (SC)	7+9	x	11.2-16 fl. oz.	x	11.2-16 fl. oz.	12h	54.7 fl. oz.
fluopyram + pyrimethanil		x	G	x	E	72d	NA
Merivon (2.09SC)	7+11	x	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	12h	22 fl. oz.
fluxapyroxad + pyraclostrobin		x	G	s	E	0d	4
Microthiol Disperss	M	x	10-20 lb.	x	10-20 lb.	24h	NA
sulfur		x	G	x	i-F	0d	NA
Miravis (1.67 SC)	7	x	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	4h	13.6 fl. oz.
pydiflumetofen		x	G	G	E	30d	4
Omega 500F	29	x	x	13.8 fl. oz.	10-13.8 fl. oz.	12h	138 fl. oz.
fluazinam		x	x	s-G	G	28d	10
OSO 5%	19	x	3.75-13 fl. oz.	x	3.75-13 fl. oz.	4h	78 fl. oz.
polyoxin D		x	F	x	F	0d	6

(continued)

Effectiveness of Fungicides for Control of Apple Diseases – Tight Cluster through Pink[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Fire blight	Powdery mildew	Rust	Scab	REI[4] PHI[3]	Max amt[5] Max app[6]
Polyram 80 DF	M	x	x	3 lb.	3 lb.	24h	21 lb.
metiram		x	x	G	G	77d	7
Pristine	11+7	x	14.5-18.5 oz.	14.5-18.5 oz.	14.5-18.5 fl. oz.	12h	74 oz.
pyraclostrobin + boscalid		x	E [r]	E	E [r]	0d	4
Procure 480 SC	3	x	8-16 fl. oz.	8-16 fl. oz.	8-16 fl. oz.	12h	64 fl. oz.
triflumizole		x	E [r]	E [r]	G [r]	14d	NA
Rally 40WSP	3	x	5-10 oz.	5-8 oz.	5-8 oz.	24h	5 lb.
myclobutanil		x	E [r]	F	E-G[r]	14d	NA
Roper DF Rainshield	M	x	6 lb.	6 lb.	6 lb.	24h	21 lb.
mancozeb		x	i	G	G	77d	6
Scala (SC)	9	x	x	x	7-10 fl. oz.	12h	40 fl. oz.
pyrimethanil		x	x	x	G-E	72d	NA
Sercadis	7	x	3.5-4.5 fl. oz.	4.5 fl. oz.	3.5-4.5 fl. oz.	12h	18 fl. oz.
fluxapyroxad		x	G	s	G-E	0d	4
Sovran (50WG)	11	x	4-6.4 oz.	3.2-6.4 fl. oz.	3.2-6.4 oz.	12h	25.6 oz.
kresoxim-methyl		x	G [r]	E	E [r]	30d	4
Syllit FL	U12	x	x	x	1.5 pt.	48h	3 pt.
dodine		x	x	x	E [r]	pink	2
Topguard Specialty Crops (SC)	3	x	8-12 fl. oz.	8-12 fl. oz.	13 fl. oz.	12h	52 fl. oz.
flutriafol		x	E	E	G	14d	4
Topsin-M WSB	1	x	0.75-1 lb.	x	0.75-1 lb.	24h	4 lb.
thiophanate methyl		x	G [r]	x	i	1d	NA
Torino (SC)	U6	x	6.8 oz.	x	x	4h	6.8 oz.
cyflufenamid		x	E	x	x	14d	1
Vangard WG (75WG)	9	x	x	x	5 oz.	12h	30 oz.
cyprodinil		x	x	x	G	0d	2
Ziram 76DF	M	x	x	6 lb.	6 lb.	48h	42.4 lb.
ziram		x	x	G	G	14d	7

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy
x = pest not on the label

Apple Tight Cluster Through Pink – Insects

Notes on insect management

- **Rosy apple aphid:** Scout for curled leaves at early pink. Apply aphicide at pink if you find any curled leaves with rosy apple aphid inside.
- **San Jose scale:** Put pheromone traps in place now to monitor adult scale activity; expect crawlers 4-6 weeks after adults emerge.
- **Pyrethroids** (Asana, Baythroid, Danitol, Mustang Maxx, Permethrin, Proaxis, and Warrior) kill predaceous mites that feed on European red mite and two-spotted spider mite, thereby triggering outbreaks of these pests. Use pyrethroids only if the potential for plant bug and stink bug damage is high.

Effectiveness of Insecticides for Control of Apple Insects – Tight Cluster through Pink[1]

Product and formulation Active Ingredient	IRAC[2]	Rosy apple aphid	REI[4] PHI[3]	Max amt[5] Max app[6]
Actara (25WDG)	4A	4.5 oz.	12h	16.5 oz.
thiamethoxam		E	See label	NA
Admire Pro (4.6F)	4A	7-10.5 fl. oz.	12h	10.5-14.0 fl. oz.
imidacloprid		E	7d	NA
Asana XL (0.66EC) **(RUP)**	3A	17-21 fl. oz.	12h	101.5 fl. oz.
esfenvalerate		G	21d	NA
Assail 30SG	4A	4.8-14.5 fl. oz.	12h	32 oz.
acetamiprid		E	7d	4
Azera 0.21EC	UN+3A	32 fl. oz.	12h	NA
azadirachtin + pyrethrins		u	0d	10
Belay (2.13SC)	4A	4-6 fl. oz.	12h	12 fl. oz.
clothianidin		E	7d	NA
Beleaf 50SG	29	2-2.8 oz.	12h	8.4 oz.
flonicamid		G	21d	3
Closer SC (2SC)	4C	1.5-2.75 fl. oz.	12h	17 fl. oz.
sulfoxaflor		E	7d	4
Danitol 2.4EC **(RUP)**	3A	10.6-21.3 fl. oz.	24h	42.7 fl. oz.
fenpropathrin		F	14d	NA
Esteem 35WP	7C	3-5 oz.	12h	10 oz.
pyriproxyfen		E	45d	2
Exirel (0.83SE)	28	13.5-20.5 fl. oz.	12h	61.5 fl. oz.
cyantraniliprole		E	3d	3
Lannate LV (2.4WSL) **(RUP)**	1A	1.5-3 pt.	3d	15 pt.
methomyl		G	14d	5
Lorsban 75WG **(RUP)**	1B	2-2.67 lb.	4d	NA
chlorpyrifos		G	28d	NA
Lorsban Advanced	1B	1.5-4 pt.	4d	NA
chlorpyrifos		G	28d	NA
Movento (2SC)	23	6-9 fl. oz.	24h	25 fl. oz.
spirotetramat		G	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	1.28-4 fl. oz.	12h	24 fl. oz.
zeta-cypermethrin		u	14d	NA

(continued)

Effectiveness of Insecticides for Control of Apple Insects – Tight Cluster through Pink[1] *(continued)*

Product and formulation Active Ingredient	IRAC[2]	Rosy apple aphid	REI[4] PHI[3]	Max amt[5] Max app[6]
Neemix 4.5 (0.39L)	UN	5-7 fl. oz.	12h	NA
azadirachtin		F	0d	NA
Permethrin 25W	3A	6.4-16 oz.	12h	32 oz.
permethrin		G	See label	NA
Permethrin 3.2EC **(RUP)**	3A	4-16 fl. oz.	12h	20 fl. oz.
permethrin		G	See label	NA
PQZ (1.87SC)	9B	2.4-3.2 fl. oz.	12h	4.8 fl. oz.
pyrifluquinazon		E	14d	2
Proaxis (0.5EC) **(RUP)**	3A	2.56-5.12 fl. oz.	24h	1.6 pt.
gamma-cyhalothrin		G	21d	NA
Sevin XLR Plus	1A	1.5-3 qt.	12h	15 qt.
carbaryl		F	3d	8
Sivanto Prime (1.67SC)	4D	7-14 fl. oz.	4h	28 fl. oz.
flupyradifurone		G	14d	NA
Versys Inscalis (0.83DC)	9D	1.5 fl. oz.	12h	7 fl. oz.
afidopyropen		G	7d	NA
Vydate L (2L) **(RUP)**	1A	4-8 pt.	48h	8 pt.
oxamyl		G	14d	4
Warrior II (2.08CS) **(RUP)**	3A	1.28-2.56 fl. oz.	24h	12.8 fl. oz.
lambda-cyhalothrin		G	21d	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Apple Pink

7-10 days after tight cluster.

Pest/Problem	Material	Rate/Acre	Comments
nutrient level	Solubor (boron) **AND/OR** feed-grade urea (nitrogen)	2 lb. 3 lb.	May add Solubor to pesticide solutions, but check for compatibility, order of mixing, etc. Solubor helps prevent cork spot; see page 31 for more information. Can add urea to pesticide sprays when needed.

Apple Bloom – Diseases

7-10 days after pink. Bloom begins when the first blossom opens (King Bloom).

- Do not use Syllit after pink.
- Fungicide applications for effective bitter rot control begins now.

Phytotoxicity Alert! From bloom to first cover, be aware of potential phytotoxicity issues with complex tank-mixes involving captan and other fungicides and insecticides.

Streptomycin is the most effective antibiotic for fire blight control. If streptomycin resistance has been confirmed in your orchard, switch to FireLine 17WP, Kasumin 2L, or Mycoshield only in those orchards with a documented streptomycin resistance.

- **Fire blight (blossom blight):** Start fire blight sprays at first sign of open blossoms. Repeat sprays at 4- to 5-day intervals through bloom and petal fall on susceptible varieties.
- A minimum of 2 applications are necessary to provide control. If warm, wet weather occurs, it is critical to apply sprays on a tight schedule using a maximum strength of 100 ppm (8 oz. per 100 gal.) of streptomycin. You can improve timing and confidence with streptomycin by using a disease warning system such as MARYBLYT. Streptomycin is not recommended for use after petal fall.
- Do not concentrate Regulaid for fire blight control.
- **Fire blight (shoot blight):** Apply the growth regulator Apogee 27.5W PLUS Regulaid at petal fall on king blooms for maximum effectiveness. It will take 10 days to 2 weeks after application for plants to be less susceptible to disease. See comments on page 47. Excessive nitrogen fertilization will make trees more susceptible to fire blight.

Effectiveness of Fungicides for Control of Apple Diseases – Bloom[1]

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Fire Blight	Powdery mildew	Rust	Scab	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Agri-Mycin 17	25	x	24-48 oz.	x	x	x	x	12h	NA
streptomycin sulfate		x	E [r]	x	x	x	x	50d	NA
Apogee (27.5W)	PGR	x	9-36 fl. oz	x	x	x	x	12h	99 oz.
prohexadione calcium		x	E	x	x	x	x	45d	NA
Aprovia (EC)	7	5.5-7 fl. oz.	x	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	12h	27.6 fl. oz.
benzovindiflupyr		G-E	x	F	u	E-G	F	30d	NA
Captan 80 WDG	M3	2.5-5 lb.	x	2.5-5 lb.	x	5 lb.	2.5-5 lb.	24h	40 lb.
captan		E*	x	i	x	G	E	0d	NA
Cevya	3	3-5 fl. oz.	x	3-5 fl. oz.	3-5 fl. oz	3-5 fl. oz.	3-5 fl. oz.	12h	NA
mefentrifluconazole		G	x	G-E	E	E	F-G	0d	NA
Excalia (2.84 SC)	7	3-4 fl. oz.	x	3-4 fl. oz.	3-4 fl. oz.	3-4 fl. oz.	x	12h	8 fl. oz.
inpyrfluxam		u	x	E-G	u	E	x	PF	2
Ferbam Granuflo (76 WDG)	M3	3.5 lb.	x	x	3.5 lb.	3.5 lb.	3.5 lb.	24h	NA
ferbam		F	x	x	G	F	G	NA	3
Flint Extra	11	2.9 fl. oz.	x	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	2.9 fl. oz.	12h	10.5 fl. oz.
trifloxystrobin		G	x	G [r]	F	E [r]	G	14d	NA
Fontelis (1.67 SC)	7	x	x	16-20 oz.	16-20 fl. oz.	16-20 fl. oz.	16-20 fl. oz.	12h	61 fl. oz.
penthiopyrad		x	x	G	E	E	u	28d	NA
Indar 2F	3	x	x	6-8 oz.	6-8 fl. oz.	6-8 fl. oz.	x	12h	32 fl. oz.
fenbuconazole		x	x	E [r]	E	E [r]	x	14d	4
Inspire Super (EW)	3+9	12 fl. oz.	x	12 fl. oz.	12 fl. oz.	12 fl. oz.	x	12h	60 fl. oz.
difenoconazole + cyprodinil		s	x	F	E	E	x	28d	NA

(continued)

Effectiveness of Fungicides for Control of Apple Diseases – Bloom[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Fire Blight	Powdery mildew	Rust	Scab	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Kasumin 2L	24	x	64 fl. oz.	x	x	x	x	12h	256 fl. oz.
kasugamycin		x	G	x	x	x	x	90d	4
Kenja 400SC	7	x	x	12.5 oz	x	12.5 oz	x	12h	NA
isofetamid		x	x	s	x	F	x	20d	NA
Luna Privilege (SC)	7	x	x	2.4-6.8 fl. oz.	x	4-6.8 fl. oz.	x	NA	NA
fluopyram		x	x	G	x	G-E	x	NA	NA
Luna Sensation (SC)	7+11	4-5.8 fl. oz.	x	5-5.8 fl. oz.	4-5.8 fl. oz.	4-5.8 fl. oz.	4-5.8 fl. oz.	12h	21 fl. oz.
fluopyram + trifloxystrobin		E	x	G [r]	F	E [r]	E	14d	4
Luna Tranquility (SC)	7+9	11.2-16 fl. oz.	x	11.2-16 fl. oz.	x	11.2-16 fl. oz.	x	12h	54.7 fl. oz.
fluopyram + pyrimethanil		G	x	G	x	E	x	72d	NA
Merivon (2.09SC)	7+11	4-5.5 fl. oz.	x	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	12h	22 fl. oz.
fluxapyroxad + pyraclostrobin		E	x	G	s	E	E	0d	4
Microthiol Disperss	M	10-20 lb.	x	10-20 lb.	x	10-20 lb.	x	24h	NA
sulfur		u	x	G	x	i-F	x	0d	NA
Miravis (1.67 SC)	7	3.4 fl. oz	x	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	4h	13.6 fl. oz.
pydiflumetofen		s-G	x	G	G	E	s	30d	4
Mycoshield	41	x	1 lb.	x	x	x	x	12h	9 lb.
oxytetracyline		x	F-G	x	x	x	x	60d	6
Omega 500F	29	13.8 fl. oz.	x	x	13.8 fl. oz.	10-13.8 fl. oz.	13.8 fl. oz.	12h	138 fl. oz.
fluazinam		F	x	x	s-G	G	s-G	28d	10
OSO 5%	19	x	x	3.75-13 fl. oz.	x	3.75-13 fl. oz.	x	4h	78 fl. oz.
polyoxin D		x	x	F	x	F	x	0d	6
Polyram 80 DF	M	x	x	x	3 lb.	3 lb.	x	24h	21 lb.
metiram		x	x	x	G	G	x	77d	7
Pristine	11+7	14.5-18.5 oz.	x	14.5-18.5 oz.	14.5-18.5 oz.	14.5-18.5 fl. oz.	14.5-18.5 oz.	12h	74 oz.
pyraclostrobin + boscalid		F-E	x	E [r]	E	E [r]	E	0d	4
Procure 480 SC	3	x	x	8-16 fl. oz.	8-16 fl. oz.	8-16 fl. oz.	x	12h	64 fl. oz.
triflumizole		x	x	E [r]	E [r]	G [r]	x	14d	NA
Rally 40WSP	3	x	x	5-10 oz.	5-8 oz.	5-8 oz.	x	24h	5 lb.
myclobutanil		x	x	E [r]	F	E-G[r]	x	14d	NA
Roper DF Rainshield	M	x	x	6 lb.	6 lb.	6 lb.	3 lb.	24h	21 lb.
mancozeb		x	x	i	G	G	G	77d	6
Scala (SC)	9	x	x	x	x	7-10 fl. oz.	x	12h	40 fl. oz.
pyrimethanil		x	x	x	x	G-E	x	72d	NA

(continued)

Effectiveness of Fungicides for Control of Apple Diseases – Bloom[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Fire Blight	Powdery mildew	Rust	Scab	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Sercadis	7	x	x	3.5-4.5 fl. oz.	4.5 fl. oz.	3.5-4.5 fl. oz.	4.5 fl. oz.	12h	18 fl. oz.
fluxapyroxad		x	x	G	s	G-E	F	0d	4
Sovran (50WG)	11	x	x	4-6.4 oz.	3.2-6.4 fl. oz.	3.2-6.4 oz.	4-6.4 oz.	12h	25.6 oz.
kresoxim-methyl		x	x	G [r]	E	E [r]	G	30d	4
Topguard Specialty Crops (SC)	3	13 fl. oz.	x	8-12 fl. oz.	8-12 fl. oz.	13 fl. oz.	13 fl. oz.	12h	52 fl. oz.
flutriafol		u	x	E	E	G	u	14d	4
Topsin-M WSB	1	x	x	0.75-1 lb.	x	0.75-1 lb.	0.75-1 lb.	24h	4 lb.
thiophanate methyl		x	x	G [r]	x	i	G	1d	NA
Torino (SC)	U6	x	x	6.8 oz.	x	x	x	4h	6.8 oz.
cyflufenamid		x	x	E	x	x	x	14d	1
Vangard WG (75WG)	9	x	x	x	x	5 oz.	x	12h	30 oz.
cyprodinil		x	x	x	x	G	x	0d	2
Ziram 76DF	M	6 lb.	x	x	6 lb.	6 lb.	6 lb.	48h	42.4 lb.
ziram		G	x	x	G	G	i	14d	7
Ziram 76DF	M	6 lb.	x	x	6 lb.	6 lb.	6 lb.	48h	42.4 lb.
ziram		G	x	x	G	G	i	14d	7

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Apple Bloom – Insects

7-10 days after pink. Bloom begins when the first blossom opens (King Bloom). Remember to protect pollinators!

- **SAVE THE BEES!** Do not use insecticides or miticides at bloom.
- Monitor for insect emergence with traps, and deploy pheromone dispensers if mating disruption is to be used.
- **Codling moth** (monitoring): Put out pheromone traps now to monitor adult codling moth activity. 1 per 10 acres, minimum of 2 per block. See page 27 for information about how to use traps to determine optimal insecticide timing.

Mating Disruption for Codling Moth Control and Oriental Fruit Moth

Several products are registered for control of codling moth (CM) and Oriental fruit moth (OFM) using the tactic of pheromone mating disruption. These products dispense a species-specific sex attractant that does not kill moths but prevents male moths from locating females for mating, which results in elimination of egg-laying in fruit. Mating disruption is most likely to succeed in blocks of at least five (5) acres where initial populations of codling moth are low. If you attempt a mating disruption program in blocks smaller than 5 acres, or where infestation is moderate or high, then you also need to make border sprays or at least one or two insecticide cover sprays. Controlling these moths by mating disruption does not control other insect pests that insecticide applications manage, for example, plum curculio and apple maggot. Many of these are products are deployed manually but aerosol emitters and sprayable products are available. The manual products last for several months, while the sprayables last for several weeks.

Products for pheromone mating disruption of codling moth and Oriental fruit moth

Target	Type	Product name	Rate	Duration
Codling moth (CM) only	manual dispensers	CheckMate CM-XL 2.0 Dispenser	120-200 dispensers/A	
		CideTrak CMDA Combo Meso-A	18-36 dispensers/A	120-150 days
		Isomate CM Flex	200-400 dispensers/A	
		Isomate C Plus	200-400 dispensers/A	
		Isomate C TT	100-200 dispensers/A	
		NoMate CM Spiral	300-400 dispensers/A	
	sprayable	CheckMate CM 2.0 Flowable	2.4-4.8 fl oz/A	
		NoMate CM MEC	1.34-2.68 fl oz/A	
	aerosol emitters	CheckMate Puffer CM-O	1-2 puffer cabinets/A	
		Isomate CM Mist Plus	1-2 units/A	
		NoMate CM Smart Release	1-2 units/A	160 days
	amorphous polymer matrix	SPLAT Cydia V2	750-2000 grams/A; for 1 kg as 400 point sources, apply 2.5-gram dollops; for 1 kg as 1,000 point sources, apply 1-gram dollops	
Oriental fruit moth (OFM) only	manual dispensers	CheckMate OFM Dispenser	100-200 dispensers/A	
		CideTrak OFM-L Meso	18-35 dispensers/A of one type + 100-200 dispensers/A of other type	180 days
		Isomate M Rosso	100-200 dispensers/A	
		Isomate OFM TT	100 dispensers/A	
		NoMate OFM Spiral	100-400 dispensers/A	
	sprayable	CheckMate OFM-F	1.32-2.93 fl oz/A	
	aerosol emitters	CheckMate Puffer OFM-O	1-2 puffer cabinets/A	
	amorphous polymer matrix	SPLAT OFM 30M-1	400-1000 grams/A; for 1 kg as 400 point sources, apply 2.5-gram (1/2 teaspoon) dollops; for 1 kg as 1,000 point sources, apply 1-gram (1/4 teaspoon) dollops	
Both CM and OFM	manual dispensers	CideTrak CM-OFM Combo	200-440 dispensers/A	120 days
		CideTrak CMDA+OFM Meso	30-38 dispensers/A	150-180 days
		Isomate CM/OFM TT	200 dispensers/A	
	aerosol emitters	CheckMate Puffer CM-OFM Pro	1-2 puffer cabinets/A	
		Isomate CM/OFM Mist Plus	1-2 units/A	

Apple Petal Fall – Diseases

7-10 days after bloom.

Notes on disease management

- Applying mancozeb at this time is recommended for orchards with a history of bitter rot (particularly on susceptible cultivars like Honeycrisp).
- Excalia may not be applied after petal fall.
- Be aware that captan products may pose a risk of phytotoxicity in complex tank mixes at this stage.
- Fire blight: Continue antibiotic sprays on susceptible varieties until all petals have fallen.

Effectiveness of Fungicides for Control of Apple Diseases – Petal Fall[1]

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Fire Blight	Powdery mildew	Rust	Scab	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Agri-Mycin 17	25	x	24-48 oz.	x	x	x	x	12h	NA
streptomycin sulfate		x	G [r]	x	x	x	x	50d	NA
Apogee (27.5W)	PGR	x	9-36 fl. oz	x	x	x	x	12h	99 oz.
prohexadione calcium		x	E	x	x	x	x	45d	NA
Aprovia (EC)	7	5.5-7 fl. oz.	x	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	12h	27.6 fl. oz.
benzovindiflupyr		G-E	x	F	u	E-G	F	30d	NA
Captan 80 WDG	M3	2.5-5 lb.	x	2.5-5 lb.	x	5 lb.	2.5-5 lb.	24h	40 lb.
captan		E*	x	i	x	G	E	0d	NA
Cevya	3	3-5 fl. oz.	x	3-5 fl. oz.	3-5 fl. oz	3-5 fl. oz.	3-5 fl. oz.	12h	NA
mefentrifluconazole		G	x	G-E	E	E	F-G	0d	NA
Excalia (2.84 SC)	7	3-4 fl. oz.	x	3-4 fl. oz.	3-4 fl. oz.	3-4 fl. oz.	x	12h	8 fl. oz.
inpyrfluxam		u	x	E-G	u	E	x	PF	2
Ferbam Granuflo (76 WDG)	M3	3.5 lb.	x	x	3.5 lb.	3.5 lb.	3.5 lb.	24h	NA
ferbam		F	x	x	G	F	G	NA	3
Flint Extra	11	2.9 fl. oz.	x	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	2.9 fl. oz.	12h	10.5 fl. oz.
trifloxystrobin		G	x	G [r]	F	E [r]	G	14d	NA
Fontelis (1.67 SC)	7	x	x	16-20 oz.	16-20 fl. oz.	16-20 fl. oz.	16-20 fl. oz.	12h	61 fl. oz.
penthiopyrad		x	x	G	E	E	u	28d	NA
Indar 2F	3	x	x	6-8 oz.	6-8 fl. oz.	6-8 fl. oz.	x	12h	32 fl. oz.
fenbuconazole		x	x	E [r]	E	E [r]	x	14d	4
Inspire Super (EW)	3+9	12 fl. oz.	x	12 fl. oz.	12 fl. oz.	12 fl. oz.	x	12h	60 fl. oz.
difenoconazole + cyprodinil		s	x	F	E	E	x	28d	NA
Kasumin 2L	24	x	64 fl. oz.	x	x	x	x	12h	256 fl. oz.
kasugamycin		x	G	x	x	x	x	90d	4
Kenja 400SC	7	x	x	12.5 oz	x	12.5 oz	x	12h	NA
isofetamid		x	x	s	x	F	x	20d	NA
Luna Privilege (SC)	7	x	x	2.4-6.8 fl. oz.	x	4-6.8 fl. oz.	x	NA	NA
fluopyram		x	x	G	x	G-E	x	NA	NA
Luna Sensation (SC)	7+11	4-5.8 fl. oz.	x	5-5.8 fl. oz.	4-5.8 fl. oz.	4-5.8 fl. oz.	4-5.8 fl. oz.	12h	21 fl. oz.
fluopyram + trifloxystrobin		E	x	G [r]	F	E [r]	E	14d	4
Luna Tranquility (SC)	7+9	11.2-16 fl. oz.	x	11.2-16 fl. oz.	x	11.2-16 fl. oz.	x	12h	54.7 fl. oz.
fluopyram + pyrimethanil		G	x	G	x	E	x	72d	NA

(continued)

Effectiveness of Fungicides for Control of Apple Diseases – Petal Fall[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Fire Blight	Powdery mildew	Rust	Scab	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Merivon (2.09SC)	7+11	4-5.5 fl. oz.	x	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	12h	22 fl. oz.
fluxapyroxad + pyraclostrobin		E	x	G	s	E	E	0d	4
Microthiol Disperss	M	10-20 lb.	x	10-20 lb.	x	10-20 lb.	x	24h	NA
sulfur		u	x	G	x	i-F	x	0d	NA
Miravis (1.67 SC)	7	3.4 fl. oz	x	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	4h	13.6 fl. oz.
pydiflumetofen		s-G	x	G	G	E	s	30d	4
Mycoshield	41	x	1 lb.	x	x	x	x	12h	9 lb.
oxytetracyline		x	G	x	x	x	x	60d	6
Omega 500F	29	13.8 fl. oz.	x	x	13.8 fl. oz.	10-13.8 fl. oz.	13.8 fl. oz.	12h	138 fl. oz.
fluazinam		F	x	x	s-G	G	s-G	28d	10
OSO 5%	19	x	x	3.75-13 fl. oz.	x	3.75-13 fl. oz.	x	4h	78 fl. oz.
polyoxin D		x	x	F	x	F	x	0d	6
Polyram 80 DF	M	x	x	x	3 lb.	3 lb.	x	24h	21 lb.
metiram		x	x	x	G	G	x	77d	7
Pristine	11+7	14.5-18.5 oz.	x	14.5-18.5 oz.	14.5-18.5 oz.	14.5-18.5 fl. oz.	14.5-18.5 oz.	12h	74 oz.
pyraclostrobin + boscalid		F-E	x	E [r]	E	E [r]	E	0d	4
Procure 480 SC	3	x	x	8-16 fl. oz.	8-16 fl. oz.	8-16 fl. oz.	x	12h	64 fl. oz.
triflumizole		x	x	E [r]	E [r]	G [r]	x	14d	NA
Rally 40WSP	3	x	x	5-10 oz.	5-8 oz.	5-8 oz.	x	24h	5 lb.
myclobutanil		x	x	E [r]	F	E-G[r]	x	14d	NA
Roper DF Rainshield	M	x	x	6 lb.	6 lb.	6 lb.	3 lb.	24h	21 lb.
mancozeb		x	x	i	G	G	G	77d	6
Scala (SC)	9	x	x	x	x	7-10 fl. oz.	x	12h	40 fl. oz.
pyrimethanil		x	x	x	x	G-E	x	72d	NA
Sercadis	7	x	x	3.5-4.5 fl. oz.	4.5 fl. oz.	3.5-4.5 fl. oz.	4.5 fl. oz.	12h	18 fl. oz.
fluxapyroxad		x	x	G	s	G-E	F	0d	4
Sovran (50WG)	11	x	x	4-6.4 oz.	3.2-6.4 fl. oz.	3.2-6.4 oz.	4-6.4 oz.	12h	25.6 oz.
kresoxim-methyl		x	x	G [r]	E	E [r]	G	30d	4
Topguard Specialty Crops (SC)	3	13 fl. oz.	x	8-12 fl. oz.	8-12 fl. oz.	13 fl. oz.	13 fl. oz.	12h	52 fl. oz.
flutriafol		u	x	E	E	G	u	14d	4
Topsin-M WSB	1	x	x	0.75-1 lb.	x	0.75-1 lb.	0.75-1 lb.	24h	4 lb.
thiophanate methyl		x	x	G [r]	x	i	G	1d	NA
Torino (SC)	U6	x	x	6.8 oz.	x	x	x	4h	6.8 oz.
cyflufenamid		x	x	E	x	x	x	14d	1
Vangard WG (75WG)	9	x	x	x	x	5 oz.	x	12h	30 oz.
cyprodinil		x	x	x	x	G	x	0d	2
Ziram 76DF	M	6 lb.	x	x	6 lb.	6 lb.	6 lb.	48h	42.4 lb.
ziram		G	x	x	G	G	i	14d	7

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy
x = pest not on the label

Apple Petal Fall – Insects

Notes on insect pest management

- The pyrethroids Asana, Baythroid, Danitol, Mustang Maxx, Permethrin, Proaxis, and Warrior are labeled for control of plum curculio, oriental fruit moth and leafrollers. However, pyrethroids are not recommended at this stage, because they kill predaceous mites that feed on European red mite and two-spotted spider mite, thereby triggering outbreaks of these pest mites.
- Use insecticides only after petal fall is complete.
- Rosy apple aphid is best treated at pink, but there is some chance to control it at petal fall if infestations develop.

Effectiveness of Insecticides for Control of Apple Insects – Petal Fall[1]

Product and formulation Active ingredient	IRAC[2]	Plum curculio	Oriental fruit moth	REI[4] PHI[3]	Max amt[5] Max app[6]
Actara (25WDG)	4A	4.5-5.5 oz.	x	12h	16.5 oz.
thiamethoxam		G	x	See label	NA
Altacor (35WDG)	28	x	2.5-4.5 oz.	4h	9 oz.
chlorantraniliprole		x	E	5d	NA
Asana XL (0.66EC) **(RUP)**	3A	21-27 fl. oz.	4.8-14.5 fl. oz.	12h	101.5 fl. oz.
esfenvalerate		G	E	21d	NA
Assail 30SG	4A	4.8-14.5 fl. oz.	4.8-14.5 fl. oz.	12h	32 oz.
acetamiprid		G	E	7d	4
Avaunt (30WDG)	22	8 oz.	5-8 oz.	12h	24 oz.
indoxacarb		G	G	14d	4
Azera 0.21EC	UN+3A	x	5-6 oz.	12h	NA
azadirachtin + pyrethrins		x	x	0d	10
Baythroid XL (1EC) **(RUP)**	3A	2.4-2.8 fl. oz.	2-2.4 fl. oz.	12h	2.8 fl. oz.
beta-cyfluthrin		G	E	7d	NA
Belay (2.13SC)	4A	6 fl. oz.	6 fl. oz.	12h	12 fl. oz.
clothianidin		G	G	7d	NA
Danitol 2.4EC **(RUP)**	3A	16-21.3 fl. oz.	16-21.3 fl. oz.	24h	42.7 fl. oz.
fenpropathrin		G	E	14d	NA
Delegate WG (25WG)	5	s	4.5-7 oz.	4h	28 oz.
spinetoram		s	E	7d	4
Delta Gold (1.5EC) **(RUP)**	3A	0.9-1.9 fl. oz.	0.9-1.9 fl. oz.	12h	3.6 fl. oz.
deltamethrin		u	u	21d	NA
Entrust SC (2SC)	5	x	6-10 fl. oz.	4h	29 fl. oz.
spinosad		x	F	7d	4
Exirel (0.83SE)	28	13.5-20.5 fl. oz.	10-17 fl. oz.	12h	61.5 fl. oz.
cyantraniliprole		G	E	3d	3
Imidan 70W	1B	2.1-5.7 lb.	2.1-5.75 lb.	4 or 7d	15.5 lb.
phosmet		G	E	7d	NA
Intrepid 2F	18	x	12-16 fl. oz.	4h	64 fl. oz.
methoxyfenozide		x	G	14d	NA
Madex HP	31	x	0.5-3 fl. oz.	4h	NA
Cydia pomonella granulovirus		x	G	0d	NA

(continued)

Effectiveness of Insecticides for Control of Apple Insects – Petal Fall[1] *(continued)*

Product and formulation Active ingredient	IRAC[2]	Plum curculio	Oriental fruit moth	REI[4] PHI[3]	Max amt[5] Max app[6]
Magister SC (1.7SC)	21	x	x	12h	36 fl. oz.
fenazaquin		x	x	7d	1
Movento (2SC)	23	x	x	24h	25 fl. oz.
spirotetramat		x	x	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	1.28-4 fl. oz.	1.28-4 fl. oz.	12h	24 fl. oz.
zeta-cypermethrin		G	E	14d	NA
Neemix 4.5 (0.39L)	UN	x	4-16 fl. oz.	12h	NA
azadirachtin		i	F	0d	NA
Permethrin 25W	3A	6.4-16 oz.	x	12h	32 oz.
permethrin		G	x	See label	NA
Permethrin 3.2EC **(RUP)**	3A	4-16 fl. oz.	x	12h	20 fl. oz.
permethrin		G	x	See label	NA
Proaxis (0.5EC) **(RUP)**	3A	2.56-5.12 fl. oz.	2.56-5.12 fl. oz.	24h	1.6 pt.
gamma-cyhalothrin		G	G	21d	NA
Proclaim (5SG) **(RUP)**	6	x	4.8 fl. oz.	12 or 48h	1.6 pt.
emamectin benzoate		x	F	14d	NA
Rimon 0.83EC	15	x	20-40 fl. oz.	12h	150 fl. oz.
novaluron		x	G	14d	NA
Sevin XLR Plus	1A	1.5-3 qt.	x	12h	15 qt.
carbaryl		G	x	3d	8
Verdepryn 100SL (0.83SL)	28	5.5-11 fl. oz.	5.5-11 fl. oz.	4h	33 fl. oz.
cyclaniliprole		G	E	7d	3
Virosoft CP4	31	x	1.6-3.2 fl. oz.	4h	NA
Cydia pomonella granulovirus		x	F	0d	NA
Warrior II (2.08CS) **(RUP)**	3A	1.28-2.56 fl. oz.	1.28-2.56 fl. oz.	24h	12.8 fl. oz.
lambda-cyhalothrin		E	E	21d	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Apple Petal Fall

Pest/Problem	Material	Rate/Acre	Comments
For thinning summer varieties	See Chemical Thinning of Apples, page 44.		
nutrient level	Solubor (boron) **AND/OR**	2 lb.	May add to pesticide spray solutions, but check for compatibility, order of mixing, etc. Solubor helps prevent cork spot; see page 49 for more information.
	feed-grade urea	8 lb.	

Apple First and Second Cover

7-10 days after petal fall and 7-10 days later.

Cork spot, bitter pit, Jonathan spot:

- Calcium chloride is best applied dilute at 8 lb./A dry formulation (1.5-2 lb. per 100 gal.) in the first or second cover. Do not reapply anytime during the growing season if rain has not washed off residue from previous spray.
- Do not exceed 4 pounds per acre for low volume spray. See Cork Spot and Bitter Pit Management in Apples, page 49.

Excess crop: see Chemical Thinning of Apples, page 44.

Apple First and Second Cover – Diseases

7-10 days after petal fall and 7-10 days later

Scab, fruit rots (for orchards with a history of fungicide resistance):

- For early apples (e.g., Lodi, Pristine, Yellow Transparent, Zestar) be aware that Luna Tranquility and mancozeb and have PHIs of 72 and 77 days, respectively. Fontelis, Inspire Super and Omega have 28d PHI; Aprovia, Miravis and Sovran have a 30d PHI.
- The addition of a spreader or penetrating adjuvant such as organo-silicon blends with either non-ionic surfactants (NIS) or vegetable oils (COC; not mineral); or NIS with 90% concentration is recommended with Aprovia. These include but are not limited to Widespread Max or Bond.
- The addition of LI-700 has been found to improve the efficacy of captan in areas where water has a pH greater than 7.0.
- Topsin-M 70WSB may cause scarf skin on Rome apples if applied within a 4-week period following petal fall. Do not use for scab control. Excellent for control of some fruit rots but is no longer effective against scab in commercial orchards.

Scab, rust, powdery mildew, fruit rots, sooty blotch, flyspeck (For orchards with minimal issues of fungicide resistance)

- For **powdery mildew** control after second cover, make applications based on field history and orchard scouting.
- Do not apply Merivon with EC or oil-based products. Do not apply with captan.
- Wettable sulfur: Do not apply in hot weather (above 80°F). Do not apply within 2 weeks of an oil spray or spreader-sticker. Can affect fruit finish of Golden Delicious.

Fungicide Resistance Management

- Rotate mode of action. Do not exceed two sequential applications of the same FRAC group. See comments on page 50.

Effectiveness of Fungicides for Control of Apple Diseases – First and Second Cover[1]

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Powdery mildew	Rust	Sooty blotch / fly speck	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Aprovia (EC)	7	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	12h	27.6 fl. oz.
benzovindiflupyr		G-E	F	u	E-G	F	30d	NA
Captan 80 WDG	M3	2.5-5 lb.	2.5-5 lb.	x	2.5-5 lb.	2.5-5 lb.	24h	40 lb.
captan		E*	i	x	G-E	E	0d	NA
Cevya	3	3-5 fl. oz.	3-5 fl. oz.	3-5 fl. oz	3-5 fl. oz.	3-5 fl. oz.	12h	NA
mefentrifluconazole		G	G-E	E	E	F-G	0d	NA
Ferbam Granuflo (76 WDG)	M3	3.5 lb.	x	3.5 lb.	3.5 lb.	3.5 lb.	24h	NA
ferbam		F	x	G	F	G	NA	3
Flint Extra	11	2.9 fl. oz.	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	2.9 fl. oz.	12h	10.5 fl. oz.
trifloxystrobin		G	G [r]	F	G	G	14d	NA
Fontelis (1.67 SC)	7	x	16-20 oz.	16-20 fl. oz.	x	16-20 fl. oz.	12h	61 fl. oz.
penthiopyrad		x	G	E	x	u	28d	NA
Indar 2F	3	x	6-8 oz.	6-8 fl. oz.	6-8 fl. oz.	x	12h	32 fl. oz.
fenbuconazole		x	E [r]	E	G	x	14d	4

(continued)

Effectiveness of Fungicides for Control of Apple Diseases – First and Second Cover[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Powdery mildew	Rust	Sooty blotch / fly speck	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Inspire Super (EW)	3+9	12 fl. oz.	12 fl. oz.	12 fl. oz.	12 fl. oz.	x	12h	60 fl. oz.
difenoconazole + cyprodinil		s	F	E	E	x	28d	NA
Kenja 400SC	7	x	12.5 oz	x	x	x	12h	NA
isofetamid		x	s	x	x	x	20d	NA
Luna Privilege (SC)	7	x	2.4-6.8 fl. oz.	x	6.8 fl. oz.	x	NA	NA
fluopyram		x	G	x	F-G	x	NA	NA
Luna Sensation (SC)	7+11	4-5.8 fl. oz.	5-5.8 fl. oz.	4-5.8 fl. oz.	4-5.8 fl. oz.	4-5.8 fl. oz.	12h	21 fl. oz.
fluopyram + trifloxystrobin		E	G [r]	F	G-E	E	14d	4
Luna Tranquility (SC)	7+9	11.2-16 fl. oz.	11.2-16 fl. oz.	x	x	x	12h	54.7 fl. oz.
fluopyram + pyrimethanil		G	G	x	x	x	72d	NA
Merivon (2.09SC)	7+11	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	12h	22 fl. oz.
fluxapyroxad + pyraclostrobin		E	G	s	E	E	0d	4
Microthiol Disperss	M	10-20 lb.	10-20 lb.	x	x	x	24h	NA
sulfur		u	G	x	x	x	0d	NA
Miravis (1.67 SC)	7	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	4h	13.6 fl. oz.
pydiflumetofen		s-G	G	G	G	s	30d	4
Omega 500F	29	13.8 fl. oz.	x	13.8 fl. oz.	10-13.8 fl. oz.	13.8 fl. oz.	12h	138 fl. oz.
fluazinam		F	x	s-G	F	s-G	28d	10
OSO 5%	19	x	3.75-13 fl. oz.	x	x	x	4h	78 fl. oz.
polyoxin D		x	F	x	x	x	0d	6
Polyram 80 DF	M	x	x	3 lb.	x	x	24h	21 lb.
metiram		x	x	G	x	x	77d	7
Pristine	11+7	14.5-18.5 oz.	14.5-18.5 oz.	14.5-18.5 oz.	14.5-18.5 oz.	14.5-18.5 oz.	12h	74 oz.
pyraclostrobin + boscalid		F-E	E [r]	E	E	E	0d	4
Procure 480 SC	3	x	8-16 fl. oz.	8-16 fl. oz.	x	x	12h	64 fl. oz.
triflumizole		x	E [r]	E [r]	x	x	14d	NA
Rally 40WSP	3	x	5-10 oz.	5-8 oz.	x	x	24h	5 lb.
myclobutanil		x	E [r]	F	x	x	14d	NA
Roper DF Rainshield	M	x	6 lb.	6 lb.	x	3 lb.	24h	21 lb.
mancozeb		x	i	G	x	G	77d	6
Sercadis	7	x	3.5-4.5 fl. oz.	4.5 fl. oz.	4.5 fl. oz.	4.5 fl. oz.	12h	18 fl. oz.
fluxapyroxad		x	G	s	F	F	0d	4
Sovran (50WG)	11	x	4-6.4 oz.	3.2-6.4 fl. oz.	4-6.4 oz.	4-6.4 oz.	12h	25.6 oz.
kresoxim-methyl		x	G [r]	E	G	G	30d	4
Topguard Specialty Crops (SC)	3	13 fl. oz.	8-12 fl. oz.	8-12 fl. oz.	x	13 fl. oz.	12h	52 fl. oz.
flutriafol		u	E	E	x	u	14d	4

(continued)

Effectiveness of Fungicides for Control of Apple Diseases – First and Second Cover[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Powdery mildew	Rust	Sooty blotch / fly speck	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Topsin-M WSB	1	x	0.75-1 lb.	x	0.75-1 lb.	0.75-1 lb.	24h	4 lb.
thiophanate methyl		x	G [r]	x	G-E	G	1d	NA
Torino (SC)	U6	x	6.8 oz.	x	x	x	4h	6.8 oz.
cyflufenamid		x	E	x	x	x	14d	1
Ziram 76DF	M	6 lb.	x	6 lb.	6 lb.	6 lb.	48h	42.4 lb.
ziram		G	x	G	G	i	14d	7

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Apple First and Second Cover – Insects

7-10 days after petal fall and 7-10 days later.

Codling moth

- Initiate codling moth control at first or second cover based on timing of capture in pheromone traps. Insecticide timing ranges from 50-250 degree days after trap-based biofix.
- See Mating Disruption for Codling Moth Control, page 26.
- Virus products (Cyd-X, Virosoft, Madex) are for codling moth. Apply virus products at weekly intervals.

Timing of First Insecticide Spray for Codling Moth Control on Apple and Pear[1]

Degree-days (base 50°F) after biofix[2]	Insecticide Products
50-75	Dimilin, Rimon
100-200	Intrepid, Confirm
150-250	Altacor, Assail, Belay, Delegate, Exirel
250	Imidan, Avaunt Pyrethroids (Asana, Baythroid, Danitol, Mustang Max, Proaxis, Warrior) Virus (Cyd-X, Virosoft CP4)

[1] A second spray should be made 10-14 days later.
[2] Biofix is defined as the date on which pheromone traps detect sustained flight of moths.

San Jose scale "crawlers"

- May be present by second or third cover. Esteem 35W Controls scale anytime between half-inch green and second cover. When used at half-inch green, it controls rosy apple aphid. When used at pink, it also controls leafminer. The minimum rate is effective when used pre-bloom, but use the maximum rate if application is delayed until the crawler stage in early summer.

Effectiveness of Insecticides for Control of Apple Insects – First and Second Cover[1]

Product and formulation Active ingredient	IRAC[2]	Codling moth	Plum curculio	Oriental fruit moth	San Jose scale	REI[4] PHI[3]	Max amt[5] app[6]
Actara (25WDG)	4A	x	4.5-5.5 oz.	x	x	12h	16.5 oz.
thiamethoxam		x	G	x	x	See label	NA
Altacor (35WDG)	28	2.5-4.5 oz.	x	2.5-4.5 oz.	x	4h	9 oz.
chlorantraniliprole		E	x	E	x	5d	NA
Asana XL (0.66EC) **(RUP)**	3A	21-27 fl. oz.	21-27 fl. oz.	4.8-14.5 fl. oz.	4.8-14.5 fl. oz.	12h	101.5 fl. oz.
esfenvalerate		E	G	E	i	21d	NA
Assail 30SG	4A	4.8-14.5 fl. oz.	4.8-14.5 fl. oz.	4.8-14.5 fl. oz.	4.8-14.5 fl. oz.	12h	32 oz.
acetamiprid		E	G	E	s	7d	4
Avaunt (30WDG)	22	4-8 oz.	8 oz.	5-8 oz.	x	12h	24 oz.
indoxacarb		F	G	G	x	14d	4
Azera 0.21EC	UN+3A	x	x	5-6 oz.	x	12h	NA
azadirachtin + pyrethrins		x	x	x	x	0d	10
Dipel	11A	0.5-2 lb.	x	x	x	NA	NA
B.t. kurstaki		F	x	x	x	NA	NA
Baythroid XL (1EC) **(RUP)**	3A	2-2.4 fl. oz.	2.4-2.8 fl. oz.	2-2.4 fl. oz.	2.4-2.8 fl. oz.	12h	2.8 fl. oz.
beta-cyfluthrin		E	G	E	G	7d	NA
Belay (2.13SC)	4A	6 fl. oz.	6 fl. oz.	6 fl. oz.	6 fl. oz.	12h	12 fl. oz.
clothianidin		G	G	G	G	7d	NA
Centaur WDG (70WDG)	16	x	x	x	34.5 oz.	12h	34.5 oz.
buprofezin		x	x	x	E	14d	1
Closer SC (2SC)	4C	x	x	x	5.75 fl. oz.	12h	17 fl. oz.
sulfoxaflor		x	x	x	s	7d	4
Confirm 2F	18	20 fl. oz.	x	x	x	4h	120 fl. oz.
tebufenozide		F	x	x	x	14d	NA
Cyd-X HP	0	0.5-3 fl. oz.	x	x	x	4h	NA
Cydia pomonella granulovirus		F	x	x	x	0d	NA
Danitol 2.4EC **(RUP)**	3A	16-21.3 fl. oz.	16-21.3 fl. oz.	16-21.3 fl. oz.	x	24h	42.7 fl. oz.
fenpropathrin		E	G	E	x	14d	NA
Delegate WG (25WG)	5	4.5-7 oz.	s	4.5-7 oz.	x	4h	28 oz.
spinetoram		E	s	E	x	7d	4
Delta Gold (1.5EC) **(RUP)**	3A	0.9-1.9 fl. oz.	0.9-1.9 fl. oz.	0.9-1.9 fl. oz.	0.9-1.9 fl. oz.	12h	3.6 fl. oz.
deltamethrin		u	u	u	u	21d	NA
Entrust SC (2SC)	5	6-10 fl. oz.	x	6-10 fl. oz.	x	4h	29 fl. oz.
spinosad		G	x	F	x	7d	4
Esteem 35WP	7C	4-5 oz.	x	x	4-5 oz.	12h	10 oz.
pyriproxyfen		F	x	x	E	45d	2
Exirel (0.83SE)	28	8.5-17 fl. oz.	13.5-20.5 fl. oz.	10-17 fl. oz.	x	12h	61.5 fl. oz.
cyantraniliprole		E	G	E	x	3d	3

(continued)

Effectiveness of Insecticides for Control of Apple Insects – First and Second Cover[1] *(continued)*

Product and formulation Active ingredient	IRAC[2]	Codling moth	Plum curculio	Oriental fruit moth	San Jose scale	REI[4] PHI[3]	Max amt[5] app[6]
Imidan 70W	1B	2.1-5.7 lb.	2.1-5.7 lb.	2.1-5.7 lb.	2.1-5.7 lb.	4 or 7d	15.5 lb.
phosmet		G	G	E	F	7d	NA
Intrepid 2F	18	16 fl. oz.	x	12-16 fl. oz.	x	4h	64 fl. oz.
methoxyfenozide		s	x	G	x	14d	NA
Lorsban 75WG **(RUP)**	1B	x	x	x	2-2.6 lb.	4d	NA
chlorpyrifos		x	x	x	E	28d	NA
Madex HP	31	0.5-3 fl. oz.	x	0.5-3 fl. oz.	x	4h	NA
Cydia pomonella granulovirus		G	x	G	x	0d	NA
Movento (2SC)	23	6-9 fl. oz.	x	x	6-9 fl. oz.	24h	25 fl. oz.
spirotetramat		s	x	x	G	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	1.2-4 fl. oz.	1.2-4 fl. oz.	1.2-4 fl. oz.	x	12h	24 fl. oz.
zeta-cypermethrin		E	G	E	x	14d	NA
Neemix 4.5 (0.39L)	UN	4-16 fl. oz.	x	4-16 fl. oz.	7-16 fl. oz.	12h	NA
azadirachtin		F	i	F	u	0d	NA
Oil (superior)	UN	x	x	x	0.5-2%	NA	NA
mineral oil		x	x	x	G	NA	NA
Permethrin 25W	3A	x	6.4-16 oz.	x	x	12h	32 oz.
permethrin		x	G	x	x	See label	NA
Permethrin 3.2EC **(RUP)**	3A	x	4-16 fl. oz.	x	x	12h	20 fl. oz.
permethrin		x	G	x	x	See label	NA
Proaxis (0.5EC) **(RUP)**	3A	2.5-5.1 fl. oz.	2.5-5.1 fl. oz.	2.5-5.1 fl. oz.	2.5-5.1 fl. oz.	24h	1.6 pt.
gamma-cyhalothrin		E	G	G	i	21d	NA
Proclaim (5SG) **(RUP)**	6	4.8 fl. oz.	x	4.8 fl. oz.	x	12 or 48h	1.6 pt.
emamectin benzoate		F	x	F	x	14d	NA
Rimon 0.83EC	15	20-40 fl. oz.	x	20-40 fl. oz.	x	12h	150 fl. oz.
novaluron		E	x	G	x	14d	NA
Sevin XLR Plus	1A	1-3 qt.	1.5-3 qt.	x	1.5-3 qt.	12h	15 qt.
carbaryl		G	G	x	F	3d	8
Sivanto Prime (1.67SC)	4D	x	x	x	10.5-14 fl. oz.	4h	28 fl. oz.
flupyradifurone		x	x	x	G	14d	NA
Verdepryn 100SL (0.83SL)	28	5.5-11 fl. oz.	5.5-11 fl. oz.	5.5-11 fl. oz.	x	4h	33 fl. oz.
cyclaniliprole		E	G	E	x	7d	3
Virosoft CP4	31	1.6-3.2 fl. oz.	x	1.6-3.2 fl. oz.	x	4h	NA
Cydia pomonella granulovirus		F	x	F	x	0d	NA
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 fl. oz.	1.2-2.5 fl. oz.	1.2-2.5 fl. oz.	1.2-2.5 fl. oz.	24h	12.8 fl. oz.
lambda-cyhalothrin		E	E	E	i	21d	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy
x = pest not on the label

Apple Third and Summer Covers – Diseases

Third cover: 10 days after second cover.

Apple Summer Cover Sprays: Depending on rainfall, apply at intervals of 10 to 14 days.

- Fontelis, Inspire Super and Omega have 28d PHI
- Aprovia, Miravis and Sovran have a 30d PHI
- ProPhyt plus captan has provided control of sooty blotch and flyspeck equal to captan plus Topsin-M.
- Captan 80WDG 4 lb. plus the use of an acidifier may be equally effective. Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.

Effectiveness of Fungicides for Control of Apple Diseases – Third and Summer Cover[1]

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Powdery mildew	Scab	Sooty blotch / fly speck	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Aprovia (EC)	7	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	5.5-7 fl. oz.	12h	27.6 fl. oz.
benzovindiflupyr		G-E	F	E-G	E-G	F	30d	NA
Captan 80 WDG	M3	2.5-5 lb.	2.5-5 lb.	5 lb.	2.5-5 lb.	2.5-5 lb.	24h	40 lb.
captan		E*	i	G	G-E	E	0d	NA
Cevya	3	3-5 fl. oz.	3-5 fl. oz.	3-5 fl. oz.	3-5 fl. oz.	3-5 fl. oz.	12h	NA
mefentrifluconazole		G	G-E	E	E	F-G	0d	NA
Ferbam Granuflo (76 WDG)	M3	3.5 lb.	x	3.5 lb.	3.5 lb.	3.5 lb.	24h	NA
ferbam		F	x	F	F	G	NA	3
Flint Extra	11	2.9 fl. oz.	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	2.5-2.9 fl. oz.	2.9 fl. oz.	12h	10.5 fl. oz.
trifloxystrobin		G	G [r]	E [r]	G	G	14d	NA
Fontelis (1.67 SC)	7	x	16-20 oz.	16-20 fl. oz.	x	16-20 fl. oz.	12h	61 fl. oz.
penthiopyrad		x	G	E	x	u	28d	NA
Indar 2F	3	x	6-8 oz.	6-8 fl. oz.	6-8 fl. oz.	x	12h	32 fl. oz.
fenbuconazole		x	E [r]	E [r]	G	x	14d	4
Inspire Super (EW)	3+9	12 fl. oz.	12 fl. oz.	12 fl. oz.	12 fl. oz.	x	12h	60 fl. oz.
difenoconazole + cyprodinil		s	F	E	E	x	28d	NA
Kenja 400SC	7	x	12.5 oz	12.5 oz	x	x	12h	NA
isofetamid		x	s	F	x	x	20d	NA
Luna Privilege (SC)	7	x	2.4-6.8 fl. oz.	4-6.8 fl. oz.	6.8 fl. oz.	x	NA	NA
fluopyram		x	G	G-E	F-G	x	NA	NA
Luna Sensation (SC)	7+11	4-5.8 fl. oz.	5-5.8 fl. oz.	4-5.8 fl. oz.	4-5.8 fl. oz.	4-5.8 fl. oz.	12h	21 fl. oz.
fluopyram + trifloxystrobin		E	G [r]	E [r]	G-E	E	14d	4
Merivon (2.09SC)	7+11	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	12h	22 fl. oz.
fluxapyroxad + pyraclostrobin		E	G	E	E	E	0d	4
Microthiol Disperss	M	10-20 lb.	10-20 lb.	10-20 lb.	x	x	24h	NA
sulfur		u	G	i-F	x	x	0d	NA
Miravis (1.67 SC)	7	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	3.4 fl. oz	4h	13.6 fl. oz.
pydiflumetofen		s-G	G	E	G	s	30d	4
Omega 500F	29	13.8 fl. oz.	x	10-13.8 fl. oz.	10-13.8 fl. oz.	13.8 fl. oz.	12h	138 fl. oz.
fluazinam		F	x	G	F	s-G	28d	10
OSO 5%	19	x	3.75-13 fl. oz.	3.75-13 fl. oz.	x	x	4h	78 fl. oz.
polyoxin D		x	F	F	x	x	0d	6

(continued)

Effectiveness of Fungicides for Control of Apple Diseases – Third and Summer Cover[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Powdery mildew	Scab	Sooty blotch / fly speck	Summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Pristine	11+7	14.5-18.5 oz.	14.5-18.5 oz.	14.5-18.5 fl. oz.	14.5-18.5 oz.	14.5-18.5 oz.	12h	74 oz.
pyraclostrobin + boscalid		F-E	E [r]	E [r]	E	E	0d	4
Procure 480 SC	3	x	8-16 fl. oz.	8-16 fl. oz.	x	x	12h	64 fl. oz.
triflumizole		x	E [r]	G [r]	x	x	14d	NA
Rally 40WSP	3	x	5-10 oz.	5-8 oz.	x	x	24h	5 lb.
myclobutanil		x	E [r]	E-G[r]	x	x	14d	NA
Sercadis	7	x	3.5-4.5 fl. oz.	3.5-4.5 fl. oz.	4.5 fl. oz.	4.5 fl. oz.	12h	18 fl. oz.
fluxapyroxad		x	G	G-E	F	F	0d	4
Sovran (50WG)	11	x	4-6.4 oz.	3.2-6.4 oz.	4-6.4 oz.	4-6.4 oz.	12h	25.6 oz.
kresoxim-methyl		x	G [r]	E [r]	G	G	30d	4
Topguard Specialty Crops (SC)	3	13 fl. oz.	8-12 fl. oz.	13 fl. oz.	x	13 fl. oz.	12h	52 fl. oz.
flutriafol		u	E	G	x	u	14d	4
Topsin-M WSB	1	x	0.7-1 lb.	0.7-1 lb.	0.7-1 lb.	0.7-1 lb.	24h	4 lb.
thiophanate methyl		x	G [r]	i	G-E	G	1d	NA
Vangard WG (75WG)	9	x	x	5 oz.	x	x	12h	30 oz.
cyprodinil		x	x	G	x	x	0d	2
Ziram 76DF	M	6 lb.	x	6 lb.	6 lb.	6 lb.	48h	42.4 lb.
ziram		G	x	G	G	i	14d	7

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Apple Third and Summer Covers – Insects

Third cover: 10 days after second cover.

Apple Summer Cover Sprays: Depending on rainfall, apply at intervals of 10 to 14 days.

Apple maggot flies

- Flies begin emerging from the soil about mid-June. Monitor for the first appearance of flies each year by examining fruit and leaves in the center of trees in detail, using yellow sticky board traps baited with an attractant, hanging red or green spheres coated with a sticky substance in trees, or combining all three methods. Continue applications until late September or as long as flies are present.

Codling moth

- Apply Intrepid or Confirm at initiation of egg hatch for the second-generation codling moth, 1,200 degree days after biofix.

Japanese beetles

- Begin treatments as soon as observed. Multiple applications may be necessary.

Brown marmorated stink bug (BMSB)

- The products below may be needed despite their harm to beneficial arthropods that help control San Jose scale, woolly apple aphid, and mites. The pyrethroids Baythroid, Danitol, Warrior II and Mustang Maxx are labeled for stink bugs, not specifically BMSB, but have shown good efficacy in trials.
- Baythroid XL 1EC, Belay 2.13SC, Danitol 2.4EC, Mustang Maxx, Lannate SP, Lannate LV, and Warrior II are only labeled for general stink bug control.

Effectiveness of Insecticides for Control of Apple Insects – Third and Summer Cover[1]

Product and formulation Active ingredient	IRAC[2]	Apple maggot	BMSB	Codling moth	Japanese beetle	Oriental fruit moth	San Jose scale	Woolly apple aphid	REI[4] PHI[3]	Max amt[5] Max app[6]
Admire Pro (4.6F)	4A	2.8 fl. oz.	x	x	x	x	x	7-10.5 fl. oz.	12h	10.5-14.0 fl. oz.
imidacloprid		G	x	x	x	x	x	G	7d	NA
Altacor (35WDG)	28	2.5-4.5 oz.	x	2.5-4.5 oz.	x	2.5-4.5 oz.	x	x	4h	9 oz.
chlorantraniliprole		s	x	E	x	E	x	x	5d	NA
Asana XL (0.66EC) **(RUP)**	3A	21-27 fl. oz.	4.8-14.5 fl. oz.	21-27 fl. oz.	x	4.8-14.5 fl. oz.	4.8-14.5 fl. oz.	x	12h	101.5 fl. oz.
esfenvalerate		G	E	E	x	E	i	x	21d	NA
Assail 30SG	4A	4.8-14.5 fl. oz.	x	4.8-14.5 fl. oz.	5-8 oz.	4.8-14.5 fl. oz.	4.8-14.5 fl. oz.	2.5-4 oz.	12h	32 oz.
acetamiprid		G	x	E	G	E	s	F	7d	4
Avaunt (30WDG)	22	8 oz.	x	4-8 oz.	x	5-8 oz.	x	x	12h	24 oz.
indoxacarb		F	x	F	x	G	x	x	14d	4
Azera 0.21EC	UN+3A	x	32 fl. oz.	x	2-3.5 pt.	5-6 oz.	x	x	12h	NA
azadirachtin + pyrethrins		x	u	x	G	x	x	x	0d	10
Dipel	11A	x	x	0.5-2 lb.	x	x	x	x	NA	NA
B.t. kurstaki		x	x	F	x	x	x	x	NA	NA
Baythroid XL (1EC) **(RUP)**	3A	2.4-2.8 fl. oz.	2-2.4 fl. oz.	2-2.4 fl. oz.	x	2-2.4 fl. oz.	2.4-2.8 fl. oz.	x	12h	2.8 fl. oz.
beta-cyfluthrin		G	E	E	x	E	G	x	7d	NA
Belay (2.13SC)	4A	6 fl. oz.	6 fl. oz.	6 fl. oz.	x	6 fl. oz.	6 fl. oz.	4-6 fl. oz.	12h	12 fl. oz.
clothianidin		G	G	G	x	G	G	u	7d	NA
Beleaf 50SG	29	x	x	x	x	x	x	2-2.8 oz.	12h	8.4 oz.
flonicamid		x	x	x	x	x	x	F	21d	3
Centaur WDG (70WDG)	16	x	x	x	x	x	34.5 oz.	x	12h	34.5 oz.
buprofezin		x	x	x	x	x	E	x	14d	1
Closer SC (2SC)	4C	x	x	x	x	x	5.75 fl. oz.	x	12h	17 fl. oz.
sulfoxaflor		x	x	x	x	x	s	x	7d	4
Confirm 2F	18	x	x	20 fl. oz.	x	x	x	x	4h	120 fl. oz.
tebufenozide		x	x	F	x	x	x	x	14d	NA
Cyd-X HP	0	x	x	0.5-3 fl. oz.	x	x	x	x	4h	NA
Cydia pomonella granulovirus		x	x	F	x	x	x	x	0d	NA
Danitol 2.4EC (**RUP**)	3A	16-21.3 fl. oz.	x	16-21.3 fl. oz.	16-21.3 fl. oz.	16-21.3 fl. oz.	x	x	24h	42.7 fl. oz.
fenpropathrin		G	x	E	E	E	x	x	14d	NA
Delegate WG (25WG)	5	6-7 oz.	x	4.5-7 oz.	x	4.5-7 oz.	x	x	4h	28 oz.
spinetoram		s	x	E	x	E	x	x	7d	4
Delta Gold (1.5EC) **(RUP)**	3A	0.9-1.9 fl. oz.	1.9 fl. oz.	0.9-1.9 fl. oz.	x	0.9-1.9 fl. oz.	0.9-1.9 fl. oz.	x	12h	3.6 fl. oz.
deltamethrin		u	u	u	x	u	u	x	21d	NA
Entrust SC (2SC)	5	6-10 fl. oz.	x	6-10 fl. oz.	x	6-10 fl. oz.	x	x	4h	29 fl. oz.
spinosad		s	x	G	x	F	x	x	7d	4

(continued)

Effectiveness of Insecticides for Control of Apple Insects – Third and Summer Cover[1] *(continued)*

Product and formulation Active ingredient	IRAC[2]	Apple maggot	BMSB	Codling moth	Japanese beetle	Oriental fruit moth	San Jose scale	Woolly apple aphid	REI[4] PHI[3]	Max amt[5] Max app[6]
Esteem 35WP	7C	x	x	4-5 oz.	x	x	4-5 oz.	x	12h	10 oz.
pyriproxyfen		x	x	F	x	x	E	x	45d	2
Exirel (0.83SE)	28	13.5-20.5 fl oz.	x	8.5-17 fl. oz.	x	10-17 fl. oz.	x	x	12h	61.5 fl. oz.
cyantraniliprole		s	x	E	x	E	x	x	3d	3
Imidan 70W	1B	2.1-5.7 lb.	x	2.1-5.7 lb.	2.1-5.7 lb.	2.1-5.7 lb.	2.12-5.7 lb.	x	4 or 7d	15.5 lb.
phosmet		E	x	G	G	E	F	x	7d	NA
Intrepid 2F	18	x	x	16 fl. oz.	x	12-16 fl. oz.	x	x	4h	64 fl. oz.
methoxyfenozide		x	x	s	x	G	x	x	14d	NA
Lannate LV (2.4WSL) **(RUP)**	1A	x	1.5-3 pt.	3 pt.	x	x	x	x	3d	15 pt.
methomyl		x	i	G	x	x	x	x	14d	5
Lorsban 75WG **(RUP)**	1B	x	x	x	x	x	2-2.67 lb.	x	4d	NA
chlorpyrifos		x	x	x	x	x	E	x	28d	NA
Madex HP	31	x	x	0.5-3 fl. oz.	x	0.5-3 fl. oz.	x	x	4h	NA
Cydia pomonella granulovirus		x	x	G	x	G	x	x	0d	NA
Movento (2SC)	23	x	x	6-9 fl. oz.	x	x	6-9 fl. oz.	6-9 fl. oz.	24h	25 fl. oz.
spirotetramat		x	x	s	x	x	G	G	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	1.2-4 fl. oz.	1.2-4 fl. oz.	1.2-4 fl. oz.	1.2-4 fl. oz.	1.2-4 fl. oz.	x	x	12h	24 fl. oz.
zeta-cypermethrin		G	E	E	E	E	x	x	14d	NA
Neemix 4.5 (0.39L)	UN	x	7-16 fl. oz.	4-16 fl. oz.	4-16 fl. oz.	4-16 fl. oz.	7-16 fl. oz.	5-7 fl. oz.	12h	NA
azadirachtin		x	u	F	F	F	u	u	0d	NA
Oil (superior)	UN	x	x	x	x	x	0.5-2%	x	NA	NA
mineral oil		x	x	x	x	x	G	x	NA	NA
Proaxis (0.5EC) **(RUP)**	3A	2.5-5.1 fl. oz.	2.5-5.1 fl. oz.	2.5-5.1 fl. oz.	2.5-5.1 fl. oz.	2.5-5.1 fl. oz.	2.5-5.1 fl. oz.	x	24h	1.6 pt.
gamma-cyhalothrin		G	E	E	E	G	i	x	21d	NA
Proclaim (5SG) **(RUP)**	6	x	x	4.8 fl. oz.	x	4.8 fl. oz.	x	x	12 or 48h	1.6 pt.
emamectin benzoate		x	x	F	x	F	x	x	14d	NA
Rimon 0.83EC	15	x	20-30 fl. oz.	20-40 fl. oz.	x	20-40 fl. oz.	x	x	12h	150 fl. oz.
novaluron		x	i	E	x	G	x	x	14d	NA
Sevin XLR Plus	1A	1.5-3 qt.	x	1-3 qt.	1.5-3 qt.	x	1.5-3 qt.	1.5-3 qt.	12h	15 qt.
carbaryl		G	x	G	E	x	F	i	3d	8
Sivanto Prime (1.67SC)	4D	x	x	x	x	x	10.5-14 fl. oz.	12-14 fl. oz.	4h	28 fl. oz.
flupyradifurone		x	x	x	x	x	G	s	14d	NA
Surround WP (95WP)	UN	x	x	x	25-50 lb.	x	x	x	4h	NA
kaolin		x	x	x	s	x	x	x	0d	NA
Verdepryn 100SL (0.83SL)	28	x	5.5-11 fl. oz.	5.5-11 fl. oz.	x	5.5-11 fl. oz.	x	x	4h	33 fl. oz.
cyclaniliprole		x	s	E	x	E	x	x	7d	3

(continued)

Effectiveness of Insecticides for Control of Apple Insects – Third and Summer Cover[1] *(continued)*

Product and formulation Active ingredient	IRAC[2]	Apple maggot	BMSB	Codling moth	Japanese beetle	Oriental fruit moth	San Jose scale	Woolly apple aphid	REI[4] PHI[3]	Max amt[5] Max app[6]
Versys Inscalis (0.83DC)	9D	x	x	x	x	x	x	3.5 fl. oz.	12h	7 fl. oz.
afidopyropen		x	x	x	x	x	x	s	7d	NA
Virosoft CP4	31	x	x	1.6-3.2 fl. oz.	x	1.6-3.2 fl. oz.	x	x	4h	NA
Cydia pomonella granulovirus		x	x	F	x	F	x	x	0d	NA
Vydate L (2L) **(RUP)**	1A	x	1.5-4 pt.	x	x	x	x	x	48h	8 pt.
oxamyl		x	i	x	x	x	x	x	14d	4
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 fl. oz.	1.2-2.5 fl. oz.	1.2-2.5 fl. oz.	1.2-2.5 fl. oz.	1.2-2.5 fl. oz.	1.2-2.5 fl. oz.	x	24h	12.8 fl. oz.
lambda-cyhalothrin		F	E	E	E	E	i	x	21d	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/Insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Special Problems and Pests of Apple

For more detailed information about disease and insect control and integrated pest management (IPM), consult the *Midwest Tree Fruit Pest Management Handbook* and use it in conjunction with this guide. Contact your state's Cooperative Extension service to get a copy.

Horticultural Management

Special Notes for Growth Regulator Use in Apples

Edited by John Strang, Elizabeth Wahle, and Daniel Becker

Blush on Apples

Blush and Blush 2x contain 5.25% and 10% Prohydrojasmon propyl-3-oxo-2-pentylcyclo-pentylacetate, respectively. Blush is used to promote early color change in red apples that have difficulty developing color. Effectiveness depends on cultivar and environmental conditions. Cultivars or strains in environments where color development is normally satisfactory may not develop significant additional red color.

Make 1-2 applications of Blush at 26-52 fl. oz. or Blush 2X at 13-52 fl. oz. per acre per year at 7-14 day intervals, 7-42 days prior to anticipated harvest. Use the higher rate if environmental conditions are not as favorable for color development. Avoid applications during the hottest part of the day. Apply under slow-drying conditions in early morning or at night. Do not apply to stressed or injured trees.

Ethephon on Apples

Ethephon, which is available as a 21.3% formulation of 2-chloroethylphosphonic acid (Ethrel, or Motivate), may:

1. Promote early color development and maturity.
2. Loosen fruit for easier harvesting by hand or machine.
3. Increase fruit bud formation and early bearing on young trees.
4. Promote fruit thinning and return bloom.
5. Cause premature fruit drop, particularly on spur-type trees.

Promoting Early Color Development and Maturity

To increase red coloration and early maturity, apply Ethephon 2 14 to 21 days prior to anticipated harvest and 1-2 weeks before the preferred harvest time at 1-4 pt. per acre for early to mid-season maturing varieties and 2-4 pt. per acre for later maturing (maturing after McIntosh) varieties. Apply in a dilute spray with plenty of water to ensure thorough coverage.

Color development should be apparent in about 7 days. Ethephon 2 is most effective under weather conditions that favor color development.

Do not apply ethephon during hot weather or when hot weather is forecasted in the next 14 days. Apply ethephon between 60°F and 90°F. Most red apple varieties do not develop red color during hot weather with or without ethephon. Ethephon speeds up ripening. Do not use ethephon on Golden Delicious.

Add a fruit drop inhibitor to control pre-harvest drop of the fruit. You can add napthaleneacetic acid (NAA) to the same spray as ethephon. NAA is effective for 7 to 10 days, and a second application might be necessary if harvest is delayed.

No spreader-sticker is necessary. Ethephon does not overcome poor management practices. Trees of moderate vigor, well-pruned, and thoroughly sprayed, respond most favorably with well-colored fruit of uniform maturity. For dense trees, harvest outer fruit first and then apply ethephon. Harvest at proper maturity; do not delay harvest to obtain additional red coloration. Treat only the acreage that you can harvest and market in a timely manner. You should promptly market fruit treated with ethephon because it may have short shelf life.

Increasing Early Bearing on Young Trees

To increase fruit bud development on young, nonbearing trees, apply a foliar spray of Ethephon 2 2 to 4 weeks after full bloom. Spray trees thoroughly almost to runoff at 2-8 pt. per acre.

Increasing Flower Bud Development on Bearing Trees

Delay treatment until after June drop and six weeks following full bloom to help prevent fruit thinning. Apply 0.5-3 pt. per acre. Yield and fruit size reduction may occur; however, flowering should increase the following spring.

Do not use on low vigor trees, as excessive growth reduction may occur.

Stop-Drop Sprays

If used properly, stop-drop sprays of napthaleneacetic acid (NAA) can significantly reduce pre-harvest apple drop. Use knowledge of orchard conditions when applying stop-drop sprays, and keep notes on the responses in your orchard.

Concentration and Timing of Stop-Drop Application

Variety	Application Time Before Picking (days)	NAA Concentration (ppm)
Red Delicious	7-10	10-15
Jonathan	7-10	10
Golden Delicious	7	10
Rome Beauty	7	10
Winesap	7	15

Apply NAA (Fruitone N, Amid-Thin W, K-salt Fruit Fix 800, K-salt Fruit Fix 200, and PoMaxa) before the beginning of fruit drop (7 to 14 days before harvest) at the rate of 5 ppm for summer varieties and 10 ppm for late varieties. This application should normally prevent fruit drop for 7 to 10 days.

Make a second NAA application within 7 to 10 days of the first application if fruits were not harvested. Do not exceed two NAA applications. Do not apply within two days of harvest. NAA works best as a dilute spray.

Using NAA too early, or in greater than recommended concentrations, may accelerate fruit maturity and decrease storage life. Apply stop-drop sprays at concentrations no higher than 3x. You may apply stop-drop sprays with pesticides. Do not use stop-drop sprays on trees in low states of vigor; healthy leaves are essential for these sprays to be effective.

ReTain

For Harvest Management

ReTain is labeled on apple, pear, peach, nectarine, plum, prune, and apricot. The active ingredient in ReTain is aminotheoxy-vinylglycine (AVG), a natural inhibitor of ethylene synthesis. Ripening fruit normally produces ethylene gas, which promotes further ripening and pre-harvest drop in some varieties. After treatment with ReTain, fruit produce less ethylene, which slows the ripening process and reduces pre-harvest drop.

Growers who have large plantings of a variety may consider applying ReTain to some of the planting as a harvest management tool to allow a later harvest of treated trees.

Timing. Best results are obtained when ReTain is applied before the first visible signs of ripening. Research has shown that ReTain should be applied four weeks before the optimum harvest date on apples and one or two weeks before the anticipated beginning of the normal harvest period for untreated fruit for other fruit types. The PHI for ReTain is 7 days.

Application rate. Apply ReTain as a single or double application. The label rate is one pouch (11.7 oz.) or two pouches per acre. For apples apply one pouch per acre 28 days prior to the anticipated beginning of the normal harvest period for untreated fruit. A second application may be made to enhance the effects of ReTain. Apply one pouch of ReTain per acre 14 to 21 days after the first application, but not less than 7 days before harvest. The second application helps fruit retain their firmness during storage. Maintain spray solution pH between 6 and 8.

Dilute ReTain in at least 100 gal. of water per acre. Best results are obtained when applied under slow drying conditions in the morning or evening.

Thorough wetting and coverage are essential for optimum effectiveness. Although ReTain seems to be compatible with other materials, it should only be applied with other products if compatibility has been verified. Do not apply if rain is expected within eight hours of application.

Additives. Include a 100% organosilicone surfactant at 0.05 to 0.1 percent (v/v) (e.g., Widespread Max).

For Increasing Fruit Set

ReTain is labeled to increase fruit set on apples, European pears, peaches, and cherries. Make a single application from pink to full bloom on apple, from white bud to full bloom on pear, and from balloon stage to first bloom on cherries. Never apply ReTain earlier or later than these stages.

Comments. ReTain is expensive; therefore, use it only on high-value, productive blocks with good fruit quality. Store treated fruit separately. Do not use an adjuvant for bloom applications. Do not apply more than two pouches of ReTain per acre per year.

ProVide 10SG on Apples

Russeting

Applying ProVide, a mixture of gibberellins A4 and A7, reduces (but does not eliminate) russeting on Golden Delicious.

Apply ProVide two to four times with the first spray beginning at petal fall and continuing at 7- to 10-day intervals. The rate is 2.1 to 3.5 oz (60-100) grams of ProVide applied in 100 gal. of solution per application per acre. Spray additives are not required and have the potential to cause russeting.

Under conditions of high humidity and rain, you will obtain best russet control with four 3.5 oz. (100-gram) per-acre applications. Do not use excessive spray volumes, because excess moisture can induce russet. Direct 85 percent of the spray volume to the upper two-thirds of the tree.

Stayman Cracking

Apply three to six consecutive sprays at 14- to 21-day intervals at an application rate of 1.8-3.5 oz. (50-100 grams) of ProVide per 50 gal. per half acre, per application. The use of a nonionic surfactant enhances spray coverage and improves absorption for cracking suppression. Do not use ProVide for cracking suppression if ProVide has been used in the same season on the same fruit for russet suppression. (REI is 4 hours.)

Because weather changes influence cracking, and because cracking can occur over extended periods,

multiple applications have given the best response. Apply ProVide early in the morning or late in the evening under slow drying conditions to maximize absorption.

Promalin on Apples

Promalin contains 1.8% N-(phenylmethyl)-1H-purine 6-amine and 1.8 percent gibberellins A4 and A7. A single application to Delicious from early king bloom to the early stages of petal fall of the side blossoms elongate the fruit and encourages the development of more prominent calyx lobes.

The application rate is 1 to 2 pt. in 75 to 200 gal. of spray mixture per acre. If the bloom period is prolonged, two lower rate applications provide better results. Make the first application of 0.5 to 1 pt. of Promalin per acre at the beginning of the bloom period as above. Make the second application of 0.5 to 1 pt. of Promalin per acre three to 21 days later when the remainder of the canopy comes into bloom.

Do not exceed 2 pt. per acre for the combined sprays. Do not apply Promalin when air temperatures are below freezing or higher than 90°F.

Promalin for Branching

Promalin may be used as a single application alone or in a Promalin-latex paint spot application to apples, non-bearing pears, and non-bearing sweet cherries. This treatment increases lateral bud break and shoot growth and improves branch angles to produce a stronger, better-shaped tree for early production. You must apply to non-bearing pear and sweet cherry one year before harvest.

You can make foliar Promalin applications on bearing and nursery apples and non-bearing pears at 1-3 inches of new terminal growth. The applications rate is 125-500 ppm (0.25-1 pt. of Promalin per 5 gal. of spray solution). On apple, non-bearing pears, and non-bearing sweet cherries, you may treat trees when they have reached a terminal height at which lateral branching is desired. For this treatment, apply Promalin at 250-1,000 ppm (0.5-2 pt.) per 5 gal. of spray solution.

You must make Promalin-latex paint applications before bud break or you may injure new shoot tips, causing shoot growth failure. Apply uniformly to cover the bark surface with a brush or sponge only on one-year-old wood. The application rate is 5,000 to 7,500 ppm (0.2-0.33 pt. or 3.2-5.3 fl. oz.) of Promalin per pint of latex paint.

Chemical Thinning of Apples

Chemical sprays can reduce fruit set on apples and promote larger fruit size at harvest and increase return bloom. These have become standard practices in most commercial orchards. Proper use is vital to the success of chemical thinning.

NAA (naphthalene acetic acid), NAD (naphthalene acetamide), Sevin (1-naphthyl-N-methyl-carbamate), and MaxCel (6-benzyladenine) are suggested.

Apply NAA to fall and winter varieties when king fruit are 11 to 13 mm in diameter. Sevin is more effective than NAA for fruit larger than 13 mm. Sevin gives uniform results from petal fall to 21 days later. NAD is most effective when applied from late bloom to petal fall. NAD is milder than NAA and is less likely to cause over-thinning.

You can combine NAA and Sevin, and apply it on fall and winter varieties when king fruit are 11 to 13 mm in diameter, and on summer varieties (Wealthy and Earliblaze) at petal fall.

Applying NAA to early summer varieties may result in excessive foliage injury, fruit cracking, and premature ripening.

In the warmer parts of the Midwest, concentrations of NAA that successfully thin frequently cause pygmy apples on spur-type Red Delicious. These small seedless apples persist through harvest and are a nuisance. Sevin is preferred for thinning spur-type Red Delicious. In some experiments, Sevin has over-thinned Rome and Gallia Beauty, so do not use it on these varieties.

NAA is not successful in thinning Fuji, as this often results in pygmy apples. Honeycrisp is easy to overthin, so you should use combinations.

You can avoid the variability of results and excessive foliage injury often experienced with NAA by using it at one-third and one-half of the rates recommended on the label in combination with 0.75 pt. of Tween 20 (also sold as Scattics, Akest TW 20) per 100 gal. Adding Tween 20 increases the rate of foliar absorption and decreases the effects of seasonal factors, such as temperature, relative humidity, and wind, on the drying rate and amount of material entering the leaf. Eliminating foliage wilting and tree "shock" results in better fruit size at harvest than the same amount of fruit thinning obtained by the full dosage of NAA alone.

Wetting agents that have been used successfully in tests in Illinois and Indiana include Regulaid and Nu Film 17.

MaxCel, Rite Way, Exilis 9.5 SC, Exilis Plus for Thinning

Apply 75 to 200 ppm in spray volumes of a minimum of 100 gal. per acre. Use a sufficient volume to ensure complete coverage. In most cases, 100 gal. per acre is adequate.

Apply when the average king fruitlets on apples and pears are 5 to 15 mm in diameter. Only two applications are allowed per season. Do not exceed 308 fl. oz. (182 grams 6-BA) of MaxCel or RiteWay, 61.6 fl oz Exilis 9.5 SC or 296 fl. oz. of Exilis Plus per acre per season for all uses. MaxCell works best at a water pH of 5-7 and the pH should not exceed 8.5. Do not apply within 86 days of harvest. Do not add surfactant to tank.

Applications are most effective when the maximum temperature is above 65°F on the day of application and the following two to three days. Apply under slow drying conditions in the morning or evening to enhance uptake. If applied in the morning, wait until most of the dew has dried off. Generally, one application is sufficient.

Do not tank mix these materials with products that contain NAA and use on varieties that are susceptible to producing pigmy fruit when treated with NAA (especially Red Delicious and Fuji).

Fuji Thinning

Fuji has been notoriously difficult to thin in the past. On young trees MaxCel at 100 ppm (2 qt.) + 1 qt. Sevin XLR per 100 gal. has worked well.

There are two options on mature trees with a heavy set:

1. 150 ppm (3 qt.) MaxCel + 1 qt Sevin XLR
2. If **captan has not been used** prior to this during the current season: 100 ppm (2 qt.) MaxCel + 1 qt. Sevin XLR + 1 qt. horticultural spray oil per 100 gal.

Important Reminders about Chemical Thinning

NAA generally gives best results under fast drying conditions and when the temperature is between 70°F and 75°F. Amid-Thin gives best results under slow drying conditions and is often applied in the evening.

Thorough spraying and uniform coverage are necessary for satisfactory results. However, to reduce the degree of thinning or avoid over-thinning, reduce the concentration (but not amount) per tree.

Lower limbs are easier to thin. Reduce spray application on lower limbs by shutting off one or more nozzles. Some spray applied to the tree tops will fall on lower limbs.

Concentrate chemical thinner sprays have been satisfactory. Calibration allows the right amount of material to reach all parts of the tree and row. Avoid double applications to row ends, etc. Miscalibrating the sprayer manifold is magnified in concentrate application. Concentrating more than 4x has provided variable results, and should be avoided.

Applying chemical thinning sprays after frost or freezing temperatures is risky. Foliage exposed to such conditions absorbs chemicals more readily, and over-thinning may result. If you must spray under such conditions, reduce the concentration 25 to 30 percent.

Chemical thinners are generally more effective under the following conditions:

1. Low vigor trees
2. Light pruning
3. Heavy bloom
4. Poor pollination
5. High humidity before spraying
6. Slow drying of spray
7. Poor air drainage
8. Cloudy, cool weather preceding or following the bloom period

Keep records of the prevailing conditions when you make applications and leave several trees unsprayed to evaluate the results of thinning. This allows you to work out the concentrations best suited for your orchard.

Defruiting Young Apple Trees

It is often desirable to remove all the fruit from young trees when they have not reached a profitable bearing size. NAA at 15 ppm + Sevin XLR at 1 qt./100 gal. applied at petal fall effectively defruits Jonathan, Red Delicious, and McIntosh. For other cultivars, use NAA at the recommended rate + Sevin XLR at 1 qt./100 gal. These sprays may not completely defruit the trees, but higher NAA rates may cause leaf damage.

Promoting Return Bloom

NAA may be used to promote return bloom for the following season in young trees that are not initiating enough flower buds and on older trees prone to biennial bearing that produce few flowers in off years such as Fuji, Jonagold, Mutsu, Braeburn and Golden Delicious. An application at a spray concentration of 3 to 5 ppm five to six weeks after full bloom in enough water to provide good coverage will increase bloom the following season. An additional one to two applications at 7 to 10-day intervals may be used for certain varieties that do not respond sufficiently based on previous experience.

Recommended Chemical Thinners for Apple[1]

Cultivars	NAD[2,3] (PPM)	NAA[2,4] (PPM)	NAA2 +WA[5] (PPM)	Sevin XLR Plus[2,6,7] (qt./100 gal.)	MaxCel[2,8]	Combinations[2,3,7,8] (PPM + qt./100 gal)
Summer Varieties	35-50				E	NAA 5-10 + Sevin 1/2-1
Paulared		5-10	3-5	1/2-1	M	
Gala		5-10	3-5	1/2-1	M	
Jonamac		5-10	3-5	1/2-1	M	
McIntosh	35-50	7 1/2-12	3-5	1/4-1/2	E	
Jonathan	35-50	7 1/2-12	3-5	1/4-1/2	E	
Spartan		10-15	5-7 1/2	1/2-1	?	
Cortland	35-50	7 1/2-12	3-5	1/4	E	
Grimes Golden	35-50	5-10	5-7 1/2		?	NAD 25-50 + Sevin 1/2-1
Red Delicious/non-spur		5-10	3-5	1/2-1	E	
Red Delicious/spur		5-10	5-7 1/2	1/2-1	M	
Honeycrisp		3-5		1/4-1/2	?	N.R.[9]
Empire		10-15	5-7 1/2	1/2-1	E	
Golden Delicious		10-20	5-10	1/2-1	M	NAA 5-10 + Sevin 1/2-1
Blushing Golden				1/4-1/2	?	
Firmgold				1/4-1/2	?	
Idared				1/2-1	E	
Winesap	35-50	7 1/2-10	3-5	1/2-1	E	
Stayman and Turley	35-50	7 1/2-10	3-5	1/2-1	M	
Braeburn		7 1/2	7 1/2			NAA 7 1/2 + Sevin 1
Rome	50-60	15-20	7 1/2-10	N.R.[9]	E	
Fuji[8]		N.R.[9]			H	MaxCel 150 ppm + Sevin 1

[1] See Apple *Thinning Guide* by P. Schwallier (Great Lakes Publishing) and the Tree Fruit Production Guide (Penn State University Extension publication AGRS-045, extension.psu.edu/plants/tree-fruit/tfpg).
[2] Lower concentrations suggested when conditions are favorable for thinning.
[3] Apply NAD (Amid-Thin) from late bloom to petal fall.
[4] Apply NAA, Sevin, or combinations to fall and winter varieties when king fruits are 11-13 mm in diameter. On summer varieties (such as Wealthy and Earliblaze) apply the combination at petal fall.
[5] WA = wetting agent: Regulaid at 0.5 pt. per 100 gal.
[6] Adding NAA at 2.5-4 ppm to Sevin stimulates the initiation of fruit buds for return bloom. This low-NAA rate should not thin fruit or cause pygmy apples on Red Delicious.
[7] The Sevin XLR Plus formulation is most commonly used for thinning and is the only formulation labeled for early use (80% petal fall to 6 mm fruit diameter). Reduce spray application to lower portion of tree to avoid overthinning. Consult the label if you use other Sevin formulations.
[8] Variety ease of thinning with MaxCel: E = easy. M = moderate. H = hard. See MaxCel Recommendation Tables for suggested rates of Maxcel and Sevin for thinning.
[9] N.R. = not recommended.

MaxCel for Apples and Pears

Use	For Fruit Thinning, Sizing, and Enhanced Return Bloom
Application	Apply 75 to 200 ppm spray concentration. Refer to dilution table on label for assistance.
Spray Volume	Use sufficient volume to ensure complete tree coverage.
Spray Timing	Apply when average king fruit diameter is 5-15 mm. 10 mm is optimal. Do not apply more than twice in a season.

MaxCel for Thinning Apples Only[1]

Thinning Difficulty	Aggressive	Moderate	Slight
Hard to thin	100-150 ppm + Sevin + oil	100 ppm + Sevin	100 ppm
Moderate to thin	100 ppm + Sevin	75-100 ppm + Sevin	75 ppm
Easy to thin	75-100 ppm + Sevin	75 ppm	50-75 ppm

[1] See Recommended Chemical Thinners for Apples for variety thinning difficulty rating.

MaxCel Dilution Table[1]

Fluid ounces of MaxCel per 100 gallons of spray required to obtain given ppm concentrations.

10 ppm	25 ppm	50 ppm	75 ppm	100 ppm	125 ppm	150 ppm	175 ppm	200 ppm
6	16	32	48	64	80	96	112	128

[1] MaxCel contains 75 grams active ingredient per 128 fl. oz. (1 gal.).

NAA Formulations

Not all NAA formulations have the same amount of active ingredients. Because calculating ppm can be difficult, this table describes materials and amounts of formulation per 100 gal. of water required to make a 10 ppm solution (table developed by R. Marini, VPI).

NAD and NAA Formulations for Chemical Thinning of Apples

Trade Name	Chemical	Formulation	Acid Equivalent (% of active ingredient)	Amount of Formulation per 100 gal. to make 10 ppm
Amid-Thin W	1-Napthaleneacetamide	WP	8.4	1.6 oz.
Fruitone N	1-Napthaleneacetic acid, sodium salt (3.5%)	WP	3.1	4.0 oz.
PoMaxa	1-Napthaleneacetic acid, sodium salt (3.5%)	liquid	3.1	4.0 fl. oz.
K-salt Fruit Fix 800	1-Napthaleneacetic acid, potassium salt (24.2%)	liquid	20.2	0.63 fl. oz.
K-salt Fruit Fix 200	1-Napthaleneacetic acid, potassium salt (6.25%)	liquid	5.18	2.47 fl. oz.

Promoting Branching on High-Density Dwarf Fruit Trees

Branch inducing growth regulators contain cytokinins, gibberellins or both. Cytokinins stimulate cell division and differentiation and promote shoot initiation and release of lateral buds from apical dominance; they also play an indirect role in overcoming dormancy. Gibberellins, like cytokinins, promote cell division while also stimulating elongation to increase shoot length. However, at rates high enough to stimulate growth, gibberellins will entirely de-fruit trees and inhibit return bloom. Growers who wish to promote lateral branching, but who also desire a potential crop the following year to manage vigor, should apply a cytokinin only bioregulator. Lower rates of active ingredient used to moderately thin fruit, reduce russeting, improve size or shape, or to increase fruit set after frost will not diminish return bloom.

The following are some chemical plant growth regulators labeled for lateral branch promotion on tree fruits. Be sure to check the product registration as some are not available for distribution in all states. Cytokinins: Maxcel® – Valent Biosciences, LLC (not registered in KS, NE, OK); Cytokin® – Miller Chemical & Fertilizer, LLC (not registered in KY, IA, KS, NE); Exilis® 9.5 SC – Fine Americas, Inc. (not registered in AR, IA, IN, IL, KY, KS, MO, NE, OK). Cytokinins and gibberellins: Promalin® – Valent BioSciences, LLC; Typy® – Nufarm Americas, Inc.; Cytoplex® HMS® – Miller Chemical & Fertilizer, LLC (not registered in IA, KY, KS, NE, OK, WV); Perlan® – Fine Americas, Inc. (not registered in AR, IA, IN, IL, KY, KS, MO, NE, OK).

Foliar sprays are effective starting when terminal growth is 1-3 inches long at the time of application.

Rates for non-bearing trees are generally between 125 and 500 ppm for apples and 250 and 1,000 ppm for pears and sweet cherries. For first-leaf apple trees received from the nursery as whips, apply 500 to 1,000 ppm of MaxCell 20 days after bud break followed about a week or so later by removal of the 2nd through 4th apical buds on the leader. For second and third-year apple trees, apply 200-300 ppm (non-bearing) or 200 ppm (bearing) of MaxCel. Spreading of some rapidly growing shoots is usually necessary, but for most, the crotch angles that develop are wider compared to other branch-promoting techniques and require less manual labor for correction.

For further information on branch promotion see https://www.uky.edu/hort/sites/www.uky.edu.hort/files/documents/HortFact3011.pdf

Managing the Shoot Blight Phase of Fire Blight with Apogee

Apogee is used on apple trees for two reasons:

- To reduce shoot growth because trees are overly vigorous because of crop loss, inappropriate rootstock, tree spacing, or excessive nitrogen fertization.
- To reduce the risk and reduce susceptibility to fire blight.

Apogee (prohexadione calcium) inhibits gibberellin biosynthesis, which stops terminal growth early. Apogee can decrease the length of shoots by 30 to 60 percent. Apogee does not affect blossom blight occurrence, but when used effectively, reduces the occurrence of shoot blight. Shoots with inhibited growth are less susceptible to fire blight. The decrease in blight susceptibility does not occur until about 10

to 14 days after application. Note that apple varieties differ in their susceptibility to damage from Apogee. Do not apply Apogee to Empire or Stayman varieties, because it causes cracking on these varieties.

Consider using Apogee to reduce the threat of shoot blight on vigorous trees of susceptible varieties that have nearly filled their tree space. Apogee only decreases host susceptibility; it does not affect the pathogen directly. Apogee is not a substitute for streptomycin for blossom blight control during bloom. If needed, you can combine Apogee with streptomycin in one of the bloom sprays.

You should apply Apogee (27.5% W) when shoot growth is 1 to 3 inches (usually at king bloom petal fall on most varieties). Ohio has a special local needs label allowing the application of Apogee between pink and 1-3 inches of new growth until December 31, 2022. Split applications have been shown to provide longer shoot suppression during the summer. Vegetative suppression lasts 2-5 weeks only during the current growing season. When fire blight is a concern, increase the first Apogee application to help control vigor early and reduce the risk of fire blight.

Apogee is locally systemic. This means if you spray the tops of trees, Apogee has an effect only on the tops where it was applied. This allows growers to use Apogee in problematic areas of trees that need localized control. For example, if the bottoms of trees had frost damage that resulted in a low crop load, applying Apogee to the bottoms will control the excessive growth. Tree vigor, variety (see table below), crop load, and application timing affect the efficacy of Apogee and the rate needed.

Apogee can cause a tree to retain more fruit and thinning programs will need to be adjusted for this. To decrease June drop on trees with light bloom, apply Apogee at 1-3 inches of new shoot growth using 10-12 oz per 100 gallons of dilute spray or 30-36 oz per acre (based on 300 gallons of dilute spray per acre).

Applying Apogee in the same season as ProVide reduces the effectiveness of both growth regulators.

Timing. Apply Apogee 27.5W at full bloom to early petal fall on the king blooms for maximum effectiveness. Apogee is considerably less effective if applied too late. The decrease in blight susceptibility does not occur until about 10 to 14 days after application.

Additives. Use a nonionic surfactant with Apogee. Follow the manufacturer's rate recommendations. If you mix Apogee in hard water (water that contains high levels of calcium carbonate), add 1 lb. of spray-grade ammonium sulfate for each pound of Apogee.

Comments. Apogee's ability to control growth does not depend on concentration. There is no difference in shoot growth control between dilute and concentrate sprays, provided the total amount of chemical per acre is the same. Apogee's level of growth control is rate dependent. The recommended rate provides the greatest and quickest reduction, and the effect on growth declines as the rate is reduced. Do not tank mix Apogee with boron, calcium chloride, or calcium nitrate. Apogee is rainfast after 8 hours. (REI is 12 hours; PHI is 45 days.)

Application Rates for Vegetative Growth Control in Apples

Application Timing	Apogee plant growth regulator Rate per 100 gallons of Dilute Spray[1] (oz)	Apogee Rate per acre[2] (oz)	Restrictions
Medium to high vigor trees Apply at 1-3 inches of new shoot growth. For best results, make subsequent applications at 1- to 4-week intervals and before or immediately after the shoots show signs of regrowth.	6 to 12	18 to 36	**DO NOT** apply more than 48 oz./A (3 lb.) of **Apogee** within any 21-day interval. **DO NOT** apply more than 99 oz./A (6.2 lb.) of **Apogee** per year.
Low vigor trees Apply at 1-3 inches of new shoot growth. For best results, make subsequent applications at 1- to 4-week intervals and before or immediately after the shoots show signs of regrowth.	3 to 8	9 to 24	
Long growing season Apply at 1 to 3 inches of new shoot growth. Make second and third applications at 7- to 14-day intervals. Make subsequent applications as needed at 10- to 14-day intervals.	3 to 8	9 to 24	

[1]Refer to the **Application Instructions** section for rate calculations on the label.
[2]Based on 300 gallons of dilute spray per acre.

Application Rates for Fire Blight Infections of Shoots (Shoot Blight) for Susceptible Apple Varieties

Application Timing	Apogee plant growth regulator rate per 100 gallons of Dilute Spray[1] (oz)	Apogee Rate per acre[2] (oz)	Restrictions
To reduce fire blight infections of shoot by decreasing vegetative growth Apply at 1-3 inches of new shoot growth. Make a second application if new shoot growth occurs.	6 to 12	18 to 36	**DO NOT** apply more than 48 oz./A (3 lb.) of **Apogee** within any 21-day interval. **DO NOT** apply more than 99 oz./A (6.2 lb.) of **Apogee** per year.

[1]Refer to the **Application Instructions** section for rate calculations on the label.
[2]Based on 300 gallons of dilute spray per acre.

Selected Apple Varieties and Their Sensitivity to Apogee

Apogee Sensitivity	Varieties	Recommendation
very sensitive	Cortland, Gala, Ginger Gold, Northern Spy, Paula Red, Rome	Consider reducing spray rates.
sensitive	Fuji, Golden Delicious, Jonamac, Spartan,	
less sensitive	Golden Supreme, Jonagold, Jonathan, IdaRed, McIntosh	Consider using an additional 1 oz. per acre.
special	Red Delicious, Spur Mac	On spur type, begin first application 2 weeks after bloom, followed by an application 2 weeks later, and then 2 weeks after for medium-size trees.
phytotoxic	Empire, Stayman, Winesap	Do not use.

Kudos is a generic formulation of prohexidione calcium, the active ingredient in Apogee.

Cork Spot and Bitter Pit Management in Apples

Cork spot and bitter pit are related to low levels of calcium and high levels of nitrogen in the fruit. However, low calcium is not the only cause of these disorders. Excessive tree vigor and a light fruit crop increase cork spot and bitter pit. Bitter pit is primarily a storage disorder, and calcium treatments before and after harvest can reduce this.

No one cultural practice eliminates these disorders and you need a multifaceted approach for control. For example:

- Apply lime to raise the soil pH to around 6.5 to make calcium more available for tree uptake.
- Balance tree nutritional levels by analyzing soil and tissue. Keep nitrogen, potassium, and magnesium levels from becoming excessive and avoid low levels of calcium, boron, and zinc. If tissue analysis boron levels are low, apply Solubor at 2 lb./acre at pink and again at petal fall.
- Work to moderate tree vigor. Avoid excessive pruning and tree overcrowding and make moderate nitrogen applications. Summer pruning of water sprouts between mid-July and mid-August also helps minimize cork spot.
- Adjust fruit density by chemically thinning fruit in heavy cropping years to avoid a light crop and calcium disorders the following year.
- Apply calcium in 6-8 sprays starting at first cover Calcium chloride is most commonly used; it is inexpensive but can be hard on pumps. Calcium nitrate (Nutrical) is an alternative. Calcium chloride is sold as dry formulations (such as DowFlake Xtra 83-87% and Cor-Clear 28%) and as liquid formulations with 10 percent calcium (such as EezyCal 8-0-0-10 and Loveland 10% Calcium). Applying calcium at a low rate every 7 days is more effective than a higher rate every 14 days. Application between first cover and third cover is most critical, but later sprays also help. You can apply higher rates after mid-July.

Managing Cork Spot in Honeycrisp

Honeycrisp is one of the cultivars most susceptible to corking. Affected cells start to show damage around two weeks after petal fall, but visual symptoms usually show up in mid to late June. When the disorder starts, damaged cells usually have higher rates of protein synthesis, respiration, and cell division, but these cells become brown and die shortly thereafter. As fruit development progresses, severely damaged fruit become cracked and deformed with deep brown, cork-like areas scattered throughout the flesh.

Calcium and boron deficiencies are suspected as the main reasons for cork spot development. The flesh and peels of honeycrisp apples have less calcium than some other varieties, so keeping up with the calcium sprays is essential for managing cork spot. Calcium moves very slowly into the tissue, so more water and good coverage are essential for better uptake.

The recommended application rate is about 1.5-2 pounds of calcium chloride dissolved in 400 gallons or more of water per acre. Begin applying calcium in the first cover spray. Apply this spray to runoff.

Disease Management Notes

Note About Mancozeb and Polyram (EBDC Products)

EBDC products have two rate recommendations, depending on how you use the fungicides. Mancozeb and Polyram cannot be used past bloom at the 6 lb. per acre rate, but they are permitted past bloom at the lower rate of no more than 3 lb. per acre. However, this lower rate may be insufficient under heavy scab pressure without a tank-mix partner. The application of mancozeb from bloom through first cover heavily contributes to the prevention of bitter rot in highly susceptible varieties, like Honeycrisp.

- Do not apply Mancozeb or Polyram within 77 days of harvest.
- Do not apply more than 24 lb. of Mancozeb or Polyram or more than 25.6 lb. of Penncozeb per acre per year if using for prebloom (6 lb.) applications.
- Do not apply more than 21 lb. of mancozeb or Polyram per year or more than 22.4 lb. of Penncozeb per year if using the 3 lb. per acre rate.
- Label recommendations for mancozeb are identical for apples and pears.

Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI)

Most captan formulations (Captan 50W, Captan 80WDG, Captan 4L) are currently available with a 24-hour REI. The REI was reduced from 4 days to 24 hours a few years ago for apples, cherries, plums/fresh prunes, and peaches. However, some formulations produced by certain companies still may have the 4-day REI. Check the label of the captan product you plan to purchase to be sure it has a 24-hour REI.

Fungicide Resistance Management

Many of our most effective fungicides have a high risk for evolving fungicide resistance in the fungi they control. These include Topsin-M, Scala, Vangard, the sterol-inhibiting fungicides (Rally, Rhyme, Rubigan, Indar, Inspire Super, and Procure); the strobilurin fungicides (Sovran, Pristine, and Flint); and the succinase dehydrogenase inhibiting fungicides (Aprovia, Fontelis, Luna Sensation, Luna Tranquility, and Merivon). Because they all have specific modes of action, fungi such as the apple scab and the powdery mildew pathogens can rapidly develop resistance to them. Fungicide resistance, or at least reduced sensitivity, has been observed for apple scab and powdery mildew to both the sterol-inhibitor and strobilurin fungicides in the United States and throughout the Midwest.

To delay resistance development, never use these fungicides alone in a season-long program and use them as little as possible. Most of the newer fungicides limit the number of applications that can be made per season (generally no more than four), and labels state that no more than two sequential applications should be made without alternating with another fungicide with a different mode of action. The sterol-inhibiting fungicides, strobilurin fungicides, and succinase dehydrogenase inhibiting fungicides have different modes of action and can be alternated with each other in a fungicide resistance management program.

A good approach is to alternate one to two spray blocks of these materials. For example: a spray of Sovran (a strobilurin fungicide) alternated with a spray that contains Rally (a sterol-inhibiting fungicide) mixed with a broad-spectrum protectant fungicide such as Captan, Mancozeb, or Polyram.

Use of Pre-mixes

Many chemical manufacturers provide pre-mixes (pre-formulated tank mixtures). Take care when using these pre-mixes so that your rotation partners are not in the same chemical family as the pre-mix. For example, if you use Pristine or Merivon (a pre-mix of a strobilurin and SDHI fungicide; FRAC11+7), avoid using Sovran or Flint (FRAC11), or the Luna series (FRAC 7+11; FRAC 7;FRAC 7+9), all of which contain either a strobilurin (FRAC 11) or an SDHI (FRAC 7). Do not rotate with Aprovia, Fontelis, Kenja or Miravis, all of which are SDHI fungicides (FRAC 7).

Blister Spot on Mutsu, Cortland, Fuji

Blister spot is a bacterial disease of susceptible apple varieties — most notably Mutsu (Crispin). It is caused by a bacterium in the genus *Pseudomonas*. New blister spot outbreaks have been identified on Cortland and Fuji, and outbreaks have been reported on other varieties interplanted with Mutsu.

Due to resistance issues, streptomycin is no longer suggested for disease management. Due to the

severity and lack of control options for blister spot on Mutsu, the variety we recommend replacing Mutsu with Shizuka, which is similar in color and quality to Mutsu.

Sanitation Methods to Aid in Apple Scab Control

Especially in years after a high incidence of apple scab developed in the orchard, sanitation is important because apple scab overwinters only in fallen leaves. The sanitation methods described below can reduce the amount of apple scab inoculum (ascospores) by as much as 50 percent.

Applying 5% urea to the orchard floor (40 lb. per acre in 100 gal. of water) provides nitrogen to help microorganisms decompose leaves, killing the overwintering apple scab fungus.

Flail mowing the orchard also has been reported to reduce apple scab inoculum by as much as 50 percent.

You can flail mow or apply nitrogen in the fall and/or spring. Each method has been reported to reduce the number of scab ascospores by as much as 50 percent; however, the combined effects do not provide complete control. Using both methods probably does not reduce ascospore more than 50 percent. Be sure to recognize that urea provides nitrogen, and modify your fertilization program appropriately.

Insect Management Notes

Insecticide Resistance in Codling Moth Populations

Several states (including those covered by this guide) have reported codling moth populations that are suspected or confirmed to be resistant to certain insecticides. The resistance traits of populations differ among orchards and regions, so resistance may account for control failures in some orchards, even though the same insecticides may provide effective control in other locations.

Resistance is not the only cause for control failures, so always consider whether the cause of poor control was due to other issues, including inadequate rates, inadequate spray volumes, spray timing, or wash-off due to rainfall. Where these factors do not appear to explain poor control, resistance — particularly to the organophosphates (Imidan, Diazinon) — may be the reason, and switching to other insecticides is recommended. Where control programs have been effective and resistance does not seem to be a problem, rotating among insecticides with different modes of action is recommended to delay resistance development.

See Effectiveness of Insecticides and Miticides for Control of Apple Mites on page 58.

Insect populations resistant to the organophosphates exhibit resistance to all the organophosphates that are labeled for codling moth control in apples (Diazinon, Imidan), so switching among these insecticides offers no benefit. Laboratory research and field observations have shown that organophosphate-resistant codling moth populations also are less susceptible to some pyrethroids, so switching to Pounce (or other permethrin formulations), Asana, Warrior, Danitol, Mustang Maxx, Baythroid, or Proaxis may not provide adequate control.

Altacor, Assail, Delegate, Exirel and Rimon are effective against organophosphate-resistant codling moth populations. Consult your state Extension specialists in entomology to plan effective seasonlong programs that make the best use of available products within the label-specified limits and restrictions for each.

Timing of First Insecticide Spray for Codling Moth Control on Apple and Pear[1]

Degree-days (base 50°F) after biofix[2]	Insecticide Products
50-75	Dimilin Rimon
100-200	Intrepid Confirm
150-250	Altacor Assail Belay Delegate Exirel
250	Imidan Avaunt Pyrethroids (Asana, Baythroid, Danitol, Mustang Max, Proaxis, Warrior) Virus (Cyd-X, Carpovirusine, Virosoft CP4)

[1] A second spray should be made 10-14 days later.

[2] Biofix is defined as the date on which pheromone traps detect sustained flight of moths

Apple Borers

The dogwood borer and American plum borer are caterpillars that attack burr knot tissue on apple trunks. Flat-headed and round-headed apple borers are beetle larvae that attack tree trunks, often trees that have received mechanical, cold, or other injury or are generally weakened.

You can treat any of these borers with Lorsban Advanced at a rate of 1.5 qt. per 100 gal. of spray, or with Lorsban 4E at a rate of 1.5 qt. per 100 gal. of spray no later than 28 days before harvest.

For dogwood borer, the best insecticide timing is at peak egg hatch, which is in late June in the central Midwest. Isomate DWB can be used starting at bloom.

For American plum borer, the best timing is at petal fall.

For flat-headed and round-headed apple borers, apply insecticide in the spring.

Apply borer sprays to the lower 4 feet of the trunk and lower branches, and soak the bark. *Do not* apply Lorsban to the fruit or foliage. Only one application of Lorsban (of any formulation) is allowed each year. Do not use for borers if already used pre-bloom.

Periodical Cicadas

Periodical cicadas are orange to black and about 1 1/2 inches long, have black transparent wings, and appear from May to July. Annual or dog-day cicadas are larger, green to black, and appear each year from July to September. Annual cicadas ordinarily do not cause much damage. Cicada males announce their presence to the voiceless females by making a continuous, high-pitched, shrill sound.

Adult females lay eggs in rows in pockets they cut in small branches and twigs of trees with their long, knife-like egg layer. The eggs hatch in six or seven weeks. The newly hatched nymphs fall to the ground and burrow until they find suitable roots, usually 1 1/2 to 2 feet beneath the soil. With their sucking mouthparts, they immediately begin to suck juices from the roots.

Females prefer oak, hickory, apple, peach, and pear trees, and grapevines for laying eggs. Females damage plants when they make slits in branches and twigs to deposit their eggs. These small twigs and branches turn brown and die and sometimes break off. The damage may be severe in newly planted orchards or on new shade trees or shrubs. Heavy populations of nymphs in the soil also may affect the growth and vigor of certain trees.

You can prevent egg-laying damage by cicadas on young fruit and ornamental trees by covering them with a protective netting, such as cheesecloth. Cover a tree and tie the netting to the trunk below the lower branches. Remove the covering when egg-laying is over. If netting is not an option, you may apply insecticides when egg laying begins and repeat 7 to 10 days later. Pyrethroids are recommended to control periodical cicada, but using these products may lead to mite outbreaks.

Notes on Soaps and Horticultural Oils

SunSpray UFO (UFO = "ultrafine" oil), Saf-T-Side, and M-Pede (a potassium salt of fatty acids, previously called an insecticidal soap) are relatively new insecticides that may be used in certified organic production systems. Summer oils and M-Pede are effective only against insects the sprays contact at the time of application. These sprays provide no residual control. Many questions about their efficacy remain, and their use should be considered experimental. Nonetheless, they appear to be useful in certain situations.

A summer oil alone, at a concentration of 1-2 percent by volume, provides some control of mites and aphids (rosy apple aphid, apple grain aphid, green apple aphid, and spirea aphid). Limited observations suggest that aphid control is likely to be greatest if you apply oil when clusters are at the 0.25 inch green stage.

M-Pede alone reduces mite, aphid, pear psylla, and white apple leafhopper populations, but control may not be satisfactory or long-lasting unless you apply multiple sprays. Unlike oils, M-Pede is not ovicidal.

If applied alone, a summer oil is likely more effective for aphid and (especially) mite control than M-Pede. Data from Michigan indicate that adding M-Pede at 2 percent by volume to full-rate sprays of Vendex, Kelthane, and presumably other miticides, greatly enhances the control they provide.

Phytotoxicity, leaf drop, and fruit blemishes should be major concerns when deciding whether to use summer oil or soap. To prevent damage to foliage or fruits, never use a summer oil with Captan, Sevin, or other sulfur-containing pesticides. Allow at least 14 days between applications of sulfur-containing compounds and the use of a summer oil. Do not apply oils if temperatures exceed 90°F or drying conditions are poor.

Because of concerns about fruit russeting, some authorities suggest that insecticidal soaps should be used only in nonbearing orchards. Applicators must mix oils and soaps at the proper dilution (1-2 percent); concentrated sprays are less effective and more phytotoxic. Deposits of large droplets or the coalescing of droplets on fruit or foliage also increases the likelihood of leaf damage and fruit blemishes.

Effectiveness of Fungicides for Control of Apple Diseases[1]

Product and formulation Active ingredient	FRAC Code[2]	Bitter rot	Fire blight	Powdery mildew	Rust	Scab	Sooty blotch / flyspeck	Summer rots (black and white)	REI[3] PHI[4]	Max amt[5] Max app[6]
Agri-Mycin 17	25	x	G-E[r]	x	x	x	x	x	12h	NA
streptomycin sulfate									50d	NA
Apogee (27.5W)	PGR	x	E	x	x	x	x	x	12h	99 oz.
Growth regulator									45d	NA
Aprovia (EC)	7	E-G	x	F	u	E-G	E-G	F	12h	27.6 fl. oz.
benzovindiflupyr									30d	NA
Captan 80 WDG	M3	E	x	i	x	G	G	E	24h	40 lb.
captan									0d	NA
Cevya (formulation)	3	G	x	E-G	E	E	E	G-F	12h	NA
mefentrifluconazole									0d	NA
Cuprofix Ultra 40 didpress	M	x	G-F	x	x	G-F	x	x	12h	NA
copper hydroxide									NA	NA
Excalia (2.84 SC)	7	u	x	E-G	u	E	u	x	12h	0.178 lb
inpyrfluxam									PF	2
Ferbam Granulfo (76WDG)	M	F	x	x	G	F	F	G	24h	NA
ferbam									NA	3
Flint Extra	11	G	x	G[r]	F	E[r]	G	G	12h	10.5 fl. oz.
trifloxystrobin									14d	NA
Fontelis (SC)	7	x	x	G	E	E	x	u	12h	61 fl. oz.
penthiopyrad									28d	NA
Indar 2F	3	x	x	E[r]	E	E[r]	G	x	12h	32 fl. oz.
fenbuconazole									14d	4
Inspire Super (EW)	3 + 9	s	x	F	E	E	E	x	12h	60 fl. oz.
difenoconazole + cyprodinil									28d	NA
Kasumin 2L	24	x	G	x	x	x	x	x	12h	256 fl. oz.
Kassugamycin Hydrochloride Hydrate									90d	4
Kenja 400SC	7	x	x	s	x	F	x	x	12h	NA
isofetamid									20d	NA
Kocide 3000	M	x	G-F	x	x	G-F	x	x	48h	53.3 lb.
copper hydroxide									0d	NA
Luna Privilege	7	x	x	G	x	G-E	F-G	x	NA	NA
fluopyram									NA	NA
Luna Sensation (SC)	7+11	i-E	x	G[r]	F	E[r]	G-E	E	12h	21 fl. oz.
fluopyram + trifloxystrobin									14d	4
Luna tranquility (SC)	7+9	x	x	G	x	E	x	x	12h	54.7 fl. oz.
fluopyram + pyrimethanil									72d	NA

(continued)

Effectiveness of Fungicides for Control of Apple Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Bitter rot	Fire blight	Powdery mildew	Rust	Scab	Sooty blotch / flyspeck	Summer rots (black and white)	REI[3] PHI[4]	Max amt[5] Max app[6]
Merivon (2.09SC)	7+11	E	x	G	s	E	E	E	12h	22 fl. oz.
fluxapyroxad + pyraclostrobin									0d	4
Microthiol Disperss	M	u	x	G	x	i-F	x	x	24h	NA
sulfur									0d	NA
Miravis (1.67 SC)	7	x	x	G	G	E	G	x	4h	13.6 fl. oz.
pydiflumetofen									30d	4
Mycoshield	41	x	G	x	x	x	x	x	12h	9 lb.
oxytetracycline									60d	6
Omega 500F	29	F	x	x	s-G	G	s	s	12h	138 fl. oz.
fluazinam									28d	10
OSO 5% SC	M3	x	x	F	x	F	x	x	4h	78 fl. oz.
polyoxin D									0d	6
Polyram 80 DF	M3	x	x	x	G	G	x	x	24h	21 lb.
metiram									77d	7
Pristine	7+11	F-E	x	E[r]	E	E[r]	E	E	12h	74 oz.
pyaclostrobin + boscalid									0d	4
Procure 480SC	3	x	x	E[r]	E[r]	G[r]	x	x	12h	64 fl. oz.
triflumizole									14d	NA
Rally 40WSP	3	x	x	E[r]	F	G[r]	x	x	24h	5 lb.
myclobutanil									14d	NA
Roper DF rainshield	M	x	x	i	G	G	x	G	24h	21 lb.
mancozeb									77d	6
Scala SC	9	x	x	x	x	E-G	x	x	12h	40 fl. oz.
pyrimethanil									72d	NA
Sercadis	7	x	x	G	s	E-G	F	F	12h	18 fl. oz.
fluxapyroxad									0d	4
Sovran (50WG)	11	x	x	G[r]	E	E[r]	G	G	12h	25.6 oz.
kresoxim-methyl									30d	4
Syllit FL	U12	x	x	x	x	E[r]	x	x	48h	3 pt.
dodine									"Pink"	2
Topguard Specialty Crops	3	u	x	E	E	E-G	x	u	12h	52 fl. oz.
flutriafol									14d	4
Topsin-M WSB	1	x	x	G[r]	x	i	E-G [r]	G	24h	4 lb.
thiophanate methyl									1d	NA

(continued)

Effectiveness of Fungicides for Control of Apple Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Bitter rot	Fire blight	Powdery mildew	Rust	Scab	Sooty blotch / flyspeck	Summer rots (black and white)	REI[3] PHI[4]	Max amt[5] Max app[6]
Torino (SC)	U6	x	x	E	x	x	x	x	4h	6.8 oz.
cyflufenamid									14d	1
Vangard WG	9	x	x	x	x	G	x	x	12h	30 oz.
cyprodinil									0d	2
Ziram 76DF	M3	G	x	x	G	G	G	i	48h	42.4 lb.
ziram									14d	7

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] FRAC code represents the mode of action of the fungicide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Effectiveness of Insecticides for Control of Minor Apple Insects[1]

Product and formulation Active ingredient	IRAC Code[2]	black stem borer	green aphids	oblique banded leafroller	potato leafhopper	redbanded leafroller	white apple leafhopper	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	E	x	u	x	E	12h	16.5 oz.
thiamethoxam								14-35d	NA
Admire Pro (4.6F)	4A	x	E	x	u	x	E	12h	10.5 fl. oz.
imidacloprid								7d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	x	x	x	x	G	12h	8.5 fl. oz.
abamectin								28d	2
Altacor (35WDG)	28	x	x	E	x	E	s	4h	9 oz.
chlorantraniliprole								5d	NA
Apta (1.34SC)	21A	x	G	G	u	u	u	12h	53.5 fl. oz.
tolfenpyrad								14d	2
Asana XL (0.66EC) **(RUP)**	3A	x	F	G	x	E	G	12h	101.5 fl. oz.
esfenvalerate								21d	NA
Assail 30SG	4A	x	E	x	G	x	G-E	12h	32 oz.
acetamiprid								7d	4
Avaunt (30WDG)	22	x	x	x	G	G	s	12h	24 oz.
indoxacarb								14d	4

(continued)

Effectiveness of Insecticides for Control of Minor Apple Insects[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	black stem borer	green aphids	oblique banded leafroller	potato leafhopper	redbanded leafroller	white apple leafhopper	REI[3] PHI[4]	Max amt[5] Max app[6]
Bacillus thuringiensis (B.t.) (Agree, Dipel, etc.)	11B	x	x	G	x	G	x	4-12h	NA
Bacillus thuringiensis								0d	NA
Baythroid XL (1EC) **(RUP)**	3A	x	x	G	G	E	G	12h	2.8 fl. oz.
cyfluthrin								7d	NA
Belay (2.13SC)	4A	x	E	u	u	x	E	12h	12 fl.oz
clothianidin								7d	NA
Beleaf 50SG	29	x	G	x	x	x	x	12h	8.4 oz.
flonicamid								21d	3
Centaur WDG (70WDG)	16	x	x	x	F	x	F	12h	34.5 oz.
buprofezin								14d	1
Closer SC (2SC)	4C	x	E	x	x	x	E	12h	17 fl. oz.
sulfoxaflor								7d	4
Confirm 2F	18	x	x	F	x	E	x	4h	120 fl. oz.
tebufenozide								14d	NA
Danitol 2.4EC **(RUP)**	3A	x	x	G	E	E	E	24h	42.6 fl. oz.
fenpropathrin								14d	NA
Delegate WG (25WG)	5	x	x	E	x	E	x	4h	28 oz.
spinetoram								7d	4
Delta Gold (1.5EC) **(RUP)**	3A	x	x	u	u	u	u	12h	3.6 fl. oz.
deltamethrin								21d	NA
Entrust SC (2SC)	5	x	x	G	x	x	x	4h	29 fl. oz.
spinosad								7d	4
Envidor 2SC	23	x	x	x	x	x	x	12h	18 fl. oz.
spirodiclofen								7d	1
Esteem 35WP, 0.86EC	7C	x	u	s	x	s	x	12h	10 oz.
pyriproxyfen								45d	2
Exirel (0.83SE)	28	x	x	E	x	E	G	12h	61.6 fl. oz
cyantraniliprole								3d	3
Imidan 70W	1B	x	x	x	x	G	x	168h	15.5 lb.
phosmet								7d	NA
Intrepid 2F	18	x	x	E	x	E	x	4h	64 fl. oz.
methoxyfenozide								14d	NA
Lannate SP (90WSB) **(RUP)**	1A	x	x	E	x	E	E	72h	5 lb.
methomyl								14d	5
Lorsban 4E (RUP)	1B	x	x	E	x	x	x	96h	2 lb.
chlorpyrifos								upf	1

(continued)

Effectiveness of Insecticides for Control of Minor Apple Insects[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	black stem borer	green aphids	oblique banded leafroller	potato leafhopper	redbanded leafroller	white apple leafhopper	REI[3] PHI[4]	Max amt[5] Max app[6]
Lorsban 75WG	1B	x	x	E	x	x	x	96h	2 lb.
chlorpyrifos								upf	1
Movento (2SC)	23	x	G	x	x	x	x	24h	25 fl. oz.
spirotetramat								7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	x	x	G	E	E	E	12h	24 fl. oz.
zeta-cypermethrin								14d	NA
Neemix 4.5 (0.39L), AzaDirect	UN	x	F	u	u	u	u	4h	NA
azadirachtin								0d	NA
Nexter SC (3.75SC)	21A	x	x	x	x	x	x	12h	17 oz.
pyridaben								25d	1
Oil (superior)	UN	x	u	u	x	u	x	4h	NA
mineral oil								0d	NA
Permethrin 25W **(RUP)**	3A	x	G	E-G	x	E	x	12h	32 oz.
permethrin								14d	NA
Permethrin 3.2EC **(RUP)**	3A	x	x	x	x	E	P	12h	20 fl. oz.
permethrin								14d	NA
Portal XLO (0.4EC)	21A	x	x	x	u	x	F	12h	2 pt.
fenpyroximate								14d	1
PQZ (1.87SC)	9B	x	E	x	x	x	x	12h	4.8 fl. oz.
pyrifluquinazon								14d	2
Proaxis (0.5EC) **(RUP)**	3A	x	G	G	E	E	E	24h	25.6 fl. oz.
gamma-cyhalothrin								21d	NA
Proclaim (5SG) **(RUP)**	6	x	x	E	x	E	x	12h	14.4 oz.
emamectin benzoate								14d	NA
Rimon 0.83EC	15	x	x	E	x	E	u	12h	150 fl. oz.
novaluron								14d	NA
Sevin XLR Plus	1A	x	F	F	x	F	x	12h	15 qt.
carbaryl								3d	8
Sivanto Prime (1.67SC)	4D	x	G	x	G	x	G-E	4h	28 fl. oz.
flupyradifurone								14d	NA
Surround WP (95WP)	UN	x	x	s	x	s	x	4h	NA
kaolin								0d	NA
Vendex 50WP **(RUP)**	12B	x	x	x	x	x	x	48h	4 lb.
fenbutatin-oxide								14d	2
Verdepryn 100SL (0.83SL)	28	x	x	x	x	E	u	4h	33 fl. oz.
cyclaniliprole								7d	3

(continued)

Effectiveness of Insecticides for Control of Minor Apple Insects[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	black stem borer	green aphids	oblique banded leafroller	potato leafhopper	redbanded leafroller	white apple leafhopper	REI[3] PHI[4]	Max amt[5] Max app[6]
Versys Inscalis (0.83DC)	9D	x	G	x	x	x	x	12h	7 fl. oz.
afidopyropen								7d	NA
Vydate L (2L) **(RUP)**	1A	x	G	x	F	x	E	48h	8 pt.
oxamyl								14d	4
Warrior II (2.08CS) **(RUP)**	3A	x	G	F	x	E	x	24h	12.8 fl. oz.
lambda-cyhalothrin								21d	NA

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[2] IRAC code represents the mode of action of the insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Effectiveness of Insecticides and Miticides for Control of Apple Mites[1]

Product and formulation Active ingredient	IRAC[2]	apple rust mite	European red mite	two-spotted mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	G	G	G	12h	NA
bifenazate					7d	1
Agri-Mek SC (0.7SC) **(RUP)**	6	x	G	F	12h	8.5 fl. oz.
abamectin					28d	2
Apollo SC (1SC)	10A	x	E	E	12h	NA
clofentezine					45d	NA
Azera 0.21EC	UN+3	u	u	u	12h	NA
azadirachtin+ pyrethrins					0d	10
Danitol 2.4EC **(RUP)**	3A	x	F	F	24h	42.6 fl. oz.
fenpropathrin					14d	NA
Envidor 2SC	23	G	E	E	12h	18 fl. oz.
spirodiclofen					7d	1
Kanemite 15SC	20 B	x	E	G	12h	62 fl. oz.
acequinocyl					14d	2
Magister SC (1.7SC)	21 A	G	E	E	12h	36 fl. oz.
fenazaquin					7d	1
Movento (2SC)	23	u	s	s	24h	25 fl. oz.
spirotetramat					7d	NA

(continued)

Effectiveness of Insecticides and Miticides for Control of Apple Mites[1] *(continued)*

Product and formulation Active ingredient	IRAC[2]	apple rust mite	European red mite	two-spotted mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Nealta (1.67SC)	25	x	E	E	12h	27.4 fl. oz.
cyflumetofen					7d	2
Nexter SC (3.75SC)	21 A	E	G	F	12h	17 fl. oz.
pyridaben					25d	1
Onager Optek (1EC)	10 A	x	E	E	12h	24 oz.
hexythiazox					28d	1
Portal XLO (0.4EC)	21 A	G	E	G	12h	2 pt.
fenpyroximate					14d	1
Proclaim (5SG) **(RUP)**	6	x	x	s	12h	14.4 oz.
emamectin benzoate					14d	NA
Savey 50DF	10 A	x	E	E	12h	6 oz.
hexythiazox					28d	1
Sevin XLR Plus	1A	G	x	x	12h	15 qt.
carbaryl					3d	8
Vendex 50WP **(RUP)**	12 B	F-G	F	F	48h	4 lb.
fenbutatin-oxide					14d	2
Vydate L (2L) **(RUP)**	1A	x	G	G	48h	8 pt.
oxamyl					14d	4
Zeal (72WP)	10 B	x	E	E	12h	3 oz.
etoxazole					14d	1

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[2] IRAC code represents the mode of action of the insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

PEAR

Pear Spray Schedule

Entomology Leads: C. Welty, R. Bessin
Pathology Leads: J. Beckerman, M.Heller-Haas

Pear Dormant to Bud Swell

Apply before growth starts in spring and when temperatures are above 45°F.

Pest/Problem	Material	Rate/Acre	Comments
fire blight	Fixed copper pesticides: copper hydroxide, copper oxychloride, basic copper sulfate, Bordeaux mixture	See label	If fire blight was severe last year, a fixed copper spray at swollen bud stage is suggested. Do not apply copper after swollen bud stage or when drying conditions are cool and slow, because severe injury can occur. Many fixed copper products are registered for use on pear. Label recommendations may vary; refer to individual label for specific application timing. Fixed coppers can be mixed with oil. However, never combine copper sulfate alone with dormant oil.

Pear Late Dormant

Apply before buds break into green tip in the spring.

Pest/Problem	Material	Rate/Acre	Comments
scale insects, European red mite eggs	superior oil	2%	Apply when temperatures are above 40°F — never during freezing weather. Do not apply within 2 weeks of a sulfur spray or later than delayed dormant.
European red mite eggs	Apollo 4SC	4-8 fl. oz.	Do not exceed 1 application per year.
	Savey 50DF	3-6 oz.	
pear psylla (adults)	Asana XL 0.66EC	4.8-14.5 fl. oz.	Apply this rate only during dormant to pre-bloom (white bud) stage.
	Danitol 2.4EC	16-21.3 fl. oz.	
	Delegate 25WG	6-7 oz.	
	Esteem 35WP	5 oz.	Single treatment during delayed dormant to pink stage.
	Mustang Maxx 0.8EC	1.28-4 fl. oz.	
	Permethrin 25WP	12.8-25.6 oz.	
	Proaxis 0.5EC	2.56-5.1 fl. oz.	
	Sivanto Prime (1.67SC)	10.5-14 fl. oz.	
	superior oil	2%	Insecticide may be combined with oil during dormant and delayed dormant periods only. Oil on wood inhibits egg laying. Apply oil as soon as first eggs are laid and again 7 days later if adults are still present. Apply dilute. Use 3% at dormant, 2% at budburst, and 1% up to whitebud.
	Surround 95WP	50 lb. per 100 gal. of water	Apply every 7-14 days beginning no later than green tip.
	Warrior II 2.08CS	1.28-2.56 fl. oz.	

Pear Pre-bloom

Pest/Problem	Material	Rate/Acre	Comments
pear scab	Aprovia	5.5-7.0 fl. oz.	
	Flint Extra	2.5-2.9 fl. oz.	Most effective at later sprays.
	Fontelis	16-20 fl. oz.	
	Inspire Super	12 fl. oz.	Use not recommended at this time.
	Luna Privilege	4-6.8 fl oz.	
	Luna Sensation	4-5.8 fl. oz.	Do not tank mix with horticultural oils due to injury potential.
	Luna Tranquility	11.2-16 fl. oz.	
	Mancozeb 75DF	3-6 lb.	Check label as generic products may vary. Use either the Pre-bloom (6 lbs.) or Extended Application (3 lbs.) schedule. See Note About Mancozeb and Polyram (EBDC Products) on page 50. Generic product include Roper, Koverall, Penncozeb 75 DF.
	Merivon	4-5.5 fl. oz.	Do not apply with EC or oil-based products.
	Pristine	14.5-18.5 oz.	Also controls powdery mildew. Refer to label for rates.
	Procure 480SC	8-16 oz.	Also controls powdery mildew. Refer to label for rates.
	Scala 5SC	7-10 fl. oz.	77-day PHI.
	Sovran 50WG	2-2.5 oz.	Also controls powdery mildew. Refer to label for rates.
	Syllit FL **PLUS** Mancozeb 75DF	1.5-3 pt. 2.25 lb.	**Pre-Bloom/Bloom:** Begin applications at 1/4- to l/2-inch green tip and continue on a 7- to 10-day schedule through bloom.
	Topguard	13 fl. oz.	
	Topsin-M WSB	1 lb.	Resistance may be an issue.
	Vangard 75WG	5 oz.	
	Ziram 76DF	6 lb.	
powdery mildew	Torino	6.8 oz.	Only effective for powdery mildew.
pear psylla (hatching eggs)	Centaur 70WDG	34.5-46 oz.	
	Dimilin 25W	2.5-3 lb.	
	Dimilin 2L	40-48 fl. oz.	
	Esteem 35WP	4-5 oz.	
	Portal XLO	2 pt.	
	Sivanto Prime (1.67SC)	10.5-14 fl. oz.	
	Surround 95WP	50 lb. per 100 gal.	

Pear Bloom

Pest/Problem	Material	Rate/Acre	Comments
pear scab	Same as for Pear Pre-bloom except do not use Syllit. Past bloom, Mancozeb may not be applied at a rate greater than 3 lb./acre. Do not apply within 77 days of harvest. Luna Tranquility has a 72-day PHI.		
fire blight	Streptomycin 17W **OR**	1.5 lb.	Generic products include AgriStrep, Strep, AgriMycin, Firewall Start fire blight sprays at first sign of open blossoms. Repeat sprays at 4- to 5-day intervals through bloom and petal fall on highly susceptible varieties. A minimum of two applications are necessary to provide control. If warm, wet weather occurs during bloom, use maximum rate of streptomycin of 100 ppm (0.5 lb./100 gal.).
	Streptomycin 17W **PLUS** Regulaid	1 lb. 1 pt.	

(continued)

Pear Bloom *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
fire blight *(continued)*	Labeled but not recommended These products are registered for fire blight control, but are only needed in orchards with a history of streptomycin resistance.		
	FireLine	16 oz./200 ppm.	Any OTC (OxyTetracycline Calcium) 200 ppm (1 lb./100 gal. water).
	Mycoshield 17WP	16 oz./200 ppm.	
	Kasumin 2L	64 oz. per 100 gal.	Do not exceed 2 sequential treatments per year for use to manage streptomycin-resistant fire blight bacteria.
insects or mites	**SAVE THE BEES!** Do not use insecticides during bloom.		

Pear Petal Fall

7-10 days after bloom.

Pest/Problem	Material	Rate/Acre	Comments
pear scab	Same as for Pear Pre-bloom except Mancozeb and Syllit, page 61.		Now is the appropriate time to deploy FRAC 3, FRAC 7 and FRAC 11 fungicides.
fire blight	Same as for Pear Bloom, page 61. Continue sprays for fire blight until the last petals have fallen.		
bitter rot, sooty blotch, flyspeck	Aprovia	5.5-7.0 fl. oz.	Suppressive against bitter rot.
	Flint Extra	2.5-2.9 fl. oz.	Most effective at later sprays.
	Inspire Super	12 fl. oz.	Use not recommended at this time.
	Luna Sensation	4-5.8 fl. oz.	Do not tank mix with horticultural oils due to injury potential.
	Merivon	4-5.5 fl. oz.	Do not apply with EC or oil-based products.
	Pristine	14.5-18.5 oz.	Also controls powdery mildew. Refer to label for rates.
	Sovran 50WG	2-2.5 oz.	Also controls powdery mildew. Refer to label for rates.
	Topsin-M WSB	1 lb.	Resistance may be an issue.
	Ziram 76DF	6 lb.	
plum curculio, tarnished plant bug, stink bugs	Apta (1.34SC)	21-27 fl. oz.	For plum curculio, tarnished plant bug.
	Baythroid XL 1EC	2-2.8 fl. oz.	Maximum rate for tarnished plant bug is 2.4 fl. oz.; plum cuculio rate is 2.4-2.8 fl. oz.
	Belay 2.13SC	6 fl. oz.	For stink bugs and plum curculio.
	Brigade 2E	2.6-12.8 fl. oz.	
	Danitol 2.4EC	16-21.3 fl. oz.	For plant bugs and stink bugs.
	Imidan 70W	2.13-5.75 lb.	Plum curculio only.
	Mustang Maxx 0.8EC	1.28-4 fl. oz.	
	Proaxis 0.5EC	2.5-5.12 fl. oz.	
	Warrior II 2.08CS	1.28-2.56 fl. oz.	

(continued)

***Pear Petal Fall** (continued)*

Pest/Problem	Material	Rate/Acre	Comments
pear psylla (nymphs)	Actara 25WDG	5.5 oz.	
	Admire Pro 4.6F	7 fl. oz.	
	Agri-Mek SC	2.25-4.25 fl. oz.	Must be mixed with an adjuvant.
	Assail 30SG	4-8 oz.	
	Azera 0.21EC	2-3.5 pt.	
	Centaur 70WDG	34.5-46 oz.	
	Belay 2.13SC	6 fl. oz.	
	Esteem 35WP	4-5 oz.	
	Portal 0.4EC	2 pt.	
	Sivanto Prime (1.67SC)	10.5-14 fl. oz.	
	Surround 95WP	50 lb. per 100 gal.	
	Verdepryn 100SL	11 fl. oz	

Pear First and Second Cover

10-14 days after petal fall and 10-14 days later.

Pest/Problem	Material	Rate/Acre	Comments
pear scab	Same as for Pear Pre-bloom, page 61. Where Fabraea leaf spot is a problem, use Flint, Flint Extra, Sovran, or Ziram until July. Observe preharvest interval requirements.		
pear rust mite	First cover is the best time to control pear rust mite.		
	Agri-Mek SC	2.25-4.25 fl. oz.	
	Apta (1.34SC)	21-27 fl. oz.	
	Magister SC (1.7SC)	32-36 fl. oz.	
	Movento 2SC	6-9 fl. oz.	
	Nexter 75WP	6.6-10.7 fl. oz.	Also suppresses pear psylla.
	Nexter SC	11-17 fl. oz	
	Envidor 2SC	16-18 fl. oz.	
	Portal XLO	2 pt.	
	Movento 2SC	6-9 fl. oz.	
codling moth, plum curculio	Same as for plum curculio at Pear Petal Fall, page 62. **OR**		
	Altacor 35 WDG	2.5-4.5 oz.	Used at first cover for psylla, also controls codling moth and plum curculio. Dimilin, Delegate, and Altacor are effective against codling moth but not plum curculio. Apply Dimilin 50-75 degree-days after codling moth biofix (see Timing of First Insecticide Spray for Codling Moth Control on Apple and Pear, page 51). Assail is for plum curculio only.
	Assail 30SG	4-8 oz.	
	Dimilin 25W	0.75-1 lb.	
	Dimilin 2L	12-16 fl. oz.	
	Delegate 25 WG	4.5-7 oz.	For codling moth only.
	Exirel 0.83 SE	8.5-20.5 fl. oz.	
	Verdepryn 100SL	5.5-11 fl. oz.	
	Esteem 35WP	4-5 oz.	For codling moth only.
	Baythroid XL 1EC	2-2.8 fl oz.	Use 2-2.4 fl. oz. for codling moth and 2.4-2.8 fl. oz. for plum curculio.
pear psylla	Same as at Pear Petal Fall. Psylla control required for first cover only. Best results occur when psylla is in adult or young nymphal stage.		

Pear Summer Covers

Apply at 10- to 14-day intervals observing harvest restrictions and limitations.

Pest/Problem	Material	Rate/Acre	Comments
pear scab, sooty blotch, flyspeck, bitter rot	Same as for Pear Pre-bloom except for Vangard, Scala, and Mancozeb, page 61. Rubigan and Procure will not control sooty blotch or flyspeck, and they should not be used past second cover. Flint, Luna Sensation, Merivon and Pristine provide excellent control of summer fruit rots, sooty blotch, and flyspeck. Aprovia, Fontelis and Luna Privilege are good rotation partners when another FRAC 7 fungicide has not been used. Vangard and Scala have a 72-day PHI. See Note About Mancozeb and Polyram (EBDC Products), page 50. All Mancozeb products have a 77-day PHI.		
codling moth	Altacor 35WDG	2.5-4.5 oz.	
	Asana XL 0.66EC	4.8-14.5 fl. oz.	
	Assail 30SG	4-8 oz.	
	Avaunt 30WDG	5-6 oz.	
	Baythroid XL 1EC	2-2.4 fl. oz.	
	Brigade 2EC	2.6-12.8 fl. oz.	
	Confirm 2F	20 fl. oz.	
	Cyd-X HP	0.5-3 fl. oz.	
	Danitol 2.4EC	16-21.3 fl. oz.	
	Delegate 25WG	4.5-7 oz.	
	Dimilin 25W	0.75-1 lb.	
	Dimilin 2L	12-16 fl. oz.	
	Entrust 2SC	6-10 fl. oz.	
	Esteem 35WP	4-5 oz.	
	Exirel 0.83SE	8.5-17 fl. oz.	
	Imidan 70W	2.1-5.75 lb.	
	Mustang Maxx 0.8EC	1.28-4 fl. oz.	
	Proaxis 0.5EC	2.5-5.1 fl. oz.	
	Sevin XLR PLUS (4L)	3 qt.	
	Verdepryn 100SL	5.5-11 fl. oz.	
	Warrior II 2.08 CS	1.28-2.56 fl. oz.	
pear psylla	Actara, Assail, Belay, Sivanto, Admire Pro or Verdepryn as listed at Pear Petal Fall, page 63 **OR**		Make 2 applications 10-12 days apart to target second-generation young nymphs. The first new summer adults appear about 3 weeks after full bloom. Second-generation adults are found on terminals and water sprouts.
	Delegate 25WG	6-7 oz.	
	Portal 0.4EC	2 pt.	
San Jose scale (crawlers)	Admire Pro 4.6F	2.8 fl. oz.	
	Baythroid XL 1EC	2.4-2.8 fl. oz.	
	Belay 2.13SC	6 fl. oz.	
	Brigade 2EC	2.6-12.8 fl. oz.	
	Centaur 70WDG	34.5-46 oz.	
	Diazinon AG 600WBC	12.75 fl. oz. per 100 gal.	
	Esteem 35WP	4-5 oz.	
	Movento 2SC	6-9 fl. oz.	
	Sivanto 200SL	10.5-14 fl. oz.	

(continued)

Pear Summer Covers *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
European red mite	Acramite 50WS	0.75-1 lb.	
	Agri-Mek SC	2.25-4.25 fl. oz.	
	Apollo 4SC	4-8 fl. oz.	
	Envidor 2SC	16-18 fl. oz.	
	Kanemite 15SC	21-31 fl. oz.	
	Magister SC (1.7SC)	32-36 fl. oz.	
	Nealta 1.67L	13.7 fl. oz.	
	Nexter 75WP	6.6-10.67 oz.	
	Onager 1EC	12-24 fl. oz.	
	Portal XLO	2 pt.	
	Savey 50DF	3-6 oz.	
	Zeal 72WP	2-3 oz.	
mealybug	Admire Pro 4.6F	7 fl. oz.	
	Actara 25WDG	4.5-5.5 oz.	
	Apta (1.34 SC)	21-27 fl. oz.	
	Assail 30SG	4-8 oz.	
	Belay 2.13SC	6 fl. oz	
	Centaur 70WDG	34.5-46 oz.	
	Movento 2SC	6-9 fl. oz.	
	Portal XLO	2 pt.	
Stink bugs	Baythroid XL 1EC	2-2.4 fl. oz.	
	Belay 2.13SC	4-6 fl. oz.	
	Brigade 2EC	2.6-12.8 fl. oz.	
	Mustang Maxx 0.8EC	1.28-4 fl. oz.	
	Proaxis 0.5EC	2.56-5.12 fl. oz.	
	Warrior II 2.08CS	1.28-2.56 fl. oz.	

Effectiveness of Fungicides for Control of Pear Diseases[1]

Product and formulation Active ingredient	FRAC Code[2]	Bitter Rot	Pear Scab	Fire Blight	Sooty blotch / Flyspeck	Powdery Mildew	REI[3]	PHI[4]	Max amt[5] app[6]
Aprovia (EC)	7	s	E-G	x	G-E	F	12h		27.6 fl. oz.
benzovindiflupyr							30d		NA
Captan 4L	M3	G	G	x	G	x	24h		32 qt.
captan							0d		NA
Cevya (formulation)	3	x	G	x	G	x	12h		NA
mefentrifluconazole							0d		NA
Ferbam Granulfo	M	G	F	x	F	x	24h		
ferbam							Not listed		3
FireLine 17WP	41	x	x	x	x	x	12h		9 lb.
oxytetracycline							60d		6
Fixed copper pesticides	M	x	x	F[r]	x	x	48h		30 lb.
basic copper sulfate							see label		NA
Flint Extra	11	x	F-G	x	G	G	12h		10.5 fl. oz.
trifloxystrobin							14d		NA
Fontelis (SC)	7	G	G-E	x	x	G	12h		61 fl. oz.
penthiopyrad							28d		NA
Inspire Super (EW)	3+9	x	G-E	x	E	G	12h		60 fl. oz.
difenoconazole + cyprodinil							28d		NA
Kasumin 2L	24	x	x	G	x	x	12h		256 fl. oz.
kasugamycin hydrochloride							90d		4
Luna Sensation (SC)	7+11	G	G-E	x	E-F	E[r]	12h		21 fl. oz.
fluopyram + trifloxystrobin							14d		4
Luna tranquility (SC)	7+9	s	G-E	x	x	G	12h		54.7 fl. oz.
fluopyram + pyrimethanil							72d		NA
Mancozeb 75DF	M3	G	G	x	x	x	24h		21 lb.
mancozeb							77d		NA
Merivon (2.09SC)	7+11	G	G-E	x	E	E	12h		22 fl. oz.
fluxapyroxad + pyraclostrobin							0d		4
Mycoshield 17WP	41	x	x	F-G	x	x	12h		NA
oxytetracycline							60d		6
Pristine	7+11	F	G-E[r]	x	E	G-F	12h		74 oz.
pyaclostrobin + boscalid							0d		4
Procure 480SC	3	x	G[r]	x	x	E[r]	12h		64 fl. oz.
triflumizole							14d		NA
Scala SC	9	x	G	x	x	x	12h		40 fl. oz.
pyrimethanil							7d		NA

(continued)

Effectiveness of Fungicides for Control of Pear Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Bitter Rot	Pear Scab	Fire Blight	Sooty blotch / Flyspeck	Powdery Mildew	REI[3]	PHI[4]	Max amt[5] app[6]
Sovran (50WG)	11	x	G[r]	x	G-E	G	12h		25.6 oz.
kresoxim-methyl								30d	4
Streptomycin 17W	25	x	x	E-G[r]	x	x	12h		NA
streptomycin sulfate								30d	NA
Sulfur , Microthiol Disperss	M	x	x	x	x	G	24h		
sulfur								0d	NA
Syllit	U12	x	F-G	x	x	x	48h		3 pt.
dodine								"Pink"	2
Topguard (SC)	3	x	E	x	x	E	12h		52 fl. oz.
flutriafol								14d	4
Topsin-M WSB	1	G	G-E	x	G-E	G[r]	24h		4 lb.
thiophanate -methyl								1d	NA
Torino (SC)	U6	x	x	x	x	G	4h		6.8 oz.
cyflufenamid								14d	1
Vangard WG (75WG)	9	x	G	x	x	x	12h		30 oz.
cyprodinil								0d	2
Ziram 76DF	M3	G	G	x	G	x	48h		42.4 lb.
ziram								14d	7

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] FRAC code represents the mode of action of the fungicide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Sources: Plant Disease Management Reports (PDMR) PF011, SMF003, PF019, PF033

Efficacy of Selected Insecticides and Acaricides Against Pear Insects and Mites[1]

		Major				Minor								
Product and formulation **Active Ingredient**	**IRAC Code[2]**	**codling moth**	**pear psylla**	**San Jose scale**	**stink bugs**	**European red mite**	**mealybug**	**pear leaf blister mite**	**pear rust mite**	**periodical cicada**	**plum curculio**	**tarnished plant bug**	**REI[3]** **PHI[4]**	**Max amt[5]** **Max app[6]**
Acramite 50WS	20D	x	x	x	x	G	x	x	x	x	x	x	12h	NA
bifenazate													7d	1
Actara (25WDG)	4A	x	E	x	x	x	G	x	x	x	G	x	12h	16.5 oz.
thiamethoxam													14 or 35d	NA
Admire Pro (4.6F)	4A	x	G	F	x	x	G	x	x	x	x	x	12h	10.5/14.0 fl. oz.
imidacloprid													7 or 21d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	G	x	x	E	x	x	E	x	x	x	12h	8.5 fl. oz.
abamectin													28d	2
Altacor (35WDG)	28	E	x	x	x	x	x	x	x	x	s	x	4h	9 fl. oz.
chlorantraniliprole													5d	NA
Apollo SC (1SC)	10A	x	x	x	x	E	x	x	x	x	x	x	12h	NA
clofentezine													21d	1
Apta (1.34SC)	21A	s	G	x	x	x	u	x	u	x	G	x	12h	53.5 fl. oz.
tolfenpyrad													14d	2
Asana XL (0.66EC) **(RUP)**	3A	G	G[r]	x	x	x	x	x	x	E	F	x	12h	72 fl. oz.
esfenvalerate													28d	NA
Assail 30SG	4A	E	G	s	x	x	G	x	x	x	G	x	12h	32 oz.
acetamiprid													7d	4
Avaunt eVo (30WDG)	22A	G	x	x	x	x	x	x	x	x	x	x	12h	24 oz.
indoxacarb													28d	4
Bacillus thuringiensis (B.t.) (Agree, Dipel, etc.)	11A	F	x	x	x	x	x	x	x	x	x	x	4h	NA
Bacillus thuringiensis													0d	NA
Baythroid XL (1EC) **(RUP)**	3A	G	x	F	G	x	x	x	x	E	F	E	12h	2.8 fl. oz.
cyfluthrin													7d	NA
Belay (2.13SC)	4A	s	G	G	E	x	G	x	x	x	G	G	12h	12 fl. oz.
clothianidin													7d	NA
Beleaf 50SG	29	x	x	x	x	x	x	x	x	x	x	G	12h	8.4 oz.
flonicamid													21d	3
Brigade WSB (10WP) (RUP)	3A	G	x	P	E	F	x	x	x	x	F	E	12h	32 fl. oz.
bifenthrin													14d	NA

(continued)

Efficacy of Selected Insecticides and Acaricides Against Pear Insects and Mites[1] *(continued)*

		Major				Minor								
Product and formulation **Active Ingredient**	**IRAC Code[2]**	**codling moth**	**pear psylla**	**San Jose scale**	**stink bugs**	**European red mite**	**mealybug**	**pear leaf blister mite**	**pear rust mite**	**periodical cicada**	**plum curculio**	**tarnished plant bug**	**REI[3]** **PHI[4]**	**Max amt[5]** **Max app[6]**
Centaur WDG (70WDG)	16	x	x	E	x	x	G	x	x	x	x	x	12h	34.5 oz.
buprofezin													14d	1
Closer SC (2SC)	4C	x	s	s	x	x	x	x	x	x	x	G	12h	17 fl. oz.
sulfoxaflor													7d	4
Confirm 2F	18	F	x	x	x	x	x	x	x	x	x	x	4h	120 fl. oz.
tebufenozide													14d	NA
Danitol 2.4EC **(RUP)**	3A	G	G[r]	x	G	G	x	x	x	E	F	G	24h	42.7 fl. oz.
fenpropathrin													14d	NA
Delegate WG (25WG)	5	E	E	x	x	x	x	x	x	x	s	x	4h	28 oz.
spinetoram													7d	4
Delta Gold (1.5EC) **(RUP)**	3A	G	s	u	u	x	x	x	x	E	F	E	12h	3.6 fl. oz.
deltamethrin													21d	NA
Diazinon AG 600WBC **(RUP)**	1B	F	F	G	x	u	G	u	x	x	x	x	4d	102 fl. oz.
diazinon													21d	2
Dimethoate (4EC)	1B	x	u	x	x	u	x	u	x	x	x	x	10d	2 pt.
dimethoate													28d	NA
Dimilin 2L (2AF) **(RUP)**	15	u	E	x	x	x	x	x	u	x	x	x	12h	64 fl. oz.
diflubenzuron													14d	4
Entrust SC (2SC)	5	F	x	x	x	x	x	x	x	x	x	x	4h	29 fl. oz.
spinosad													7d	4
Envidor 2SC	23	x	x	x	x	E	x	x	E	x	x	x	12h	18 fl. oz.
spirodiclofen													7d	1
Esteem 35WP	7C	G	G	E	x	x	x	x	x	x	x	x	12h	10 oz.
pyriproxyfen													45d	2
Exirel (0.83SE)	28	E	s	x	x	x	x	x	x	x	G	x	12h	61 fl. oz.
cyantraniliprole													3d	3
Grandevo	UN	F	u	x	x	u	u	u	u	x	x	x	4h	NA
Chromobacterium subtsugae													0d	NA
Imidan 70W	1B	G	x	x	x	x	F	x	x	x	G	x	7 or 14d	16 lb.
phosmet													7d	NA
Intrepid 2F	18	s	x	x	x	x	x	x	x	x	x	x	4h	64 fl. oz.
methoxyfenozide													14d	NA

(continued)

Efficacy of Selected Insecticides and Acaricides Against Pear Insects and Mites[1] *(continued)*

		Major				Minor								
Product and formulation **Active Ingredient**	**IRAC Code[2]**	**codling moth**	**pear psylla**	**San Jose scale**	**stink bugs**	**European red mite**	**mealybug**	**pear leaf blister mite**	**pear rust mite**	**periodical cicada**	**plum curculio**	**tarnished plant bug**	**REI[3]** **PHI[4]**	**Max amt[5]** **Max app[6]**
Kanemite 15SC	20B	x	x	x	x	E	x	x	x	x	x	x	12h	62 fl. oz.
acequinocyl													14d	2
Lime-Sulfur	UN	x	E	u	x	u	x	G	u	x	x	x	48h	NA
calcium polysulfide													(prebloom only)	NA
Lorsban Advanced (3.755EW) **(RUP)**	1B	x	G	E	x	u	x	x	x	x	x	x	4d	4 pt.
chlorpyrifos													(prebloom only)	1
Lorsban 75WG	1B	x	G	E	x	u	x	x	x	x	x	x	4d	2.67 lb.
chlorpyrifos													(prebloom only)	1
Magister SC (1.7SC)	21A	x	G	x	x	G	x	x	G	x	x	x	12h	36 fl. oz.
fenazaquin													7d	1
mating disruption	UN	G	x	x	x	x	x	x	x	x	x	x	0h	NA
Isomate, Checkmate													0d	NA
Movento (2SC)	23	s	G	E	x	s	G	x	u	x	x	x	24h	25 fl. oz.
spirotetramat													7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	G	G[r]	x	G	x	x	x	x	x	F	E	12h	24 fl. oz.
zeta-cypermethrin													14d	NA
Nealta (1.67SC)	25A	x	x	x	x	E	x	x	x	x	x	x	12h	27.4 fl. oz.
cyflumetofen													7d	2
Neemix 4.5 (0.39L)	un	F	F	u	u	x	P	x	x	x	x	G	4h	NA
azadirachtin													0d	NA
Nexter SC (3.75SC)	21A	x	G	x	x	E	x	x	E	x	x	x	12h	NA
pyridaben													7d	1
oil (superior)	UN	x	G	G	x	G	x	u	x	x	x	x	4h	NA
mineral oil													0d	NA
Onager Optek (1EC)	10A	x	x	x	x	E	x	x	x	x	x	x	12h	24 fl. oz.
hexythiazox													28d	1
Permethrin 3.2EC **(RUP)**	3A	G	G[r]	x	x	x	x	x	x	x	x	x	12h	26 fl. oz.
permethrin													(prebloom only)	NA
Pounce 25WP **(RUP)**	3A	G	G[r]	x	x	x	x	x	x	x	x	x	12h	41.6 oz.
permethrin													(prebloom only)	NA
Portal XLO (0.4EC)	21A	x	G	x	x	E	u	x	G	x	x	x	12h	2 pt.
fenpyroximate													14d	1
PQZ (1.87SC)	9B	x	x	x	x	x	x	x	x	x	x	x	12h	4.8 fl. oz.
pyrifluquinazon													14d	2
Proaxis (0.5EC) **(RUP)**	3A	G	s	G	F	x	x	x	x	E	G	E	24h	25.6 fl. oz.
gamma-cyhalothrin													21d	NA

(continued)

Efficacy of Selected Insecticides and Acaricides Against Pear Insects and Mites[1] *(continued)*

		Major				Minor								
Product and formulation **Active Ingredient**	**IRAC Code[2]**	**codling moth**	**pear psylla**	**San Jose scale**	**stink bugs**	**European red mite**	**mealybug**	**pear leaf blister mite**	**pear rust mite**	**periodical cicada**	**plum curculio**	**tarnished plant bug**	**REI[3] PHI[4]**	**Max amt[5]** **Max app[6]**
Proclaim (5SG) **(RUP)**	6	F	s	x	x	s	x	x	x	x	x	x	12 or 48h	14.4 oz.
emamectin benzoate													14d	NA
Sevin XLR Plus (4F)	1A	F	u	F	x	x	x	F	G	G	F	P	12h	15 qt.
carbaryl													3d	8
Sivanto Prime (1.67SC)	4D	x	G	s	x	x	x	x	x	x	x	x	12h	28 fl. oz.
flupyradifurone													14d	NA
soap (M-Pede, Des-X, etc.)	UN	x	F	F	x	u	G	x	u	x	x	x	12h	NA
potassium salts of fatty acids													0d	NA
Surround WP (95WP)	UN	s	G	x	s	x	x	x	x	s	x	s	4h	NA
kaolin													0d	NA
Transform WG (50WG)	4C	x	s	s	x	x	x	x	x	x	x	u	24h	8.5 oz.
sulfoxaflor													7d	4
Vendex 50WP **(RUP)**	12B	x	x	x	x	G	x	x	G	x	x	x	48h	4 lb.
fenbutatin-oxide													14d	2
Verdepryn 100SL (0.83SL)	28	E	u	x	s	x	x	x	x	x	G	x	4h	33 fl. oz.
cyclaniliprole													7d	3
Versys Inscalis (0.83DC)	9D	x	x	x	x	x	x	x	x	x	x	x	12h	7 fl. oz.
afidopyropen													7d	NA
virus (Cyd-X HP, Madex HP, Virosoft CP4)	31	G	x	x	x	x	x	x	x	x	x	x	4h	NA
Cydia pomonella granulovirus													0d	NA
Vydate L (2L) **(RUP)**	1A	x	x	x	G	G	x	x	F	x	x	x	48h	8 pt.
oxamyl													14d	1
Warrior II (2.08CS) **(RUP)**	3A	G	s	F	G	x	x	x	x	E	G	G	24h	12.8 fl. oz.
lambda-cyhalothrin													21d	NA
Zeal (72WP)	10B	x	x	x	x	E	x	x	x	x	x	x	12h	3 oz.
etoxazole													14d	1

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] IRAC code represents the mode of action of the insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.

Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Cherry Spray Schedule

Entomology Lead: D. Lewis
Pathology Lead: J. Beckerman, M. Heller-Haas

Cherry Dormant

Before buds break in the spring.

Pest/Problem	Material	Rate/Acre	Comments
bacterial canker	copper compounds		Bacterial canker is generally more serious on sweet than tart cherry. Many copper compounds are registered for use as a dormant application for control of bacterial canker on cherry. See labels for rates and timings. Do not apply copper later than white bud stage; flower injury can occur.
European red mite eggs	Apollo SC	2-8 fl. oz.	
	Diazinon 600WBC	12.75 fl. oz.	
	Magister SC	24-36 fl. oz.	
	superior oil	3-6 gal.	

Cherry Early Bloom

Also referred to as popcorn or white bud. Although many fungicides are labeled for use at this time, save FRAC 3 and FRAC 11 for later use when multiple disease pressures are high.

Pest/Problem	Material	Rate/Acre	Comments
brown rot (blossom blight)	Abound	12-15.5 fl. oz.	Also controls shot hole, powdery mildew and anthracnose.
	Bravo Weather Stik	3-4 pt.	Other formulations and generics available.
	Cabrio	9.5 oz.	Do not exceed 2 sequential applications before alternating to a non-Group 11 fungicide with a different mode of action.
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP.
	CaptEvate 68WDG	3.75 lb.	
	Ceyva	3-5 fl oz.	
	Elevate 50WG	1-1.5 lb.	
	Elite 45DF	4-8 fl oz.	
	Fontelis	14-20 fl. oz.	Do not exceed 61 fl. oz. per acre per year.
	Indar 2F	6 oz.	Do not exceed 8 applications or 48 fl. oz. per acre per season. Indar has a PHI of up to day of harvest.
	Inspire Super	16-20 fl. oz.	
	Luna Experience	6-10 oz.	
	Luna Privilege	4-6.84 fl oz.	
	Luna Sensation	5-5.6 fl. oz.	
	Merivon XBF	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan. Maximum of 3 applications per season.
	Pristine	10.5-14.5 oz.	Do not exceed 2 sequential applications before alternating to a non-FRAC Group 11 fungicide with a different mode of action.
	Procure 480SC	8-16 oz.	

(continued)

Cherry Early Bloom *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
brown rot (blossom blight) *(continued)*	Quadris Top	12-14 fl. oz.	Contains azoxystrobin, a fungicide known to cause phytotoxicity on these apple cultivars: Braeburn, Cortland, Gala, GoldRush, Hampshire, Jonamac, Macintosh, Silken, Spigold, Suncrisp, Zestar! These fungicides are labeled for use only on stone fruit, but drift or improper sprayer cleaning could damage apple fruit.
	Quash	2.5-4 oz.	Do not apply more than 12 oz. per acre per year.
	Quilt Xcel	14 fl. oz.	Contains azoxystrobin, a fungicide known to cause phytotoxicity on these apple cultivars: Braeburn, Cortland, Gala, GoldRush, Hampshire, Jonamac, Macintosh, Silken, Spigold, Suncrisp, Zestar! These fungicides are labeled for use only on stone fruit, but drift or improper sprayer cleaning could damage apple fruit.
	Rally 40WSP	2.5-6 oz.	Registered for control of brown rot (blossom blight), leaf spot, and powdery mildew on cherries. Do not exceed 2.75 lb. per acre per season or apply within 7 days of harvest.
	Rovral 4F	1-2 lb.	Do not exceed 2 sprays per season. Cannot be applied after petal fall on any stone fruit.
	wettable sulfur 95%	18 lb.	Many sulfur compounds are registered. See label for appropriate rate. Can be used between petal and harvest. Must be reapplied frequently in wet seasons.
	Tilt	4 fl. oz.	Do not exceed 8 applications or 48 fl. oz. per acre per season for Orbit. Do not exceed 20 fl. oz./ year for Tilt. *Generics names include various Propiconazole trade names.
	Topguard	14 fl. oz.	
	Topguard EQ	6-8 oz.	Start application at 1-5% bloom followed by an application at 50-100% bloom. This product includes 2 active ingredients — FRAC groups 3 and 11.
	Topsin M70 WSB	1- 1.5 lb.	Not available in IA, KS; other generic formulations may be available for purchase in these states.
	Ziram	5-6 lb.	Two different formulations (76DF and XCEL), same rate, read and follow the labels.

Cherry Full Bloom

Pest/Problem	Material	Rate/Acre	Comments
brown rot (blossom blight)	Same as for Cherry Early Bloom, page 72.		
insects, mites	**SAVE THE BEES!** Do not apply insecticides during bloom.		

Cherry Petal Fall

Pest/Problem	Material	Rate/Acre	Comments
brown rot (blossom blight)	Same as for Cherry Early Bloom, page 72. However, Rovral cannot be applied after petal fall. If previously using Rally, rotate to another product with a different mode of action.		
	Except for sulfur, all materials listed for brown rot under Cherry Early Bloom (pages 72-73) may be used for both brown rot and leaf spot. Do not apply Bravo after shuck fall.		
Tart cherry is more susceptible to leaf spot than is sweet cherry. See Cherry Leaf Spot Management, page 80.			
leaf spot	Abound	12-15 oz.	Contains azoxystrobin, a fungicide known to cause phytotoxicity on these apple cultivars: Braeburn, Cortland, Gala, GoldRush, Hampshire, Jonamac, Macintosh, Silken, Spigold, Suncrisp, and Zestar! These fungicides are labeled for use only on stone fruit, but drift or improper spray tank cleaning could damage apple fruit.
	Bravo Weather Stik	3-4 pt.	Other formulations and generics available.
	Cabrio	9.5 oz.	Do not exceed 2 sequential applications before alternating to a non-FRAC Group 11 fungicide with a different mode of action.
	Cevya	3-5 oz.	
	Fontelis	14-20 fl. oz.	Do not exceed 61 fl. oz. per acre per year.
	Flint Extra	2.5-3.8 fl. oz.	
	Indar 2F	6 fl. oz.	
	Luna Experience	6-10 oz.	
	Luna Sensation	5-7 fl. oz.	
	Merivon XBF	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan. Maximum of 3 application per season.
	Pristine	10.5-14.5 oz.	Do not make more than 2 sequential application of Pristine or other FRAC Group 7 or 11 fungicides.
	wettable sulfur	See label	Can be used between petal and harvest. Must be reapplied frequently in wet seasons.
	Topguard	14 fl. oz.	
	Topguard EQ	6-8 fl. oz.	Start applications now and repeat as necessary.

(continued)

Cherry Petal Fall *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
powdery mildew	Abound	12-15.5 fl. oz.	
	Cabrio	9.5 oz.	Do not exceed 2 sequential applications before alternating to a non-Group 11 fungicide with a different mode of action.
	Fontelis	14-20 fl. oz.	Do not exceed 61 fl. oz. per acre per year.
	Flint Extra	2.5-3.8 oz.	
	Gatten	6-8 fl oz.	For powdery mildew only.
	Inspire Super	16-20 fl. oz.	
	Luna Experience	6-10 oz.	
	Luna Sensation	5-5.6 fl. oz.	Not recommended unless other foliar disease problems are an issue.
	Merivon	4-6.7 fl. oz.	
	Pristine	10.5-14.5 oz.	
	Procure 480SC	10-16 oz.	
	Quash	3.5-4 oz.	
	Quintec 2.08F	7 fl. oz.	For powdery mildew only.
	Rally 40WSP	2.5-6 oz.	
	sulfur 90%	10-30 lb.	Refer to label for further information about recommended rates.
	Topguard	14 fl. oz.	
	Topguard EQ	6-8 fl. oz.	
plum curculio	Actara	4.5-5.5 oz.	
	Apta	21-27 fl. oz.	
	Assail 30SG	5.3-8 oz.	
	Asana XL 0.66EC	4.8-14.5 fl. oz.	
	Avaunt 30 WDG	5-6 oz.	
	Baythroid XL 1EC	2.4-2.8 fl. oz.	
	Danitol 2.4EC	10.7-21.3 fl. oz.	
	Exirel 0.83SE	13.5 -20.5 fl. oz.	
	Imidan 70W	2.13-2.5 lb.	Do not use on sweet cherries.
	Mustang Maxx 0.8EC	1.28-4 fl. oz.	
	Proaxis 0.5EC	2.56-5.12 fl. oz.	
	Sevin XLR Plus (4L)	2-3 qt.	
	Verdepryn 100SL	8.2-11 fl. oz.	
	Warrior II	1.28-2.56 fl. oz.	

Cherry Shuck Fall

When shucks have split and are falling from expanding fruit. Tart cherry is more susceptible to leaf spot than sweet cherry. See Cherry Leaf Spot Management, pages 80.

Pest/Problem	Material	Rate/Acre	Comments
leaf spot	Abound	12-15 oz.	Azoxystrobin only. Contains azoxystrobin, a fungicide known to cause phytotoxicity on these apple cultivars: Braeburn, Cortland, Gala, GoldRush, Hampshire, Jonamac, Macintosh, Silken, Spigold, Suncrisp, and Zestar! These fungicides are labeled for use only on stone fruit, but drift or improper sprayer cleaning could damage apple fruit.
	Bravo Weather Stik	3-4 pt.	Make 1 application at shuck fall. Do not apply Bravo after shuck fall and before harvest. If additional disease control is needed before harvest, use another registered fungicide. Other formulations and generics available.
	Cabrio	9.5 oz.	Do not exceed 2 sequential applications before alternating to a non-Group 11 fungicide with a different mode of action.
	Cevya	3-5 oz.	
	Flint Extra	2.5-3.8 fl. oz.	
	Fontelis	14-20 fl. oz.	
	Indar 2F	6 fl. oz.	
	Inspire Super	16-20 fl. oz.	
	Luna Experience	6-10 oz.	
	Luna Sensation	5-7.6 fl. oz.	
	Merivon XFB	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan.
	Pristine 38WG	10.5-14.5 oz.	
	Quash	4 oz.	
	Quilt Xcel	14 fl. oz.	Contains azoxystrobin, a fungicide known to cause phytotoxicity on these apple cultivars: Braeburn, Cortland, Gala, GoldRush, Hampshire, Jonamac, Macintosh, Silken, Spigold, Suncrisp, and Zestar! These fungicides are labeled for use only on stone fruit, but drift, or improper sprayer cleaning could damage apple fruit.
	Rally 40WSP	2.5-6 oz.	
	Topguard EQ	6-8 fl. oz.	
	Topsin-M 70 WSB	1.5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	PLUS		
	Captan 80WDG	2.5 lb.	

Cherry First Cover Spray

10 days after shuck fall. The timing of the first cover spray after shuck fall is critical in tart cherry orchards.

Pest/Problem	Material	Rate/Acre	Comments
powdery mildew	Same as for Cherry Petal Fall, page 75.		
plum curculio	Same as for Cherry Petal Fall, page 75.		
leaf spot	Same as for Cherry Shuck Fall except not Bravo, page 76. See Cherry Leaf Spot Management, page 80.		
powdery mildew, leaf spot	Same as for Cherry Petal Fall or a copper fungicide, pages 72-73.		
plum curculio, cherry fruit fly	Actara	4.5-5.5 oz.	
	Apta 1.34SC	21-27 fl. oz.	Use at lower rate for plum curculio and at higher rate for cherry fruit fly.
	Asana XL 0.66EC	4.8-14.5 fl. oz.	
	Assail 30SG	5.3-8 oz.	
	Baythroid XL 1EC	2.4-2.8 fl. oz.	
	Danitol 2.4EC	10.7-21.3 fl. oz.	Use at lower rate for plum curculio and at higher rate for cherry fruit fly.
	Exirel 0.83SE	10-20.5 fl. oz.	Use at lower rate for cherry fruit fly and at higher rate for plum curculio.
	Imidan 70W	2.13 lb.	Do not use on sweet cherries.
	Lorsban 75WG	2 lb.	May be used on tart cherries only — is phytotoxic on sweet cherries.
	Mustang Maxx 0.8EC	1.28-4 fl. oz.	
	Proaxis 0.5EC	2.56-5.12 fl. oz.	
	Sevin XLR Plus (4L)	2-3 qt.	
	Verdepryn 100SL	5.5-11 fl. oz.	Use 8.2-11 fl. oz. for plum curculio.
	Warrior II	1.28-2.56 fl. oz.	
cherry fruit fly only	The products listed above for both pests **OR**		
	Admire Pro 4.6F	2-2.8 fl. oz.	
	Altacor 35WDG	3-4.5 oz.	For suppression only.
	Diazinon AG	6.5-12.7 fl. oz. per 100 gal.	
	Entrust 2SC	4-8 fl. oz.	
	Malathion 57EC	1 pt.	
	Movento SC	6-9 fl. oz.	

Cherry Second Cover Spray

10 days after first cover.

Pest/Problem	Material	Rate/Acre	Comments
leaf spot	Same as for Cherry Shuck Fall except not Bravo, page 76. Do not apply Bravo after shuck fall. See Cherry Leaf Spot Management, page 80.		
powdery mildew	Same as for Cherry Petal Fall, page 75.		
plum curculio, cherry fruit fly	Same as for Cherry First Cover.		

Cherry Additional Cover Sprays

10 days after second cover, then every 10-14 days.

Pest/Problem	Material	Rate/Acre	Comments
brown rot	Same as for Cherry Early Bloom except not Rovral, page 72. Do not apply Rovral after petal fall.		
leaf spot	Same as for Cherry Shuck Fall except not Bravo, page 76. Do not apply Bravo after shuck fall. See Cherry Leaf Spot Management, page 80.		
powdery mildew	Same as for Cherry Petal Fall, page 75.		
cherry fruit fly	Actara 25WDG	4.5-5.5 oz.	
	Admire Pro 4.6F	2-2.8 fl. oz.	
	Altacor 35WDG	3-4.5 oz.	
	Asana XL 0.66EC	4.8-14.5 fl. oz.	
	Assail 30SG	5.3-8 oz.	
	Baythroid XL 1EC	2.4-2.8 fl. oz.	
	Danitol 2.4EC	16-21.3 fl. oz.	
	Diazinon AG 600WBC	6.5-12.7 fl. oz. per 100 gal.	
	Entrust 2SC	4-8 fl. oz.	
	Exirel 0.83SE	10-17 fl. oz.	
	Imidan 70W	2.13 lb.	
	Lorsban 75WG	2 lb.	
	Movento SC	6-9 fl.oz.	
	Mustang Maxx 0.8EC	1.28-4 fl. oz.	
	Proaxis 0.5EC	2.56-5.12 fl. oz.	
	Sevin XLR Plus (4L)	2-3 qt.	
	Verdepryn 100SL	5.5-11 fl.oz.	Use full rate for best results.
	Warrior II	1.28-2.56 fl. oz.	
borer control	See Borers of Peach, Cherry, and Plum Trees, page 112.		

Cherry Pre-harvest Sprays

Beginning 3-4 weeks before harvest.

Pest/Problem	Material	Rate/Acre	Comments
brown rot	Abound	12-15 oz.	
	Cabrio	9.5 oz.	
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP.
	CaptEvate 68WDG	3.75 lb.	
	Cevya	3-5 oz.	
	Elite 45DF	4-8 oz.	
	Elevate 50WDG	1-1.5 lb.	
	Fontelis	14-20 fl. oz.	Do not exceed 61 fl. oz. per acre per year.
	Indar 2F	6 oz.	Do not exceed 8 applications or 48 fl. oz. per acre per season. Indar has a PHI of up to day of harvest.
	Luna Sensation	5-5.6 fl. oz.	
	Merivon 2.09SC	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan.

(continued)

Cherry Pre-harvest Sprays *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
brown rot *(continued)*	Pristine 38WG	10.5-14.5 oz.	
	Procure 50WS	9-12 oz.	
	Quadris Top	12-14 oz.	Contains azoxystrobin, a fungicide known to cause phytotoxicity on these apple cultivars: Braeburn, Cortland, Gala, GoldRush, Hampshire, Jonamac, Macintosh, Silken, Spigold, Suncrisp, Zestar! These fungicides are labeled for use only on stone fruit, but drift, or improper sprayer cleaning could damage apple fruit. Check PHI restrictions very carefully.
	Quash	2.5-3.5 oz.	
	Quilt Xcel	14 fl. oz.	Contains azoxystrobin, a fungicide known to cause phytotoxicity on these apple cultivars: Braeburn, Cortland, Gala, GoldRush, Hampshire, Jonamac, Macintosh, Silken, Spigold, Suncrisp, Zestar! These fungicides are labeled for use only on stone fruit, but drift, or improper sprayer cleaning could damage apple fruit. 0-day PHI.
	Rally 40WSP	2.5-6 oz.	Registered for control of brown rot (blossom blight), leaf spot, and powdery mildew on cherry. Do not exceed 2.75 lb. per acre per season or apply within 7 days of harvest.
	wettable sulfur 90%	10-30 lb.	
	Topguard	14 fl. oz.	
	Topguard EQ	6-8 fl. oz.	
spotted wing Drosophila	Danitol 2.4EC	10.7-21.3 fl. oz.	
	Delegate 25WG	4.5-7 oz.	
	Entrust 2SC	4-8 fl. oz.	See 2(ee) label.
	Exirel 0.83SE	13.5-20.5 fl. oz.	
	Imidan 70W	2.13 lb.	
	Malathion	See label	Formulations and rates vary by state. Check labels for specific information.
	Mustang Maxx 0.8EC	4 fl. oz.	
	Pyganic 5EC	4.5-17 fl. oz.	
	Rimon 0.83EC	20-40 fl. oz.	
	Verdepryn 100SL	5.5-11 fl. oz.	Use full rate for best results.

Cherry Post-harvest Sprays

Pest/Problem	Material	Rate/Acre	Comments
leaf spot	Tart cherry is more susceptible to leaf spot than is sweet cherry. See Cherry Leaf Spot Management, page 80.		
	Adament 50WG	4-8 oz.	
	Bravo Weather Stik	3-4 pt.	Can be applied on trees after harvest, and would be the fungicide of choice for fungicide resistance management. Make one application to foliage within 7 days after fruit is removed. In orchards with a history of high leaf spot, make a second application 10-14 days later. Other formulations and generics available.
	Orbit*, Tilt	4 fl. oz.	Do not exceed 8 applications or 48 fl. oz. per acre per season for Orbit. Do not exceed 20 fl. oz./ year for Tilt. *Generics names include various Propiconazole trade names.
	Rally 40WSP	2.5-6 oz.	

(continued)

Cherry Post-harvest Sprays *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
leaf spot *(continued)*	Syllit F	1.5-3 pt.	
	Topguard	14 fl. oz.	
leaf spot, powdery mildew	Fontelis	14-20 fl. oz.	Do not exceed 61 fl. oz. per acre per year.
	Indar 2F	6 fl. oz.	
	Luna Sensation	5-5.6 fl. oz.	
	Merivon XBF	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan.
	Pristine	10.5-14.5 oz.	
	Rally 40WSP	2.5-6 oz.	
	Topguard	14 fl. oz.	

Cherry Leaf Spot Management

Integrated Copper/Sterol Inhibitor/Strobilurin Program

The objective is to reduce selection for resistance to the sterol inhibitor and strobilurin fungicides in the cherry leaf spot pathogen *and* to reduce cost of the program.

Pest/Problem	Material	Rate/Acre spray on 10- to 14-day interval	Comments
late petal fall or shuck fall stage	Bravo Weather Stik	4 pt.	Other formulations and generics available.
first cover	copper (e.g., Kocide 2000)	5 lb.	Copper fungicides can cause leaf bronzing and russeting but have negligible effects on photosynthesis and do not noticeably affect yield or fruit quality. Adding lime to COCS (copper oxychloride) is recommended on the label to prevent plant injury. Trees under drought stress may be more susceptible to premature defoliation from copper injury. Therefore, irrigate copper-treated trees in dry weather. The integrated copper program has been tested on tart cherries only. Cherry leaf spot is generally less severe on sweet cherries. However, the risk of copper injury on sweet cherries is unknown. Many different copper fungicides are available at a range of prices but not all are labeled on all stone fruits in all areas. Check labels. We have tested and have had similar results with Kocide (45 DF or 2000 formulations), Cuprofix, and COCS. We have had good results using copper in 1st, 2nd, and 3rd cover sprays. However strobilurin and/or sterol inhibitor fungicides should be used in 4th and 5th pre-harvest covers to prevent brown rot and powdery mildew. The long-term effects of copper on soil health are not known. Copper is toxic to aquatic organisms, so take great care if using it near surface water. Do not apply copper when temperatures are predicted to exceed 80°F.
second cover	Gem	4 oz.	
	Pristine	14.5 oz.	
third cover	Copper (e.g., Kocide 2000)	5 lb.	
fourth cover	Rally 40WSP	2.5-6 oz.	
fifth cover (if needed before harvest)	Pristine	10.5 oz.	
post-harvest	Bravo Weather Stik	4 pt.	Other formulations and generics available.

Special Comments on Cherry Schedule

Edited by John Strang

Spotted Lanternfly

The spotted lanternfly is an invasive planthopper that was first detected in Pennsylvania in 2014 and has since spread to six states — most recently Ohio in 2020. It is projected to invade throughout the Midwest.

This insect feeds on plant sap, causing wilting, dieback and even death.

Spotted lanternfly is currently believed to pose the greatest threat to the blueberry, blueberry, grape, hops, stone fruit and hardwood industries. Know how to identify this pest and remain vigilant for its appearance in your vineyard and orchard systems.

Pro-Gibb on Cherries

The active ingredient in Pro-Gibb is a natural plant hormone, gibberellin A3. You can use it to maintain and extend high fruiting capacity of bearing tart cherry trees and to reduce the occurrence of "blind" nodes by stimulating lateral vegetative buds and a more productive balance of lateral shoots and spurs.

Apply 4 to 18 fl. oz. of Pro-Gibb 4% per acre from 14 to 28 days after bloom when 1-3 inches of terminal shoot extension has occurred in sufficient water to provide uniform coverage Application rate depends on tree age and vigor. See label.

Since Pro-Gibb acts on buds that will flower the following growing year, responses will not begin to be visible until the year after application. Shoot, spur and flower changes will be evident 2 or 3 years after the program is started. Applications must be applied annually to promote spur development and yield improvement.

RainGard, Cherry Cracking Suppressant

RainGard is applied as a protective coating to decrease rainwater uptake by fruit to reduce cracking susceptibility.

Make the first application 4 weeks before anticipated harvest, and additional applications at 7- to 10-day intervals. Three weekly applications are much more effective at reducing rain cracking than a single application. Use 102 ounces of RainGard per 100 gal. per acre. Do not mix with organosillicone surfactants. Ground sprayer speed should not exceed 2 miles per hour. RainGard must cover all fruit for maximum crack prevention.

Apogee for Vegetative Control

Apogee is registered for vegetative control on sweet cherry. See label for additional information.

Efficacy of Selected Fungicides Against Cherry Diseases[1]

Product and formulation Active Ingredient	FRAC Code[2]	Black Knot	Brown rot	Cherry Leaf spot	Powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	x	G[r]	x	G	4h	90 fl. oz.
azoxystrobin						0d	5
Bravo Weather Stik	M5	E	F-G	E	G	12h	20.5 pt.
chlorothalonil						through shuck split	NA
Cabrio EG (20EG)	11	x	F-E	x	E	12h	47.5 oz.
pyraclostrobin						0d	5
Captan 80WDG	M	x	G	F-G	x	24h	17.5 lb.
captan						0d	NA
CaptEvate 68WDG	M+17	x	E	G	x	24h	18.75 lb
captan + fenhexamid						0d	NA
Cevya	3	x	E	E	E	12h	NA
mefentrifluconazole						0d	see label
C-0-C-S WDG	M	E	F	F	x	48h	36 lb.
copper oxychloride						21d	3
Cuprofix Ultra 40 Disperss	M	E	F	F	P	48h	45 lb.
basic copper sulfate						120d	NA

(continued)

Efficacy of Selected Fungicides Against Cherry Diseases[1] *(continued)*

Product and formulation Active Ingredient	FRAC Code[2]	Black Knot	Brown rot	Cherry Leaf spot	Powdery mildew	REI[3]	PHI[4]	Max amt[5] Max app[6]
Elevate 50WDG fenhexamid	17	x	G-E	x	x	12h 0d		6 lbs NA
Elite 45DF tebuconazole	3	x	E [r]	E-G[r]	G[r]	12h 0d		3 lb. NA
Flint Extra trifloxystrobin (higher rate)	11	x	E	E	E	12h 1d		15.2 oz. 4
Fontelis (SC) penthiopyrad	7	x	E	F-G	G	12h 0d		61 fl. oz. NA
Gatten flutianil	U13	x	x	x	E	12 3 d		32 fl. oz. 4
Indar 2F fenbuconazole	3	x	E[r]	E[r]	G[r]	12h 0d		48 fl. oz. 8
Inspire Super (EW) difenoconazole + cyprodinil	3+9	x	E	x	E	12h 2d		80 fl. oz. 4
Kenja 400SC isofetamid	7	x	E	x	x	12 1 d		37.5 fl oz 3
Kocide 3000 copper hydroxide	M	E	G-F	G	F	48h 0d		60 lb. 4
Luna Experience (SC) fluopyram + tebuconazole	7+3	x	G-E	x	E	12h 0d		34 fl. oz. NA
Luna Privilege fluopyram	7	E	E-G	s	G	12h 0d		13.7 fl oz NA
Luna Sensation (SC) fluopyram + trifloxystrobin	7+11	x	E	EG	G	12h 1d		27.1 fl. oz. 4
Merivon XBF fluxapyroxad + pyraclostrobin	7+11	x	E	E-G	G	12h 0d		20.1 fl. oz. 3
PhD polyoxin D	19	x	x	x	G	4 h 0d		
Pristine pyaclostrobin + boscalid	7+11	x	G	E	E	12h 0d		72.5 oz. 5
Procure 480SC2 triflumizole	3	x	G	G[r]	E	12h 1d		56 fl. oz. 4
Quadris Top azoxystrobin + difenoconazole	11+3	x	E	F-G	G	12h 0d		56 fl. oz. NA
Quash metconazole	3	x	G	GR	E	12h 14d		10.5-12 oz. 3
Quilt Xcel azoxystrobin + propiconazole	11+3	x	E	G	G	12h 0d		70 fl. oz. 5
Quintec (2.08F) quinoxyfen	13	x	x	x	G	12h 7d		32 fl. oz. NA

(continued)

Efficacy of Selected Fungicides Against Cherry Diseases[1] *(continued)*

Product and formulation Active Ingredient	FRAC Code[2]	Black Knot	Brown rot	Cherry Leaf spot	Powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Rally 40WSP2	3	x	E	ER	E	24h	3.25 lb.
myclobutanil						0d	NA
Rovral 4F	2	x	E	F-G	E	24h	4 pt.
iprodione						60d	2
Microthiol Disperss	M2	x	F	x	G	24h	N/A
sulfur						N/A	NA
Syllit F2	U12	x	G	G	x	48h	12 pt.
dodine						7d	6
Tilt (EC)	3	x	G[r]	G[r]	E[r]	12h	20 fl. oz.
propiconazole						0d	5
Topguard Specialty Crop	3	x	E	G	G	12h	56 fl. oz.
flutriafol						7d	4
Topsin M70 WSB 2	1	E	G	F-G	F[r]	48h	4 lb.
thiophanate-methyl						1d	NA
Vanguard WG (75WG)	9	x	G	x	u	12h	30 oz.
cyprodinil						2d	4
Ziram 76DF	M3	E	F-i	F-i	x	48hr	24.2 lb.
ziram						14d	4

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] FRAC code represents the mode of action of the fungicide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Efficacy of Selected Insecticides and Acaricides Against Cherry Insects and Mites[1]

Compiled by D. Lewis

Product and formulation Active ingredient	IRAC Code[2]	borers	cherry fruit fly	European red mite	plum curculio	spotted wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS bifenazate	20	x	x	E	x	x	12h 3d	NA 1
Actara (25WDG) thiamethoxam	4A	x	F	x	G	x	12h 14d	11 oz. NA
Admire Pro (4.6F) imidacloprid	4A	i	F	G	s	x	12h 0-21d	8.4-10.5 fl. oz. NA
Agri-Mek SC (0.7SC) **(RUP)** abamectin	6	x	x	u	x	x	12h 21d	8.5 fl. oz 2
Altacor (35WDG) chlorantraniliprole	28	x	s	x	x	x	4h 10d	9 oz. NA
Apollo SC (1SC) clofentezine	10A	x	x	E	x	x	12h 21d	NA NA
Apta (1.34SC) tolfenpyrad	21A	x	u	x	G	s	12h 14d	53.5 fl. oz. 2
Asana XL (0.66EC) **(RUP)** esfenvalerate	3A	G	G	x	G	x	12h 14d	72.5 fl. oz. NA
Assail 30SG acetamiprid	4A	G	F	x	G	F	12h 7d	32 oz. 4
Avaunt (30WDG) indoxacarb	22	x	x	x	E	x	12h 14d	24 oz 4
Baythroid XL (1EC) **(RUP)** cyfluthrin	3A	G	G	x	G	x	12h 7d	5.6 fl. oz. NA
Beleaf 50SG flonicamid	29	x	x	x	x	x	12h 14d	8.4 oz. 3
Centaur WDG (70WDG) buprofezin	16	x	x	x	x	x	12h 14d	69 oz. 2
Closer SC (2SC) sulfoxaflor	4C	x	x	x	x	x	12h 7d	17 fl. oz. 4
Danitol 2.4EC **(RUP)** fenpropathrin	3A	x	x	F	G	E	24h 3d	42.7 fl. oz. NA
Delegate WG (25WG) spinetoram	5	x	s	x	s	G	4h 7d	28 oz. 4
Diazinon AG 600WBC **(RUP)** diazinon	1B	x	G	u	x	x	72h 21d	102 fl. oz. 2

(continued)

Efficacy of Selected Insecticides and Acaricides Against Cherry Insects and Mites[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	borers	cherry fruit fly	European red mite	plum curculio	spotted wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Dimilin 25W, 2L **(RUP)** diflubenzuron	15	x	x	x	x	x	12h 10d	NA NA
Entrust SC (2SC) spinosad	5	x	F	x	x	x	4h 7d	29 fl. oz. 3
Envidor 2SC spirodiclofen	23	x	x	E	x	x	12h 7d	18 fl. oz. 1
Esteem 35WP, 0.86EC pyriproxyfen	7C	x	x	x	x	x	12h 14d	15 oz. 3
Exirel (0.83SE) cyantraniliprole	28	x	E	x	G	E	12h 3d	61.5 fl. oz. 3
Imidan 70W phosmet	1B	x	G	x	G	E	72h 7d	5.25 lb. NA
Intrepid 2F methoxyfenozide	18	x	x	x	x	x	4h 7d	64 fl. oz. NA
Lorsban 4E **(RUP)** chlorpyrifos	1B	E	x	u	x	x	96h dormant	2 lb. 1
Lorsban 75WG chlorpyrifos	1B	E	G	x	u	x	96h 14	2 lb. 1
Magister SC (1.7SC) fenazaquin	21A	x	x	u	x	x	12h 3d	36 fl. oz. 1
Malathion malathion	1B	x	G	x	x	G	12h 3d	7 pt. 4
Movento (2SC) spirotetramat	23	x	u	u	x	u	24h 7d	15.3 fl. oz. NA
Mustang Maxx (0.83EC) **(RUP)** zeta-cypermethrin	3A	x	F	x	G	E	12h 14d	24 fl. oz. NA
Neemix 4.5 (0.39L), AzaDirect azadirachtin	un	F	x	x	i	x	4h 0d	NA NA
Nexter (75WP) pyridaben	21	x	x	u	x	x	12h 300d	21.34 oz. 2
Nexter SC (3.75SC) pyridaben	21A	x	x	u	x	x	12h 300d	34 fl. oz. 2
Oil (superior) mineral oil	UN	x	x	u	x	x	12h dormant	UN NA
Onager (1EC) hexythiazox	10	x	x	u	x	x	12h 7d	24 oz. 1

(continued)

Efficacy of Selected Insecticides and Acaricides Against Cherry Insects and Mites[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	borers	cherry fruit fly	European red mite	plum curculio	spotted wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Portal XLO (0.4EC) fenpyroximate	21A	x	x	u	x	x	12h 7d	4 pt. 2
Pounce 25WP permethrin	3A	F	x	x	G	x	12h 3d	0.6 lb. 3
PQZ (1.87SC) pyrifluquinazon	9B	x	x	x	x	x	12h 7d	4.8 fl. oz. 2
Proaxis (0.5EC) **(RUP)** gamma-cyhalothrin	3A	x	G	x	G	x	24h 14d	0.1 lb. NA
Pyganic 5EC, 1.4EC pyrethrins	3A	x	i	x	i	i	12h 0d	15.61 fl. oz. 10
Rimon 0.83EC novaluron	15	x	x	x	x	G	12h 8d	150 fl. oz. NA
Savey 50DF hexythiazox	10A	x	x	E	x	x	12h 28d	6 oz. 1
Sevin XLR Plus (4F) carbaryl	1A	x	G	x	F	x	12h 3d	14 qt. 3
Sivanto Prime (1.67SC) flupyradifurone	4D	x	x	x	x	x	4h 14d	28 fl. oz. NA
Surround WP (95WP) kaolin	UN	x	s	x	s	x	4h 0d	NA NA
Transform WG sulfoxaflor	4C	x	x	x	x	x	24h 7d	8.5 oz. 4
Vendex 50WP **(RUP)** fenbutatin-oxide	12B	x	x	G	x	x	48h 14d	4.5 lb. 2
Verdepryn 100SL (0.83SL) cyclaniliprole	28	x	G	x	u	u	4h 7d	33 fl. oz. 3
Versys Inscalis (0.83DC) afidopyropen	9D	x	x	x	x	x	12h 7d	3 fl. oz. NA
Warrior II (2.08CS) **(RUP)** lambda-cyhalothrin	3A	G	G	x	G	x	24h 14d	12.8 fl. oz. NA
Zeal (72WP) etoxazole	10 B	x	x	E	x	x	12h 7d	3 oz. 1

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[2] IRAC code represents the mode of action of the insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
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PEACH

Peach Spray Schedule

Entomology Lead: R. Bessin
Pathology Lead: J. Beckerman, M. Heller-Haas
Horticulture Lead: J. Strang

Peach Dormant

After leaves drop in the fall or before buds swell in spring.

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot	copper hydroxide (Kocide 3000, Champ FL)	3.5-5 lb.	Using copper at the dormant stage may also reduce the overwintering inoculum of the bacteria that cause bacterial canker and bacterial spot. As season progresses, reduce the rate of copper applied to reduce the risk of phytotoxicity. Copper applied using tank with a pH of less than 6.5 may result in phytotoxicity issues.
	copper oxychloride (C-O-C-S WDG)	6 lb.	
peach leaf curl	To effectively control peach leaf curl, fungicide must be applied before bud swell. Best control is achieved by applying in late autumn at leaf fall.		
	Bordeaux mixture	See label	Using copper at the dormant stage may also reduce the overwintering inoculum of the bacteria that cause bacterial canker and bacterial spot.
	Bravo Weather Stik	3-4 pt.	Other formulations and generics available.
	copper hydroxide (Kocide 3000, Champ FL)	3.5-5 lb.	Using copper at the dormant stage may also reduce the overwintering inoculum of the bacteria that cause bacterial canker and bacterial spot.
	copper oxychloride (C-O-C-S WDG)	12-15.6 lb.	
	Ferbam 76WDG	4.5 lb.	
	Syllit FL	3 pt.	Use 3 pints per acre just before buds swell in the spring only. Not labeled for fall application.
	Ziram 76DF	3.75-8 lb.	
Phytophthora crown, collar, and root rot	Ridomil Gold SL	2 qt. or 1.5 oz. per 1,000 sq. ft.	Apply under tree canopy in spring before growth starts. See Phytophthora Root, Crown, and Collar Rots, page 111.
mites, San Jose scale	superior oil		Check labels for temperature restrictions.
San Jose scale	Centaur 70WDG	34.5 oz.	
	Diazinon AG600 WBC	12.75 fl. oz. per 100 gal.	
	Esteem 35WP	4-5 oz.	
	Lorsban Advanced 4E	1-4 pt.	
	Sivanto Prime 1.67SL	10.5-14 fl. oz.	

Peach Pink

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot	copper hydroxide (Kocide 3000) Cuprofix Ultra 40 Disperss	1.7 lb./100 gal. 1.25 lb./100 gal.	As season progresses, reduce the rate of copper applied, to reduce the risk of phytotoxicity. Copper applied to tanks with a pH of less than 6.5 may result in phytotoxicity issues.
brown rot (blossom blight)	Abound	12-15 fl. oz.	Begin applications at early bloom and continue through petal fall. Not recommended at this time. Generic formulations are available.
	Bravo Weather Stik	3.1-4.1 pt.	Other formulations and generics available.
	Captan 80WDG	2.5-5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Cevya	5 oz.	Not recommended at this time.
	Elevate 50WDG	1-1.5 lb.	
	Elite 45WSP	4-8 oz.	
	Fontelis	14-20 fl. oz.	Do not exceed 61 fl. oz./acre per year.
	Flint Extra	2.5-3.8 fl. oz	
	Indar 2F	6 oz.	Apply in a minimum of 50 gal. of water per acre.
	Inspire Super	16-20 fl. oz.	
	Kenja 400SC	12.5 fl. oz.	
	Luna Experience	6-10 oz.	
	Luna Privilege	4-6.8 fl. oz.	
	Luna Sensation	5-7.6 fl. oz.	
	Miravis	3.4-5.1 oz.	
	Merivon	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan.
	Meteor	1-2 pt.	Apply at bud break when tissue is susceptible.
	Orbit/Tilt	4 fl. oz.	Apply in a minimum of 50 gal. of water per acre.
	Pristine	10.5-14.5 oz.	
	Quadris Top	12-14 fl. oz.	Effective for brown rot management. Contains azoxystrobin, which is known to be phytotoxic to certain apple varieties. Do not use where drift might affect apples. Generic formulations available.
	Quash	2.5-3.5 oz.	Do not exceed 3 applications per season. Do not exceed 12 oz./acre per season. Do not exceed 2 applications after petal fall.
	Quilt Xcel	14 fl. oz.	Effective for brown rot management. Contains azoxystrobin, which is known to be phytotoxic to certain apple varieties. Do not use where drift might affect apples.
	Rally 40WSP	2.5-6 oz.	Do not exceed 3.25 lb. per season.
	Rovral 50 WP	1-2 pt.	Do not exceed 2 applications per season. May not be applied after petal fall on stone fruit.
	Scala 5SC	9-18 fl. oz.	
	wettable sulfur 90%	10-30 lb.	
	Topguard Specialty Crop	14 fl. oz.	Also controls scab. Not recommended at this time.
	Topguard EQ	6-8 oz.	Also controls powdery mildew and scab. Not recommended at this time.

(continued)

Peach Pink *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
brown rot (blossom blight) *(continued)*	Topsin-M 70WSB **PLUS**	1.5 lb.	Topsin-M and the sterol-inhibiting fungicides (Rally, Indar, and Orbit) should always be alternated or combined with another fungicide (such as captan) to minimize the development of resistance. Topsin-M also is available in a flowable formulation (4.5 FL). Make one application at popcorn (pink, red, or early white bud) and a second application at full bloom. If weather conditions are 60-70° and wet, make an additional application at petal fall.
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Vangard 75WG	5 oz.	Designated as reduced-risk by the EPA.
	Ziram 76DF	4.5-8 lb.	Under severe disease pressure, use the higher rate.
oriental fruit moth (monitoring)	Put pheromone traps to monitor oriental fruit moth in place now to determine the need for sprays at petal fall (page 51).		
	CheckMate OFM	108-150 dispensers	
	CheckMate OFM-F Sprayable pheromone	1.32-2.93 fl. oz.	
	Cidetrak OFM-L	100-200 dispensers	
	Isomate-M 100 Isomate M Rosso Isomate OFM TT	100-200 dispensers (depending on product)	Place dispensers in upper third of tree now. Note: pheromone traps in orchards with mating disruption are expected to catch no moths ("trap shutdown"). See Mating Disruption for Peach Pests, page 111.
tarnished plant bug, stink bugs	As pink begins to show, examine trees for tarnished plant bug . If present, apply insecticides. Make application before any blooms open.		
	Asana XL 0 .66EC	4.8-14.5 fl. oz.	
	Assail 30SG	5.3-8 oz.	
	Baythroid XL	2-2.4 fl. oz.	
	Beleaf 50SG	2-2.8 oz.	Not labeled for stink bug control.
	Danitol 2.4EC	10.7-21.3 fl. oz.	Not for brown stink bug.
	Pounce 25WP	6.4-16 oz.	Not labeled for stink bug control.
	Proaxis 0 .5EC	2.56-5.12 fl. oz.	
	Mustang Maxx 0.8EC	1.28-4 fl. oz.	
	Scorpion 35SL	5.25-7 fl. oz.	Not for tarnished plant bug.
	Sevin XLR Plus (4L)	2-3 qt.	Not labeled for stink bug control.
	Venom 70SG	3-4 oz.	Not for tarnished plant bug.
	Warrior II	1.28-2.56 fl. oz.	

Peach Full Bloom

Pest/Problem	Material	Rate/Acre	Comments
brown rot (blossom blight)	Abound	12-15.5 fl. oz.	This product contains azoxystrobin and may be phytotoxic if applied to apples. For brown rot blossom blight, begin applications at bloom and continue through petal fall.
	Bravo Weather Stik	3.1-4.1 pt.	Other formulations and generics available.
	Captan 80WDG	2.5-5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Cevya	5 oz.	
	Elevate 50WDG	1-1.5 lb.	
	Elite 45WSP	4-8 oz.	
	Fontelis	14-20 fl. oz.	
	Flint Extra	1.9-3.8 oz.	
	Indar 2F	2 oz.	Apply in a minimum of 50 gal. of water per acre.
	Inspire Super	16-20 fl. oz.	
	Kenja 400SC	12.5 fl. oz.	
	Luna Experience	6-10 oz.	
	Luna Privilege	4-6.8 fl. oz.	
	Luna Sensation	5-7.6 fl. oz.	1-day PHI.
	Merivon	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan.
	Miravis	3.4-5.1 oz.	
	Pristine	10.5-14.5 oz.	
	PhD WSP	6.2 oz.	
	Quadris Top	12-14 fl. oz.	Effective for brown rot management. Contains azoxystrobin, which is known to be phytotoxic to certain apple varieties. Do not use where drift might affect apples. Under high disease pressure and/or with very susceptible varieties, applications may be needed at 50-75% bloom and petal fall. Do not exceed 2 sequential applications before switching to a non-Group 11 fungicide.
	Quash	2.5-3.5 oz.	Do not exceed 3 applications per season. Do not exceed 12 oz./acre per season. Do not exceed 2 applications after petal fall.

(continued)

***Peach Full Bloom** (continued)*

Pest/Problem	Material	Rate/Acre	Comments
brown rot (blossom blight) *(continued)*	Quilt Xcel	14 fl. oz.	Effective for brown rot management. Contains azoxystrobin, which is known to be phytotoxic to certain apple varieties. Do not use where drift might affect apples. Under high disease pressure and/or with very susceptible varieties, applications may be needed at 50-75% bloom and petal fall. Do not exceed 2 sequential applications before switching to a non-Group 11 fungicide.
	Rally 40WSP	2.5-6 oz.	Do not exceed 3.25 lb. per season.
	Rovral	1-2 pt.	Do not exceed 2 applications per season. May not be applied after petal fall on stone fruit. Contains iprodione.
	Scala 5SC	9-18 fl. oz.	For brown rot control of all stone fruit except cherry.
	wettable sulfur 95%	10-30 lb.	
	Tilt	4 fl. oz.	Apply in a minimum of 50 gal. water per acre. Other generics available.
	Topguard EQ	6-8 oz.	Also controls powdery mildew and scab.
	Topguard Specialty Crop	14 oz.	7-day PHI. Does not contain azoxystrobin.
	Topsin-M 70WSB **PLUS**	1.5 lb.	Topsin-M should always be alternated or combined with another fungicide (such as captan, or a FRAC 3, FRAC 7 or FRAC 11) to minimize the development of resistance. Topsin-M also is available in a flowable formulation (4.5 FL).
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Vangard 75WG	5 oz.	
	Ziram 76DF	4.5-8 lb.	
insects, mites	**SAVE THE BEES!** Do not apply insecticides during bloom.		

Peach Petal Fall

Pest/Problem	Material	Rate/Acre	Comments
brown rot	Same as for Peach Pink, page 88. Do not apply Rovral after petal fall. If previously using Rally, rotate to another product with a different mode of action.		
bacterial spot	FireLine	12 oz.	If bacterial spot has been a problem, apply at 7-day intervals beginning at petal fall (<5% shuck split) through first cover.
	Mycoshield	12 oz.	
	copper hydroxide (Kocide 3000) Badge SC Cuprofix Ultra 40 Disperss	0.25-0.5 lb./100 gal. 1.5 pint/100 gal. 0.75 lb/100 gal.	Note reduced rate of copper applied, to reduce the risk of phytotoxicity. Copper applied to tanks with a pH of less than 6.5 may result in phytotoxicity issues. When using coppers post-bloom, drying conditions should be excellent. Do not apply during extended dews or foggy conditions. Do not apply after shuck split.
peach scab	Abound	12.0-15.5 fl. oz.	Begin applications at petal fall and continue at 7- to 14-day intervals in rotation with other products. For peaches, do not exceed 15.5 fl. oz. for scab control.
	Bravo Weather Stik	3.1-4.1 oz.	Other formulations and generics available.
	Captan 80WDG	2.5-5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Cevya	3-5 fl. oz.	
	Flint Extra	2.5-3.8 fl. oz.	Effective against scab. Suppresses brown rot.
	Indar 2F	6 fl. oz.	

(continued)

Peach Petal Fall *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
peach scab (continued)	Kenja 400SC	12.5 fl. oz.	
	Luna Experience	6-10 oz.	
	Luna Privilege	4-6.8 fl. oz.	
	Luna Sensation	5-7.6 fl. oz.	1-day PHI.
	Merivon	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan.
	Miravis	3.4-5.1 oz.	
	PhD WDG	6.2 oz.	
	Pristine	10.5-14.7 oz.	
	Quilt Xcel	14 fl. oz.	Effective for brown rot management. Contains azoxystrobin, which is known to be phytotoxic to certain apple varieties. Do not use where drift might affect apples. Under high disease pressure and/or with very susceptible varieties, applications may be needed at 50-75% bloom and petal fall. Do not exceed 2 sequential applications before switching to a non-Group 11 fungicide.
	Rovral	1-2 pt.	Contains iprodione. Also sold as Meteor. Do not apply after petal fall.
	Scala SC	9-18 oz.	For brown rot control of all stone fruit except cherry.
	Tilt	4 fl. oz.	Apply in a minimum of 50 gal. water per acre. Other generics available.
	Topguard Specialty Crop	14 oz.	Does not contain azoxystrobin.
	Topguard EQ	6-8 oz.	This is a pre-mix of azoxystrobin and flutriafol.
oriental fruit moth, plum curculio, stink bugs, tarnished plant bug	Asana, Baythroid, Pounce, Actara, Mustang Maxx, Warrior, Proaxis, Danitol, or Assail as at Pink Dormant, page 51. **OR**		
	Apta 1.31EC	21-27 fl. oz.	For plum curculio.
	Avaunt 30WDG	5-6 oz.	For plum curculio.
	Belay 2.13 EC	6 fl. oz.	Not labelled for oriental fruit moth.
	Exirel 0.83SE	10-20.5 fl. oz.	Not labeled for tarnished plant bug or stink bug. User lower rate for oriental fruit moth; use higher rate for plum curculio.
	Imidan 70W	2.13-4.25 lb.	Not for tarnished plant bug or stink bug.
	Venom 70SG	3-4 oz.	Not for tarnished plant bug.
	Verdepryn 100SL	5.5-11 fl. oz.	
oriental fruit moth	Any of the products listed above for four species combined **OR**		
	Altacor 35WDG	3-4.5 oz.	
	Delegate 25WG	6-7 oz.	
	Entrust 2SC	4-8 fl. oz.	
	Intrepid 2F	10-16 fl. oz.	
	Rimon 0.83EC	20-40 fl. oz.	

Peach Shuck Split

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot	FireLine	12 oz.	If bacterial spot has been a problem, apply at 7-day intervals beginning at petal fall (<5% shuck split) through first cover.
	Mycoshield	12 oz.	Oxytetracycline is most effective when applied during extended periods of leaf wetness. Apply within 24 hours of wetting events and allow time for the spray to dry before rain.
	copper hydroxide (Kocide 3000) Badge SE Cuprofix Ultra 40 Disperss	0.25-0.5 lb. per 100 gal. 8 oz./100 gal. 0.75 lb./100 gal.	As season progresses, reduce the rate of copper applied to reduce the risk of phytotoxicity. Copper applied to tanks with a pH of less than 6.5 may result in phytotoxicity issues. When using coppers post-bloom, drying conditions should be excellent. Do not apply during extended dews or foggy conditions. Do not apply Cuprofix after shuck split.
brown rot, scab	Abound	9-15.5 fl. oz.	Begin applications at petal fall and continue at 7-14 day intervals in rotation with other products.
	Bravo Weather Stik	3.1-4.1 pt.	This should be the last Bravo application to minimize damage to fruit finish. Other formulations and generics available.
	Captan 80WDG	2.5-5 lb.	See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50. Captan at 2.5 lb. is a good tank mix partner if disease and fungicide resistance risk are high.
	Cevya	5 oz.	Effective against powdery mildew and scab. Suppresses brown rot.
	Flint Extra	2.5-3.8 fl. oz.	
	Fontelis	14-20 fl. oz.	
	Indar 2F	2 oz.	
	Indar		
	Inspire Super	16-20 fl. oz.	
	Kenja 400SC	12.5 fl. oz.	
	Luna Experience	6-10 oz.	
	Luna Privilege	4-6.8 fl. oz	
	Luna Sensation	5-7.6 fl. oz.	
	Merivon	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan. Can be used day of harvest.
	Miravis	3.4-5.1 oz.	
	PhD WDG	6.2 oz.	
	Pristine	10.5-14.5 oz.	
	Quash	3.5-4 oz.	
	wettable sulfur 90%	10-30 lb.	
	Tilt	4 fl. oz.	Apply in a minimum of 50 gal. water per acre. Other generics available.
	Topsin-M 70WSB **PLUS**	1.5 lb.	Topsin-M and the sterol-inhibiting fungicides (Rally, Indar, and Orbit) should always be alternated or combined with another fungicide (such as captan) to minimize the development of resistance. Topsin-M also is available in a flowable formulation (4.5 FL).
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Topguard Specialty Crop	14 oz.	7-day PHI. Does not contain azoxystrobin.
	Topguard EQ	6-8 oz.	Also controls powdery mildew. Higher rate of flutriafol (Topguard) plus azosxystrobin.
	Ziram 76DF	4.5-8 lb.	

(continued)

Peach Shuck Split *(continued)*

powdery mildew	Captan 80WDG	2.5-5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Flint Extra	2.5-3.8 fl. oz.	Effective against powdery mildew and scab. Suppresses brown rot.
	Fontelis	14-20 fl. oz.	
	Kenja 400SC	12.5 fl. oz.	
	Luna Experience	6-10 oz.	0-day PHI.
	Luna Privilege	4-6.8 fl. oz.	Also effective against brown rot, scab and powdery mildew.
	Luna Sensation	5-7.6 fl. oz.	1-day PHI.
	Merivon	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan.
	Microthiol Disperss	10-20 lb.	
	Miravis	3.4-5.1 oz.	
	PhD WDG	6.2 oz.	
	Pristine	10.5-14.5 oz.	
	Quash	3.5-4 oz.	Do not apply more than 12 oz. product per acre per year when the maximum rate per application is 4.0 oz. product per acre.
	Quintec 2.08F	7 fl. oz.	
	Rally 40WSP	2.5-6 oz.	
	Tilt	4 fl. oz.	Apply in a minimum of 50 gal. water per acre. Other generics available.
	Topguard EQ	6-8 oz.	Also controls powdery mildew and scab.
	Topguard Specialty Crop	14 oz.	7-day PHI. Does not contain azoxystrobin.
plum curculio, stink bugs, tarnished plant bug	Same as for Peach Petal Fall, page 92.		
plum curculio	Any of the products listed at Peach Petal Fall for the three species combined, page 92. **OR**		
oriental fruit moth	Same for Peach Petal Fall, page 92.		
green peach aphid	Admire Pro 4.6F	1.4-2.8 fl. oz.	
	Beleaf 50SG	2-2.8 oz.	
	Closer SC	1.5-2.75 fl. oz.	
	Movento 2SC	6-9 fl. oz.	
	PQZ 1.87SC	2.4-3.2 fl. oz.	
	Versys Inscalis 0.83SC	1.5 fl. oz.	
European red mite, twospotted spider mite	Acramite 50WS	0.75-1 lb.	Use low rate for twospotted mite, high rate for European red mite. Limit of 1 application per year.
	Agri-Mek 0.7SC	2.25-4.25 fl. oz.	Must mix with a non-ionic adjuvant or horticultural oil.
	Apollo 4SC	2-8 oz.	Limit of 1 application per year.
	Envidor 2SC	16-18 fl. oz.	Limit of 1 application per year.
	Magister 1.7SC	32-36 fl. oz.	Limit of 1 application per year.
	Nexter 75WP	4.4-10.67 oz. (1-3 bags)	Controls European red mite at 4.4-5.2 oz./acre, and twospotted spider mite at 8.8-10.67 oz./acre. Limit of 2 applications per year.
	Onager 1EC	12-24 fl. oz.	Limit of 1 application per year.
	Portal XLO (0.4EC)	2 pt.	Limit of 2 applications per year.
	Savey 50DF	3-6 oz.	Limit of 1 application per year.
	Zeal 72WP	2-3 fl. oz.	

Peach First Cover

7-10 days after shuck split.

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot	FireLine	12 oz.	If bacterial spot has been a problem, apply at 7-day intervals beginning at petal fall (<5% shuck split) through first cover.
	Mycoshield	12 oz.	Oxytetracycline is most effective when applied during extended periods of leaf wetness. Apply within 24 hours of wetting events and allow time for the spray to dry before rain.
	Badge SC copper hydroxide (Kocide 3000)	8 fl. oz. /100 gal. 0.13 lb. per 100 gal.	As season progresses, reduce the rate of copper applied to reduce the risk of phytotoxicity. Copper applied to tanks with a pH of less than 6.5 may result in phytotoxicity issues.
brown rot, scab	Abound	12.0-15.5 fl. oz.	Begin applications at petal fall and continue at 7-14 day intervals in rotation with other products.
	Captan 80WDG	2.5-5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50. Do not exceed 30 lb. of captan per season.
	Cevya	5 oz.	
	Flint Extra	2.5-3.8 fl. oz.	Effective against powdery mildew and scab. Suppresses brown rot.
	Fontelis	14-20 fl. oz.	
	Indar 2F	6 fl. oz.	
	Inspire Super	16-20 fl. oz.	
	Luna Privilege	4-6.8 fl.oz.	
	Luna Sensation	5-7.6 fl. oz.	
	Merivon	4-6.7 fl. oz.	Do not apply with an EC or oil-based products. Do not apply with Bravo or captan.
	Miravis	3.4-5.1 oz.	
	Pristine	10.5-14.5 oz.	
	Quadris Top	12-14 fl. oz.	Effective for brown rot management. Contains the fungicide azoxystrobin, which is known to be phytotoxic to certain varieties of apple. Do not be use where drift might affect apples.
	Quash	3.5-4 oz.	
	Quilt Xcel	14 fl. oz.	Effective for brown rot management. Contains the fungicide azoxystrobin, which is known to be phytotoxic to certain varieties of apple. Do not be use where drift might affect apples.
	wettable sulfur 90%	10-30 lb.	
	Tilt	4 fl. oz.	Apply in a minimum of 50 gal. water per acre. Other generics available.
	Topguard EQ	6-8 oz.	Also controls powdery mildew and scab.
	Topguard Specialty Crop	14 oz.	7-day PHI. Does not contain azoxystrobin.
	Topsin-M 70WSB	1.5 lb.	
	PLUS		
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Ziram 76DF	4.5-8 lb.	

(continued)

Peach First Cover *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
powdery mildew	Abound	12-15.5 oz.	Begin application at the onset of disease as a protectant fungicide and continue on a 7- to 14-day schedule.
	Cevya	3-5 oz.	
	Flint Extra	2.5-3.8 fl. oz.	Effective against powdery mildew and scab. Suppresses brown rot.
	Fontelis	14-20 fl. oz.	
	Inspire Super	16-20 fl. oz.	
	Luna Experience	6-10 oz.	0-day PHI.
	Luna Privilege	4-6.8 fl. oz.	
	Luna Sensation	5-7.6 fl. oz.	1-day PHI.
	Merivon	4-6.7 fl. oz.	Do not apply an EC or oil-based products. Do not apply with Bravo or captan.
	Microthiol Disperss	10-20 lb.	
	Miravis	3.4-5.1 oz.	
	Pristine	10.5-14.5 oz.	
	Quadris Top	12-14 fl. oz.	Effective for brown rot management. Contains the fungicide azoxystrobin, which is known to be phytotoxic to certain varieties of apple. Do not use where drift might affect apples.
	Quash	3.5-4 fl. oz.	
	Quilt Xcel	14 fl. oz.	Effective for brown rot management. Contains the fungicide azoxystrobin, which is known to be phytotoxic to certain varieties of apple. Do not use where drift might affect apples.
	Quintec 2.08F	7 fl. oz.	
	Rally 40WSP	2.5-6 oz.	Can be applied at 10- to 14-day intervals for powdery mildew control until terminal growth stops.
	Scala SC	9-18 oz.	For brown rot control of all stone fruit except cherry.
	Tilt	4 fl. oz.	Apply in a minimum of 50 gal. water per acre. Other generics available.
	Topguard EQ	6-8 oz.	7-day PHI.
	Topguard Specialty Crop	14 oz.	7-day PHI. Does not contain azoxystrobin.
	wettable sulfur 90%	10-30 lb.	
bacterial spot	FireLine	12 oz.	
	Kocide 2000/3000	0.13-0.5 lb.	Only recommended if bacterial spot is a recurring issue. Post-bloom application applied at first and second cover sprays. NOTE: Do not spray 3 weeks prior to harvest. Use only recommended rates. Spotting of leaves and defoliation may occur from use in cover sprays.
	Mycoshield 17WP	1-1.5 lb.	Use lower rates; higher concentrations may be phytotoxic. Essential to spray entire tree once a week.
plum curculio, oriental fruit moth, stink bugs, tarnished plant bug	Same as for Peach Petal Fall, page 92.		
oriental fruit moth	Same as for Peach Petal Fall, page 92.		
European red mite	Same as for Peach Shuck Split, page 94.		
lesser peachtree borer	Control of the first generation of lesser peachtree borer with trunk sprays is during the time of peak moth flight, generally from early May to early June, depending on latitude and spring temperatures. See Borers of Peach, Cherry, and Plum Trees, page 112.		

Peach Second Cover

10 days after first cover.

Pest/Problem	Material	Rate/Acre	Comments
brown rot, scab	Same as for Peach First Cover, page 95.		
bacterial spot	FireLine	0.75 lb.	Only recommended if bacterial spot is a recurring issue. Post-bloom application applied at first and second cover sprays. NOTE: Do not spray 3 weeks prior to harvest. Use only recommended rates. Spotting of leaves and defoliation may occur from use in cover sprays.
	Kocide 2000/3000	0.13-0.5 lb.	Only recommended if bacterial spot is a recurring issue. Post-bloom application applied at first and second cover sprays. Sprays are critical from late May to through June to prevent large fruit lesions. Under wet conditions, bacterial spot infections may continue through harvest. Small bacterial spot lesions increase susceptibility to brown rot, and failure to control can result in significantly more brown rot. Spotting of leaves and defoliation may occur from use in cover sprays.
	Mycoshield 17WP	0.75 lb.	Use lower rates; higher concentrations may be phytotoxic. Essential to spray entire tree once a week.
powdery mildew	Same as for Peach First Cover, page 96.		
plum curculio, oriental fruit moth, catfacing insects	Same as for Peach Petal Fall, page 92.		
mites	Same as for Peach Shuck Split, page 94.		
San Jose scale	Admire Pro 4.6F	1.4-2.8 fl. oz.	
	Assail 30SG	5.3-8 oz.	
	Belay 2.13SC	6 fl. oz.	
	Centaur 70WDG	34.5 oz.	Apply at early crawler emergence.
	Esteem 35WP	4-5 oz.	Time application for first activity of crawlers.
	Movento 2SC	6-9 oz.	Must be tank mixed with a spray adjuvant.
	Sivanto Prime 1.67SL	10.5-14 fl. oz.	

Peach Third, Fourth, and Additional Covers

Apply at 10- to 14-day intervals.

Pest/Problem	Material	Rate/Acre	Comments
brown rot, scab	Same as for Peach First Cover, page 95. Scab requires control until fruit is within 40 days of harvest.		
powdery mildew	Same as for Peach First Cover, page 96.		
oriental fruit moth	Same as for Peach Petal Fall, page 92.		
mites	Same as for Peach Shuck Split, page 94.		
peachtree borer	If not using Isomate PTB Dual for mating disruption, peachtree borer is best controlled by a trunk drench at the time of peak moth flight, usually in early August. See Borers of Peach, Cherry, and Plum Trees, page 112.		

Peach Pre-harvest

Apply according to label directions beginning 3 weeks before harvest.

Pest/Problem	Material	Rate/Acre	Comments
brown rot	Abound	12-15.5 oz.	0-day PHI. Do not apply more than 92.3 fl. oz. of product/A/season.
	Captan 80WDG	5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50. Do not exceed 30 lb. of captan per season.
	Cevya	5 oz.	
	Elite 45WSP	4-8 oz.	
	Flint Extra	2.5-3.8 fl. oz.	Suppresses brown rot. 1-day PHI.
	Fontelis	14-20 fl. oz.	
	Indar 2F	6 oz.	
	Inspire Super	16-20 fl. oz.	
	Kenja 400SC	12.5 fl. oz.	
	Luna Experience	6-10 fl. oz.	0-day PHI.
	Luna Privilege	4-6.8 fl. oz.	0-day PHI.
	Luna Sensation	5-7.6 oz.	1-day PHI.
	Merivon	4-6.7 fl. oz.	Do not apply with an EC or oil-based products. Do not apply with Bravo or captan.
	Pristine	10.5-14.5 oz.	
	Quadris Top	12-14 fl. oz.	Effective for brown rot management. Contains azoxystrobin, which is known to be phytotoxic to certain varieties of apple. Do not use where drift might affect apples.
	Quash	3.5-4 oz.	
	Quilt Xcel	14 fl. oz.	Effective for brown rot management. Contains azoxystrobin. Do not use where drift might affect apples.
	Tilt	4 fl. oz.	Apply in a minimum of 50 gal. water per acre. Other generics available.
	Topguard EQ	6-8 oz.	7-day PHI.
	Topguard Specialty Crop	14 oz.	7-day PHI. Does not contain azoxystrobin.
	Topsin-M 70WSB **PLUS**	1.5 lb.	Pre-harvest use, restrictions, and limitations vary by product; refer to label for details.
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Ziram 76DF	4.5-8 lb.	Do not apply within 14 days of harvest.

(continued)

***Peach Pre-harvest** (continued)*

Pest/Problem	Material	Rate/Acre	Comments
oriental fruit moth, Japanese beetle, green June beetle	Assail 30SG	5.3-8 oz.	Not for green June beetle control.
	BeetleGONE!	1-17.5 lb.	For Japanese beetle.
	Danitol 2.4EC	10.7-21.3 fl. oz.	
	Exirel 0.83SE	10-20.5 fl. oz.	Use 13.5-20.5 fl.oz. for Japanese beetle. Not for green June beetle.
	Proaxis 0.5EC	2.56-5.12 fl. oz.	
	Sevin XLR Plus (4L)	2-3 qt.	Can be used up to three days before harvest. Oriental fruit moth pheromone traps indicate the need for control.
	Verdepryn 100SL	5.5-11 fl. oz.	Not for green June beetle control.
	Warrior II	1.28-2.56 fl. oz.	
spotted wing Drosophila	Danitol 2.4EC	10.7-21.3 fl. oz.	
	Delegate 25WG	4.5-7 oz.	
	Entrust 2SC	4-8 fl. oz.	
	Exirel 0.83SE	13.5-20.5 fl. oz.	
	Mustang Maxx	4 fl. oz.	
	Pyganic 5EC	4.5-15.61 fl. oz.	
	Verdepryn 100SL	5.5-11 fl. oz.	

Special Notes on Peach Schedule

Spotted Lanternfly

The spotted lanternfly is an invasive planthopper that was first detected in Pennsylvania in 2014 and has since spread to six states — most recently Ohio in 2020. It is projected to invade throughout the Midwest. This insect feeds on plant sap, causing wilting, dieback and even death.

Currently spotted lanternfly is believed to pose the greatest threat to the blueberry, grape, hops, stone fruit and hardwood industries. Know how to identify this pest and remain vigilant for its appearance in your vineyard and orchard systems.

Efficacy of Selected Fungicides Against Peach Diseases[1]

Product and formulation Active ingredient	FRAC Code[2]	Bacterial spot	Brown rot	Peach leaf curl	Peach scab	Powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC) azoxystrobin	11	x	F-E[r]	x	G	F	4h 0d	92.3 fl. oz. 15
Badge SC copper oxychloride+copper hydroxide	M	G-F	F	G	x	x	24h 0d	18 lb. NA
Bravo Weather Stick chlorothalonil	M5	x	G	G	u	F	12h shuck-split	18.8 lb. NA
Captan captan	M3	x	G	F	G	x	24h 0d	30 lb. NA
Cevya mefentrifluconazole	3	x	E	x	E	x	12h 0d	NA see label
copper oxychloride (C-O-C-S WDG) copper oxychloride	M	G-F	F	G	x	x	48h 21d	36 lb. 3
Cuprofix Ultra 40 Disperss basic copper sulfate	M	G-F	F	G	x	x	48h 120d	45 lb. NA

(continued)

Efficacy of Selected Fungicides Against Peach Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Bacterial spot	Brown rot	Peach leaf curl	Peach scab	Powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Elevate 50 WDG fenhexamid	17	x	E-G	x	x	x	12h 0d	6 lb. NA
Elite 45DF tebuconazole	3	x	E	x	x	G	12h 0d	3 lb. NA
Ferbam Granuflo ferbam	M	x	F	E-G	F	x	24h 21d	3-4 lb NA
Flint Extra trifloxystrobin (higher rate)	11	x	E-G	x	E	E	12h 1d	15.2 fl. oz. 3
Fontelis (SC) penthiopyrad	7	x	E-G	x	F-G	F-G	12h 0d	61 fl. oz. 4
Indar 2F2 fenbuconazole	3	x	E[r]	x	F	E-G	12h 0d	48 fl. oz. NA
Inspire Super (EW) difenoconazole+cyprodinil	3+9	x	E	x	G-F	G-F	12h 2d	80 fl. oz. 8
Kenja 400 SC isofetamid	7	x	E	x	x	x	12h 1 day	37.5 fl oz 3
Kocide 3000 copper hydroxide	M	G-F	F	G	x	x	48h 0d	60 lb. 4
Luna Privilege fluopyram	7	x	E	x	F	G	12h 0d	34 fl. oz. 6
Luna Sensation (SC) fluopyram+trifloxystrobin	7+11	x	E	x	F	E-G	12h 1d	27.1 fl. oz. NA
Merivon XBF fluxapyroxad+pyraclostrobin	7+11	x	E	x	E-G	E-G	12h 0d	20.1 fl. oz. 4
Mycoshield xxytetracycline	41	E[r]	x	x	x	x	12h 21d	N/A 3
Pristine pyaclostrobin+boscalid	7+11	x	E-G[r]	x	E-G	E[r]	12h 0d	72.5 oz. 9
Quadris Top azoxystrobin+difenoconazole	11+ 3	x	E	x	x	G	12h 0d	56 fl. oz. 5
Quash metconazole	3	x	E-G	x	G	E	12h 14d	10.5-12 oz. NA
Quilt Xcel azoxystrobin+propiconazole	11+ 3	x	E	x	G	G	12h 0d	70 fl. oz. 3
Quintec quinoxyfen	13	x	x	x	x	E	12h 7d	28 fl. oz. 5
Rally 40WSP myclobutanil	3	x	G	x	x	E-G	24h 1d	3.25 lb. NA
Rovral 4F iprodione	2	x	E	x	x	x	24h N/A	4 pt. NA

(continued)

Efficacy of Selected Fungicides Against Peach Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Bacterial spot	Brown rot	Peach leaf curl	Peach scab	Powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Scala (SC) pyrimethanil	9	x	E-G	x	x	x	12h 2d	54 fl. oz. 2
Microthiol Disperss sulfur	M	x	F	i	i	G	24h 0d	NA 3
Syllit F dodine	U12	x	F	E	F	x	48h petal fall	9 pt. 3
Thiram Granuflo thiram	M3	x	G	G	G	x	24h 7d	NA NA
Tilt (EC) propiconazole	3	x	E	x	F	G	12h 0d	20 fl. oz. 5
Topguard EQ flutriafol + azoxystrobin	3+11	x	G	x	x	E	12h 7d	NA 4
Topsin M70 WSB 2 thiophanate-methyl	1	x	E[r]	x	G	G[r]	48h 1d	4 lb. NA
Vanguard WG (75WG) cyprodinil	9	x	E-G	x	x	x	12h 2d	30 oz. 4
Ziram 76DF ziram	M3	x	G	G	G	x	48h 14d	48.2 lb. 6

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] FRAC code represents the mode of action of the fungicide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Efficacy of Selected Insecticides and Acaricides Against Peach Insects and Mites[1]

Compiled by Ric Bessin

Product and formulation Active ingredient	IRAC Code[2]	European red mite	Green peach aphid	Japanese beetle	Oriental fruit moth	Peachtree borers	Plant bugs / stink bugs	Plum curculio	San Jose scale	Spotted wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS bifenazate	20D	G	x	x	x	x	x	x	x	x	12h 3d	1 lb. 1
Actara (25WDG) thiamethoxam	4A	x	E	x	x	x	G	G	x	x	12h 14d	11 oz. NA
Admire Pro (4.6F) imidacloprid	4A	x	E	G	x	x	u	F	F	x	12h 0d	8.4 fl. oz. NA
Agri-Mek SC (0.7SC) **(RUP)** abamectin	6	G	x	x	x	x	x	x	x	x	12h 21d	8.5 fl. oz. 2
Altacor (35WDG) chlorantraniliprole	28	x	x	x	E	x	x	x	x	x	4h 10d	9 oz. NA
Apollo SC (1SC) clofentezine	10A	E	x	x	x	x	x	x	x	x	12h 21d	8 oz. NA
Apta (1.34SC) tolfenpyrad	21A	x	G	x	x	x	s	G	x	s	12h 14d	53.5 fl. oz. 2
Asana XL (0.66EC) **(RUP)** esfenvalerate	3A	x	x	x	E[r]	G	G	G	x	s	12h 14d	72.5 fl. oz. NA
Assail 30SG acetamiprid	4A	x	E	G	E	x	F	E	F	x	12h 7d	32 oz. 4
Avaunt (30WDG) indoxacarb	22	x	x	x	G	x	x	G	x	x	12h 14d	24 oz. 4
Baythroid XL (1EC) **(RUP)** cyfluthrin	3A	x	x	x	E[r]	G	E	G	x	E	12h 7d	5.6 fl. oz. NA
Belay (2.13SC) clothianidin	4A	x	E	x	x	x	E	G	G	x	12h 21d	12 fl oz. NA
Beleaf 50SG flonicamid	29	x	E	x	x	x	G	x	x	x	12h 14d	8.4 oz. 3
Centaur WDG (70WDG) buprofezin	16	x	x	x	x	x	s	x	E	x	12h 14d	69 oz. 2
Closer SC (2SC) sulfoxaflor	4C	x	E	x	x	x	F	x	x	x	12h 7d	17 fl. oz. 4
Danitol 2.4EC **(RUP)** fenpropathrin	3A	F	F	E	E[r]	G	E	G	x	E	24h 3d	42.7 fl. oz. NA
Delegate WG (25WG) spinetoram	5	x	x	x	E	x	x	s	x	E	4h 1d	28 oz. 4

(continued)

Efficacy of Selected Insecticides and Acaricides Against Peach Insects and Mites[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	European red mite	Green peach aphid	Japanese beetle	Oriental fruit moth	Peachtree borers	Plant bugs / stink bugs	Plum curculio	San Jose scale	Spotted wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Diazinon AG600 WBC **(RUP)** diazinon	1B	u	G	x	G	x	x	x	F	x	96h 21d	102 fl. oz. 2
Entrust SC (2SC) spinosad	5	x	x	x	F	x	x	x	x	G	4h 1d	29 fl. oz. 3
Envidor 2SC spirodiclofen	23	E	x	x	x	x	x	x	x	x	12h 7d	18 fl. oz. 1
Esteem 35WP pyriproxyfen	7C	x	x	x	F	x	x	x	E	x	12h 14d	15 oz. 3
Exirel (0.83SE) cyantraniliprole	28	x	x	G	E	x	x	G	x	G	12h 3d	61.5 fl. oz. 3
Imidan 70W phosmet	1B	x	x	G	E[r]	x	x	G	u	E	72h 14d	12 lb. NA
Intrepid 2F methoxyfenozide	18	x	x	x	G	x	x	x	x	x	4h 7d	64 fl. oz. NA
Lannate SP **(RUP)** methomyl	1A	x	G	x	F	x	E	x	x	x	96h 4d	6 lb. 8
Lorsban 4E **(RUP)** chlorpyrifos	1B	x	x	x	x	E	x	x	x	x	96h 14d	3 qt. 1
Magister SC (1.7SC) fenazaquin	21A	E	x	x	x	x	x	x	x	x	12h 3d	36 fl. oz. 1
Malathion 8 (8EC) malathion	1B	x	x	x	u	i	x	u	u	x	24h 7d	3.75 pt. 3
Movento (2SC) spirotetramat	23	s	G	x	x	x	x	x	G	s	24h 7d	15.3 fl. oz. NA
Mustang Maxx (0.83EC) **(RUP)** zeta-cypermethrin	3A	x	x	x	E[r]	G	E	E	x	E	12h 14d	24 fl. oz. NA
Nexter SC (3.75SC) pyridaben	21A	G	x	x	x	x	x	x	x	x	12h 7d	34 fl. oz. 2
oil (superior) mineral oil	un	E	G	x	x	x	x	x	x	x	4h 0d	UN
Onager (1EC) hexythiazox	10A	E	x	x	x	x	x	x	x	x	12h 7d	24 fl. oz. 1
Portal XLO (0.4EC) fenpyroximate	21A	E	x	x	x	x	x	x	x	x	12h 7d	4 pt. 2

(continued)

Efficacy of Selected Insecticides and Acaricides Against Peach Insects and Mites[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	European red mite	Green peach aphid	Japanese beetle	Oriental fruit moth	Peachtree borers	Plant bugs / stink bugs	Plum curculio	San Jose scale	Spotted wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Pounce 25WP permethrin	3A	x	x	x	E[r]	G	G	G	x	x	12h 14d	0.75 lb. NA
PQZ (1.87SC) pyrifluquinazon	9B	x	E	x	x	x	x	x	x	x	12h 7d	4.8 fl. oz. 2
Proaxis (0.5EC) **(RUP)** gamma-cyhalothrin	3A	x	G	E	G[r]	G	E	G	x	x	24h 14d	1.6 pt. NA
Pyganic 5EC pyrethrins	3A	u	F	F	x	x	u	x	u	F	12h 0d	15.6 fl. oz. 10
Rimon 0.83EC novaluron	15	x	x	x	E	u	u	x	x	F	12h 8d	150 fl. oz. NA
Savey 50DF hexythiazox	10A	E	x	x	x	x	x	x	x	x	12h 28d	6 oz. 1
Sevin XLR Plus (4F) carbaryl	1A	x	x	E	F	u	F	F	u	x	12h 3d	14 qt. 3
Sivanto Prime (1.67SC) flupyradifurone	4D	x	E	x	x	x	x	x	G	x	4h 14d	28 fl. oz. NA
Surrond WP (95WP) kaolin clay	un	x	x	F	u	x	x	F	x	x	4h 0d	NA NA
Venom (70SG) dinotefuran	4A	x	s	x	x	u	E	u	x	x	12h 3-21d	6 oz. NA
Verdepryn 100SL (0.83SL) cyclaniliprole	28	x	x	G	E	x	s	u	x	u	4h 7d	33 fl. oz. 3
Versys Inscalis (0.83DC) afidopyropen	9D	x	E	x	x	x	x	x	x	x	12h 7d	3 fl. oz. NA
Warrior II (2.08CS) **(RUP)** lambda-cyhalothrin	3A	x	x	E	G[r]	G	E	G	x	x	24h 14d	12.8 fl. oz. NA
Zeal (72WP) etoxazole	10B	E	x	x	x	x	x	x	x	x	12h 7d	3 oz. 1

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] IRAC code represents the mode of action of the insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Plum Spray Schedule

Entomology Lead: R. Bessin
Pathology Lead: J. Beckerman, M. Heller-Haas

Plum Dormant

Before buds break in the spring.

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot	copper hydroxide (Kocide 3000)	3.5-7 lb.	Plum is on most, but not all, copper labels. Check label before use. Using copper at the dormant stage may also reduce the overwintering inoculum of the bacteria that cause bacterial canker and bacterial spot. As season progresses, reduce the rate of copper applied to reduce the risk of phytotoxicity. Copper applied to tanks with a pH of less than 6.5 may result in phytotoxicity issues. Apply as dormant spray up to budswell. May be combined with oil.
	copper oxychloride (C-O-C-S WDG)	6-12 lb.	
black knot	copper pesticides	See label	Check labels carefully because they change. If labeled, apply at bud swell up to early bloom for early-season disease suppression. Prune out all black knots during the dormant period, making cuts 6-8 inches below any knots. Remove these prunings from the orchard and burn or bury them. Plum is on most, but not all, copper labels. Check label before use.
	Bordeaux mixture	See label	Not as effective as Bravo, but using copper at dormant stage will protect against black knot and may also reduce the overwintering inoculum of the bacteria that cause bacterial canker and bacterial spot. Copper hydroxide (Kocide 3000): Apply as dormant spray up to bud-swell. May be combined with oil.
	copper hydroxide (Kocide 3000)	1.75-3.5 lb.	
	Cuprofix Ultra 40 Disperss	3-3.75 lb.	
	Bravo Weather Stik	3 1/8-4 1/8 pt. 50-64 fl. oz.	Most effective fungicide for black knot control. Other formulations and generics available.
brown rot	C-O-C-S	6-12 lb.	Apply as dormant spray up to budswell. May be combined with oil.
Plum pockets/Leaf Curl	Bravo Weather Stik	3 1/8-4 1/8 pt. 50-64 fl. oz.	Note: Ferbam is NOT labeled for plums.
	Copper hydroxide (Champ FL)	3.5-5 lb.	
	Cuprofix Ultra 40 Disperss	3-3.75 lb.	
	Luna Experience	6-10 oz.	Unless disease pressure is severe, these products are better deployed later in the season for control of brown rot and powdery mildew.
	Luna Sensation	5-7.6 oz.	
European red mite, scale insects	superior oil	2 gal. per 100 gal.	Apply when temperatures are above 40°F — never during freezing weather.

Plum Pre-bloom *(including bud burst, green cluster, white bud/popcorn)*

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot	Copper hydroxide (Champ FL)	5.33-8.0 pt.	Copper rates are tied to crop development, with rates reduced as the season progresses to minimize the risk of phytotoxicity. Also labeled for black knot.
	Cuprofix Ultra 40 Disperss	3-3.75 lb.	When using coppers post-bloom, drying conditions should be excellent. Do not apply during extended dews or foggy conditions.

(continued)

Plum Pre-bloom *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
black knot	See Plum Dormant		
	Bravo Weather Stik	3-4 pt.	
	Topsin-M 70WSB	1-1.5 lb.	Apply at pre-bloom and petal fall.
brown rot (blossom blight)	Abound	12.0-15.5 fl. oz.	Begin applications at petal fall and continue at 7-14 day intervals in rotation with other products. Generic fungicides include Aframe and Azoxystar.
	Bravo Weather Stik	3.1-4.1 pt.	Other formulations and generics available.
	Captan 80WDG	5.0 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50. Do not exceed 33.75 lb. per season.
	Cevya	5 oz.	Not recommended at this time.
	C-O-C-S	6-12 lb.	Apply as dormant spray up to budswell. May be combined with oil. This application may also help with bacterial shot hole.
	Elevate 50WDG	1-1.5 lb.	
	Flint Extra	2.5-3.8 fl. oz.	Begin applications at bud stage.
	Fontelis	14-20 fl. oz.	Do not exceed 61 fl. oz./acre per year.
	Indar 2F	6 oz.	Begin application at red bud stage.
	Inspire Super	16-20 fl. oz.	
	Luna Privilege	4-6.8 oz.	Fluopyram alone (FRAC 7)
	Luna Experience	6-10 oz.	Also controls fruit rot and powdery mildew. (FRAC 7+11)
	Luna Sensation	5-7.6 fl. oz.	Also controls fruit rot and powdery mildew. fluopyram +trifloxystrobin. FRAC 7+11
	Merivon	4-6.7 fl. oz.	Do not apply EC or oil-based products. Do not apply with Bravo or captan.
	Miravis	3.4-5.1 oz.	
	Pristine 38WG	10.5-14.5 fl. oz.	
	Quadris Top	12-14 fl. oz.	Effective for brown rot management. It contains the fungicide azoxystrobin, which is known to be phytotoxic to certain apple varieties. Do not use this product where drift might affect apples.
	Quash	2.5-3.5 oz.	Do not exceed 3 applications per season. Do not exceed 12 oz./acre per season. Do not exceed 2 applications after petal fall. Do not apply to Stanley-type plums.
	Quilt Xcel	14 oz.	Applications during bloom to Stanley plums have occasionally caused fruit to be less oval in shape and smaller in size at harvest. To avoid this, do not apply to Stanley plums earlier than 21 days prior to harvest.
	Rally 40WSP	2.5-6 oz.	Registered for control of brown rot (blossom blight) and powdery mildew. Do not exceed 2.75 lb./acre per season. Do not apply within 7 days of harvest.
	Rovral 50WP	1-2 lb.	Do not exceed 2 applications per season. Cannot be applied after petal fall on stone fruit.
	Scala SC	9-18 fl. oz.	
	wettable sulfur 90%	10-30 lb.	
	Tilt	4 fl. oz.	
	Topsin-M 70WSB.	1.5 lb.	
	PLUS		
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Topguard EQ	6-8 oz.	Start applications at 1-5% bloom, and then at 50-100%.
	Topguard Specialty Crop	14 fl. oz.	Does not contain azoxystrobin.
	Vanguard 75WG	5 oz.	Begin application at green tip and again at full bloom.

Plum Full Bloom

Pest/Problem	Material	Rate/Acre	Comments
brown rot (blossom blight), black knot	Same as at Plum Pre-bloom, page 106.		
brown rot (blossom blight)	Same as at Plum Pre-bloom, page 106.		
insects, mites	**SAVE THE BEES!** Do not apply insecticides during bloom.		

Plum Petal Fall

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot	Copper hydroxide (Kocide 3000, Champ FL)	0.25-0.5 lb./100 gal.	Copper rates are tied to crop development, with rates reduced as the season progresses to minimize the risk of phytotoxicity. Note these uses are specific for plum and bacterial spot, and are at the 100 gallon rate.
	Cuprofix Ultra 40 Disperss	0.75 lb./100 gal.	
	Badge SC	1.5 pt./100 gal.	
brown rot (blossom blight), black knot	Same as at Plum Pre-bloom, page 106.		
brown rot (blossom blight)	Same as at Plum Pre-bloom, page 106. If previously using Rally, rotate to another product with a different mode of action.		
plum curculio, oriental fruit moth	Failure to control plum curculio may result in an increase in brown rot.		
	Apta 1.31 EC	21-27 fl. oz.	Plum curculio only.
	Asana XL	4.8-14.5 fl. oz.	
	Assail 30SG	5.3-8 oz.	
	Avaunt 30WDG	5-6 oz.	Use 6 oz. rate for oriental fruit moth.
	Baythroid XL	2.4-2.8 fl. oz.	Use 2.4-2.8 fl. oz. for plum curculio, 2-2.4 fl. oz. for Oriental fruit moth.
	Danitol 2.4EC	10.7-21.3 fl. oz.	
	Exirel 0.83SE	10-20.5 fl. oz.	Use 13.5-20.5 fl. oz. for plum curculio.
	Imidan 70W	2.13-4.25 lb.	
	Mustang Maxx 0.8EC	1.28-4 fl. oz.	
	Proaxis 0.5EC	2.56-5.12 fl. oz.	
	Verdepryn 100SL	5.5-11 fl. oz.	
	Warrior II	1.28-2.56 fl. oz.	
oriental fruit moth	Any of the products listed above for two species combined **OR**		
	Altacor 35WDG	3-4.5 fl. oz.	
	Entrust 2SC	4-8 fl. oz.	
	Intrepid 2F	10-16 fl. oz.	
	Rimon 0.83EC	20-40 fl. oz.	Begin application before egg hatch of each generation to prevent larval penetration of the fruit.

Plum Shuck Split

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot	copper hydroxide (Kocide 3000) Badge SC Cuprofix Ultra 40 Disperss	0.25-0.5 lb. per 100 gal. 8 oz./100 gal. 0.75 lb./100 gal.	As season progresses, reduce the rate of copper applied to reduce the risk of phytotoxicity. Copper applied to tanks with a pH of less than 6.5 may result in phytotoxicity issues. When using coppers post-bloom, drying conditions should be excellent. Do not apply during extended dews or foggy conditions. Do not apply Cuprofix after shuck split.
brown rot, black knot	Same as at Plum Pre-bloom except Roval, page 106. Rovral cannot be applied after petal fall.		
brown rot	Abound	12.0-15.5 fl. oz.	Begin applications at petal fall and continue at 7- to 14-day intervals in rotation with other products.
	Bravo Weather Stik	3.1-4.1 pt.	Other formulations and generics available. Cannot be applied past shuck split. Also controls black knot.
	Captan 80WDG	3.75 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50. Also controls black knot.
	Cevya	3-5 oz.	
	Luna Experience	6-10 oz.	35-day PHI.
	Luna Privilege	4-6.8 oz.	
	Luna Sensation	5-7.6 fl. oz.	Also controls fruit rot and powdery mildew.
	Merivon	4-6.7 oz.	
	Miravis	3.4-5.1 oz.	
	PhD WDG	6.2 oz.	
	Pristine	10.5-14.5 fl. oz.	
	Quadris Top	12-14 oz.	Effective for brown rot management. It contains the fungicide azoxystrobin, which is known to be phytotoxic to certain apple varieties. Do not use this product where drift might affect apples.
	Quash	2.5-3.5 lb.	Do not make more than 2 sequential applications after petal fall.
	Quilt Xcel	14 oz.	Applications during bloom to Stanley plums have occasionally caused fruit to be less oval in shape and smaller in size at harvest. To avoid this, do not apply to Stanley plums earlier than 21 days prior to harvest.
	Tilt	4 oz.	
	Topguard Specialty Crop	14 fl. oz.	Does not contain azoxystrobin.
	Topguard EQ	6-8 oz.	Start applications at 1-5% bloom, and then at 50-100%.
	wettable sulfur 90%	10-30 lb.	
	Topsin-M 70WSB **PLUS**	1.5 lb.	
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
plum curculio, oriental fruit moth	Same as at Plum Petal Fall, page 107.		

(continued)

***Plum Shuck Split** (continued)*

Pest/Problem	Material	Rate/Acre	Comments
mites	Acramite 50WS	0.75-1 lb.	Do not exceed 1 application per year.
	Agri-Mek 0.7 SC	2.25-4.25 fl. oz.	Must be mixed with a non-ionic adjuvant or horticultural oil.
	Envidor 2SC	16-18 fl. oz.	Do not exceed 1 application per year.
	Magister 1.7SC	32-36 fl. oz.	Do not exceed 1 application per year. Use only after petal fall complete.
	Nexter 75WP	4.4-10.67 oz.	Do not exceed 2 applications per year.
	Onager 1EC	12-24 oz.	Do not exceed 1 application per year.
	Portal XLO	2 pt.	Do not exceed 2 applications per year. Maximum of 4 pints per acre per growing season.
	Savey 50DF	3-6 oz.	Do not exceed 1 application per year.

Plum First Cover Spray

7-10 days after shuck split.

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot	copper hydroxide (Kocide 3000) Badge SC Cuprofix Ultra 40 Disperss	0.13-0.5 lb./100 gal. 8 oz./100 gal. 0.75 lb./100 gal.	As season progresses, reduce the rate of copper applied to reduce the risk of phytotoxicity. Copper applied to tanks with a pH of less than 6.5 may result in phytotoxicity issues. When using coppers post-bloom, drying conditions should be excellent. Do not apply during extended dews or foggy conditions. Do not apply Cuprofix after shuck split.
brown rot, black knot	Same as Shuck Split EXCEPT Rovral and Bravo can no longer be applied, page 108. Rovral cannot be applied after petal fall. Bravo cannot be applied after shuck split.		
plum curculio, oriental fruit moth	Same as at Plum Petal Fall, page 107.		
peachtree borers	See Borers of Peach, Cherry, and Plum Trees, page 112.		

Plum Second and Additional Cover Sprays

Two weeks after first cover spray and 10- to 14-day intervals thereafter.

Pest/Problem	Material	Rate/Acre	Comments
bacterial spot			Same as First Cover, as needed.
brown rot	Same as Plum Shuck Split, page 108, EXCEPT Rovral and Bravo can no longer be applied. Orbit applied to Stanley prune plums has a 21-day PHI.		
plum curculio, oriental fruit moth	Same as at Plum Petal Fall, page 107.		
Japanese beetle	Admire Pro 4.6F	1.4-2.8 fl. oz.	
	Assail 30SG	5.3-8 oz.	
	Danitol 2.4EC	10.7-21.3 fl. oz.	
	Exirel 0.83SE	13.5-20.5 fl. oz.	
	Proaxis 0.5EC	2.56-5.12 fl. oz.	
	Sevin XLR Plus (4 L)	2-3 qt.	Do not exceed 3 applications per crop.
	Verdepryn 100SL	5.5-11 fl. oz.	
	Warrior II	1.28-2.56 fl. oz.	

Plum Pre-harvest Sprays

Beginning 3-4 weeks before harvest.

Pest/Problem	Material	Rate/Acre	Comments
brown rot	Abound	12-15.5 oz.	Do not use with silicone-based surfactants (e.g., Silwe L-77t, Sur-Plus, Sylgard 309 etc.).
	Captan 80WDG	3.75 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
	Cevya	3-5 oz.	
	Elevate	1-1.5 lb.	
	Flint Extra	2.5-3.8 fl. oz.	Suppressive against brown rot. 1-day PHI.
	Fontelis	14-20 fl. oz.	
	Indar 2F	6 oz.	
	Inspire Super	16-20 fl. oz.	2-day PHI.
	Luna Privilege	4-6.84 fl. oz.	This is fluopyram, the SDHI component of Luna Sensation.
	Luna Sensation	5-7.6 fl. oz.	Also controls fruit rot and powdery mildew. 1-day PHI.
	Merivon	4-6.7 fl. oz.	Do not apply with EC or oil-based products. Do not apply with Bravo or captan. Do not use nonionic adjuvants that acidify or enhance penetration within 2 weeks of harvest. 1-day PHI.
	PhD WDG	6.2 oz.	
	Pristine	10.5-14.5 fl. oz.	1-day PHI.
	Quadris Top	12-14 fl. oz.	Effective for brown rot management. It contains the fungicide azoxystrobin, which is known to be phytotoxic to certain apple varieties. Do no use this product where drift might affect apples. 0-day PHI.
	Quilt Xcel	14 oz.	Applications during bloom to Stanley plums have occasionally caused fruit to be less oval in shape and smaller in size at harvest. To avoid this, do not apply to Stanley plums earlier than 21 days prior to harvest.
	Tilt	4 oz.	Applications of propiconazole during bloom to Stanley plums have occasionally caused fruit to be less oval in shape and smaller in size at harvest. Do not apply to Stanley plums earlier than 21 days before harvest.
	Topguard Specialty Crop	14 fl. oz.	
	Topguard EQ	6-8 oz.	
	Topsin-M 70WSB	1.5 lb.	Pre-harvest use, restrictions, and limitations are variable according to product; refer to label for details.
	PLUS		
	Captan 80WDG	2.5 lb.	Other formulations are available, such as 4L and 50WP. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.
spotted wing Drosophila	Danitol 2.4EC	10.7-21.3 fl. oz.	
	Delegate 25WG	4.5-7 oz.	
	Entrust 2SC	4-8 fl. oz.	
	Exirel 0.83SE	13.5-20.5 fl. oz.	
	Mustang Maxx	4 fl. oz.	
	Pyganic 5EC	4.5-15.61 fl. oz.	
	Verdepryn 100SL	5.5-11 fl. oz.	

Special Problems and Pests of Stone Fruit

Bacterial Canker of Sweet Cherry

Bacterial canker is a sporadic but serious problem on sweet cherries. It is generally less severe on tart cherries, plums, and prunes.

The disease is favored by cold, wet conditions during and shortly after bloom. Copper compounds are moderately effective in reducing pathogen populations and controlling the disease. Apply copper compounds according to the product label in the spring while trees are dormant.

If favorable conditions for the disease persist, apply reduced-rate applications (25-35 percent of dormant rate) after budbreak but before bloom. You can add hydrated lime (6-9 lb./acre) to reduce the phytotoxicity that can occur when copper compounds are applied in cool, wet conditions.

Bacterial Spot of Peach

Bacterial spot of peach can be a serious problem in certain varieties, areas, and years. The disease is favored by stormy, rainy weather during June and July. It causes the most damage in areas where the soil is sandy and where strong winds blow the sand.

Planting cultivars resistant to bacterial spot provides the best control. In the past, various control programs have tried using foliar sprays of zinc sulfate plus lime, or fall applications of copper with or without lime. None of these programs offered reliable control and, in some cases, caused foliar and twig damage.

For peaches, the antibiotic oxytetracycline (Mycoshield or FireLine) provides good control when properly applied. For best results, use oxytetracycline at 12 oz. per 100 gal. of dilute spray. Use dilute or 2x; higher concentrates are not effective and may be phytotoxic.

Spraying the entire tree once per week is essential. If you spray only one side of the tree (alternate row middle), make certain to spray the other side of the tree within 3-4 days. Begin sprays at shuck split and continue at 7-day intervals until three weeks before harvest. Copper sprays, applied for peach leaf curl at leaf drop, also may help control bacterial spot. The rate of copper decreases over the growing season. On peaches, copper can cause injury to leaves and appears as reddish spots and shot-holes with some very mild defoliation when using an effective rate of copper. Because of risk for foliar injury, most copper materials are not registered for use post-bloom or in more than two applications post-bloom, and then only at low rates (always read and follow label instructions).

For more information, see "Learning from Peach Bacterial Spot Epidemics: Potential Strategies for Reducing Fruit Losses" (David Ritchie, North Carolina State University), plantpathology.ces.ncsu.edu/wp-content/uploads/2013/06/Learning-from-Peach-Bacterial-Spot-Epidemics.pdf?fwd=no.

Phytophthora Root, Crown, and Collar Rots

Peach rootstocks are highly susceptible to Phytophthora root, crown, and collar rots. The main defense against these diseases is providing good soil drainage through proper site selection and tiling.

However, Ridomil Gold SL provides additional protection in wet years, on marginal sites, or in wetter sections of the orchard. Make applications just before growth starts in the spring and at two- to three-month intervals thereafter if soil is very wet. Apply to the soil beneath the tree canopy in sufficient water to ensure good coverage. (Subsequent rain or irrigation moves material into the soil.)

Ridomil Gold SL is also registered for use on cherries (sweet and tart), nectarines, plums, and prunes. See label for further information and use rates. See page 15 for additional information on phosphorous acid, phosphonates and phosphites.

Mating Disruption for Peach Pests

Multiple mating disruption products are labeled for control of oriental fruit moth, lesser peachtree borer, and (greater) peachtree borer. They dispense specific sex attractants that prevent male moths from locating and mating with females.

This approach works best in blocks of at least 1-2 acres, where populations are low to moderate and surrounding areas do not harbor large populations of the target pest. If you use mating disruption in smaller blocks, or in blocks adjacent to unmanaged populations of the target pest, we recommend border sprays and/or higher rates of dispensers.

Mating disruption controls only the target pests listed on each product label. Mating disruption has proven to be effective against oriental fruit moth (several dispenser types), and Isomate PTB Dual is effective against both lesser peachtree borer and (greater) peachtree borer.

Borers of Peach, Cherry, and Plum Trees

The peachtree borer, lesser peachtree borer, and shothole borer often infest peach, apricot, cherry and plum trees. Peachtree borers infest the trunk at the soil line, while lesser peachtree borers infest scaffold limbs and the upper trunk.

The peachtree borer is primarily a pest of young trees, whereas the lesser peachtree borer is a pest of older trees. The shothole borer is often found in trees of low vigor with dead and/or diseased limbs. Moths of the two peachtree borers lay their eggs on the surface of the bark; shothole beetles lay their eggs in the inner bark.

Some of the regularly applied cover sprays help control borers; however, specific trunk and scaffold branch sprays are often required. Pheromone traps are available to monitor emergence of the adult stage (moth) of lesser peachtree borer and peachtree borer. Knowing the time of initial moth emergence and peak emergence can help you properly time insecticide applications, because insecticides target the hatching eggs laid by the newly emerged moths.

Periodical Cicadas

See Periodical Cicadas, page 52.

Insecticides Used to Manage Borers of Peach, Cherry, and Plum Trees

Borer	Material	Rate/Acre	Comments
lesser peachtree borer	The pheromone trap for lesser peachtree borer should be in place by peach petal fall (usually mid- to late April), in time to detect the first of the two generations of this pest.		
	Asana XL 0.66EC	4.8-14.5 fl. oz.	
	Pounce 25WP	6.4-25.6 oz.	Not labeled for plum.
	Warrior II	1.28-2.56 fl. oz.	
	Baythroid XL 1EC	1.4-2 fl. oz.	
	Lorsban Advanced 4EC	1.5-4 pt.	Apply to bark of scaffold branches and trunk, but do not allow to contact fruit. Where lesser peachtree borer has been a light to moderate problem, apply Lorsban to scaffold branches once at the peak of the second moth flight (often mid-August, usually post-harvest). Where lesser peachtree borer has been a moderate to heavy problem, make the application earlier — about 14 days after emergence of first-generation moths begins (spray mid-May to early June). Do not exceed 1 application on peaches, plums, and nectarines. Do not exceed 3 applications on cherries. 14-day PHI for peaches, plums, and nectarines. 21-day PHI for cherries.
	Isomate-PTB Dual	150-250 dispensers	Deploy dispensers before moth flight begins (approximately mid-April). For more information, see Mating Disruption for Peach Pests, page 111.
peachtree borer	The pheromone trap for peachtree borer should be in place by early June to detect the first emergence of the single generation of this pest.		
	Asana XL 0.66EC	4.8-14.5 fl. oz.	
	Isomate-P	100-250 dispensers	Deploy dispensers before moth flight begins (approximately early June). For more information, see Mating Disruption for Peach Pests, page 111.
	Isomate-PTB Dual	150-250 dispensers	Deploy dispensers before moth flight begins (approximately early June), or by mid-April if control of lesser peachtree borer is also desired. For more information, see Mating Disruption for Peach Pests, page 111.
	Lorsban Advanced 4EC	3 qt.	Make a single spray directed at the base of the trunk at the time of peak moth emergence (usually in late July or early August). Do not exceed 1 application on peaches, plums, and nectarines. Do not exceed 3 applications on cherries. 14-day PHI for peaches, plums, and nectarines. 21-day PHI for cherries.
	Mustang Maxx 0.8EC	1.28-4.0 fl. oz.	
	Venom 70SG	3-4 oz.	This low rate is for foliar (trunk) application.
		6 oz.	This low rate is for foliar (trunk) application.
	Warrior II	1.28-2.56 fl. oz.	This higher rate is for a soil application; note 21-day PHI.
peachtree borer (preplant dip)	Lorsban 75WG	2-4 lb.	Dip trees several inches above the graft and plant immediately or allow to dry before returning to storage. Do not allow trees to remain in the dip solution.
	Lorsban Advanced 4E	3 qt.	
shothole borer	Insecticide sprays are not effective. Maintain tree health and vigor, prune dead and dying limbs, and remove dead trees to prevent beetle problems.		

Efficacy of Selected Foliar Fungicides and Antibiotics Against Plum and Prune Diseases[1]

Data assembled by J. Beckerman

Product and formulation Active ingredient	FRAC Code[2]	Bacterial spot	Black knot	Brown rot	Plum pockets	Powdery Mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC) azoxystrobin	11	x	x	F-E[r]	x	G	4h 0d	90 fl. oz. 5
Badge SC copper oxychloride+copper hydroxide	M	G-F	x	i	G-F	F	24h 0d	18 lb. NA
Bravo Weather Stik chlorothalonil	M5	x	x	G	G	F	12h shuck split	20.5 pt. NA
C-O-C-S WDG copper oxychloride	M	F	G	u	G	u	48h N/A	36 lb. NA
Captan 80WDG captan	M	x	x	G	G	F	24h 0d	33.75 lb. NA
Cevya mefentrifluconazole	3	x	x	E	x	E-s	12h 0d	NA 3
Cuprofix Ultra 40 Disperss copper hydroxide	M	G-F	G	F	G	x	48h N/A	45 lb. NA
Elevate 50WDG fenhexamid	17	x	x	G	x	x	12h 0d	6 lb. NA
Flint Extra trifloxystrobin (higher rate)	11	x	x	G-s	x	E-s	12h 1d	15.2 oz. 4
Fontelis (SC) penthiopyrad	7	x	x	E-G	x	F	12h 0d	61 fl. oz. NA
Indar 2F fenbuconazole	3	x	x	E[r]	x	E	12h 0d	24 fl. oz. 4
Inspire Super (EW) difenoconazole + cyprodinil	3+9	x	x	E	x	F	12h 2d	80 fl. oz. 4
Kocide 3000, Champ copper hydroxide	M	x	G	F	G	x	48h 0d	60 lb. NA
Luna Privilege fluopyram	7	x	u	E	x	u	12h 0d	34 fl.oz 6
Luna Sensation (SC) fluopyram + trifloxystrobin	7+11	x	x	E	G	E	12h 1d	27.1 fl. oz. 4
Merivon fluxapyroxad + pyraclostrobin	7+11	x	x	E	x	E	12h 0d	20.1 fl. oz. 3
Miravis pydiflumetofen	7	x	x	E	x	G	4h 30d	13.6 fl. oz. 4
OSO 5% SC polyoxin D	M3	x	u	G	x	G	NA 0d	78 fl. oz. NA

(continued)

Efficacy of Selected Foliar Fungicides and Antibiotics Against Plum and Prune Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Bacterial spot	Black knot	Brown rot	Plum pockets	Powdery Mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Pristine (38WG) pyraclostrobin + boscalid	7+11	x	u	E-G[r]	x	E[r]	12h 0d	72.5 oz. 5
Quash metconazole	3	x	x	E	x	E	12h 14d	10.5-12 oz. 3
Quilt Xcel azoxystrobin + propiconazole	3+11	x	x	E	E	G	12h 0d	70 fl. oz. 5
Rally 40WSP myclobutanil	3	x	x	G	x	E	24h 0d	10 oz. NA
Rovral (50WP) iprodione	2	x	x	E	x	x	24h not after petal fall	4 pt. 2
Scala (SC) pyrimethanil	9	x	x	E-G	x	x	12h 2d	54 fl. oz. 3
Sulfur (Wettable sulfur 90%) sulfur	M	x	x	F	i	G	NA See label	NA NA
Tilt (3.6EC) propiconazole	3	x	x	E	x	G	12h 0d	20 fl. oz. 5
Topguard EQ flutriafol + azoxystrobin	3+11	x	x	G-E	x	E	12h 7d	N/A 4
Topguard Specialty Crop (SC) flutriafol	3	x	x	G	x	E	12h 7d	56 fl. oz. 4
Topsin-M WSB thiophanate-methyl	1	x	x	E	i	G	48h 1d	4 lb. NA
Vangard WG cyprodinil	9	x	x	G-E	x	x	12h 2d	30 oz. 4

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] FRAC code represents the mode of action of the fungicide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Efficacy of Selected Insecticides and Acaricides Against Plum Insects and Mites[1]

Compiled and edited by Ric Bessin

Product and formulation Active ingredient	IRAC Code[2]	European red mite	Japanese beetle	oriental fruit moth	peachtree borers	plum curculio	spotted wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	G	x	x	x	x	x	12h	1 lb.
bifenazate								3d	1
Actara (25WDG)	4A	x	G	x	x	x	x	12h	11 oz.
thiamethoxam								14d	NA
Admire Pro (4.6F)	4A	x	F	x	x	G	x	12h	10.5 fl. oz.
imidacloprid								0-21d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	G	x	x	x	x	x	12h	8.5 fl. oz.
abamectin								21d	2
Altacor (35WDG)	28	x	x	E	x	x	x	4h	9 oz.
chlorantraniliprole								10d	NA
Apta (1.34SC)	21A	x	G	x	x	x	s	12h	53.5 fl. oz.
tolfenpyrad								14d	2
Asana XL (0.66EC) **(RUP)**	3A	x	G	E[r]	G	x	x	12h	72 fl. oz.
esfenvalerate								14d	NA
Assail 30SG	4A	x	E	E	x	F	x	12h	32 oz.
acetamiprid								7d	4
Avaunt (30WDG)	22	x	G	F	F	x	x	12h	24 oz.
indoxacarb								14d	4
Baythroid XL (1EC) **(RUP)**	3A	x	G	E[r]	G	x	E	12h	5.6 fl. oz.
cyfluthrin								7d	NA
Beleaf 50SG	29	x	x	x	x	x	x	12h	8.4 oz.
flonicamid								14d	3
Centaur WDG (70WDG)	16	x	x	x	x	x	x	12h	69 oz.
buprofezin								14d	2
Closer SC (2SC)	4C	x	x	x	x	x	x	12h	17 fl. oz.
sulfoxaflor								7d	4
Danitol 2.4EC **(RUP)**	3A	F	G	E[r]	x	E	E	24h	42.7 fl. oz.
fenpropathrin								3d	NA
Delegate WG (25WG)	5	x	s	E	x	x	E	4h	28 oz.
spinetoram								1d	4
Diazinon AG600 WBC **(RUP)**	1B	u	x	G	x	x	x	96h	102 fl. oz.
diazinon								21d	2
Dimilin 25W, 2L **(RUP)**	15	x	x	x	x	x	x	12h	32 fl. oz.
diflubenzuron								14d	2
Entrust SC (2SC)	5	x	x	F	x	x	G	4h	29 fl. oz.
spinosad								1d	3

(continued)

Efficacy of Selected Insecticides and Acaricides Against Plum Insects and Mites[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	European red mite	Japanese beetle	oriental fruit moth	peachtree borers	plum curculio	spotted wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Envidor 2SC spirodiclofen	23	E	x	x	x	x	x	12h 7d	18 fl. oz. 1
Esteem 35WP pyriproxyfen	7C	x	x	F	x	x	x	12h 14d	15 oz. 3
Exirel (0.83SE) cyantraniliprole	28	x	G	E	x	G	G	12h 3d	61.5 fl. oz. 3
Imidan 70W phosmet	1B	x	G	E	i	G	E	168h 7d	13 lb. NA
Intrepid 2F methoxyfenozide	18	x	x	G	x	x	x	4h 7d	64 fl. oz. NA
Lorsban 4E **(RUP)**, 75WG chlorpyrifos	1B	x	x	x	E	x	x	96h 14d	3 qt. NA
Magister SC (1.7SC) fenazaquin	21A	E	x	x	x	x	x	12h 3d	36 fl. oz. 1
Movento (2SC) spirotetramat	23	x	x	x	x	x	x	24h 7d	15.3 fl. oz. NA
Mustang Maxx (0.83EC) **(RUP)** zeta-cypermethrin	3A	x	E	E[r]	G	x	E	12h 14d	24 fl. oz. NA
Nexter (75WP), SC (3.75SC) pyridaben	21A	G	x	x	x	x	x	12h 7d	21.34 oz. 2
oil (superior) mineral oil	un	E	x	x	x	x	x	4h 0d	NA NA
Onager (1EC) hexythiazox	10A	E	x	x	x	x	x	12h 7d	24 fl. oz. 1
Portal XLO (0.4EC) fenpyroximate	21A	E	x	x	x	x	x	12h 7d	4 pt. 2
PQZ (1.87SC) pyrifluquinazon	9B	x	x	x	x	x	x	12h 7d	4.8 fl. oz. 2
Proaxis (0.5EC) **(RUP)** gamma-cyhalothrin	3A	x	G	G[r]	G	E	x	24h 14d	25.6 fl. oz. NA
Pyganic 5EC pyrethrins	3A	u	i	x	x	F	i	12h 0d	15.6 fl. oz. 10
Rimon 0.83EC novaluron	15	x	x	E	u	x	F	12h 8d	15 fl. oz. NA
Savey 50DF hexythiazox	10A	E	x	x	x	x	x	12h 28d	6 oz. 1

(continued)

Efficacy of Selected Insecticides and Acaricides Against Plum Insects and Mites[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	European red mite	Japanese beetle	oriental fruit moth	peachtree borers	plum curculio	spotted wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Sevin XLR Plus (4F) carbaryl	1A	x	F	F	i	E	x	12h 3d	14 qt. 3
Sivanto Prime (1.67SC) flupyradifurone	4D	x	x	x	x	x	x	4h 14d	28 fl. oz. NA
Surround WP (95WP) kaolin	un	x	F	u	x	F	x	4h 0d	NA NA
Vendex 50WP **(RUP)** fenbutatin-oxide	12B	G	x	x	x	x	x	48h 14d	3 lb. 2
Verdepryn 100SL (0.83SL) cyclaniliprole	28	x	G	E	x	u	u	4h 7d	33 fl. oz. 3
Versys Inscalis (0.83DC) surround	9D	x	x	x	x	x	x	12h 7d	3 fl. oz. NA
Warrior II (2.08CS) **(RUP)** lambda-cyhalothrin	3A	x	G	G[r]	G	E	x	24h 14d	12.8 fl. oz. NA
Zeal (72WP) etoxazole	10B	E	x	x	x	x	x	12h 7d	3 oz. 1

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[2] IRAC code represents the mode of action of the fungicide/insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides/insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

GRAPE

Grape Insect Pests

Prepared by E. Long, K. Athey, C. Welty, R. Bessin, C. Guedot, D. Lewis

The shaded/colored boxes represent the crop stages where common pests in the Midwest are active. Scouting and/or preventative sprays may be necessary or recommended.

View this table in color at the website, qrco.de/Grapebugs

Grape Growth Stage								
Delayed Dormant through Bud Swell	**Bud Break**	**4- to 10-inch Shoots**	**Pre-bloom through Bloom**	**Bloom**	**Shatter**	**Shatter to Veraison**	**Veraison to Harvest**	**Post-harvest**
Grape flea beetle								
	Grape phylloxera							
		Rose chafer			Rose chafer			
					Grape berry moth			
					Japanese beetle			
							Drosophila flies	
							Multicolored Asian lady beetle	
							Green June beetle	
							Grape root borer	
Climbing cutworm								
Grape mealybug					Grape mealybug			
Grape scale			Grape scale					
							Stink bug	
					potted lanternfly			

Major	Present in most vineyards in most years and usually causing economic damage if not managed.
Minor	Often present but usually not causing economic damage and not requiring management.
Impending	Pest is not known to occur in Midwestern states but is likely to appear in the future.

Grape Spray Schedule

Entomology Lead: E.Y. Long, R. Bessin, C. Welty
Pathology Lead: J. Beckerman, M. Lewis Ivey, L. Rodriguez-Salamanca
Horticulture Lead: J. Strang

Please give us your feedback on the new table.
qrco.de/FruitSpray

How to read the spray schedule tables
Every grape growth stage has important notes on disease or insect management. In some cases, the reader will be directed to the special problems section at the end of the chapter. Please make sure to read thoroughly, contact your local Extension specialist with questions.

Key to tables

E = excellent control
G = good control
F = fair control
[r] = Fungicide/Insecticide resistance possible
s = suppression only
i = ineffective
u = unknown efficacy
x = pest not on the label

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state.

[2] F/I-RAC code represents the mode of action of the fungicide/insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides/insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI as restrictions may prohibit the use of certain pesticides during harvest.

[5] Max amt refers to the product's maximum amount/acre/year. **Applicators must abide by both maximum amount of product per season AND maximum number of applications.**

[6] Max app refers to the product's maximum number of applications per year. **Applicators must abide by both maximum amount of product per season AND maximum number of applications.**

[7] The REI is 5 days for treated wine grapes when conducting cane tying, turning, or girdling on wine grape. The REI is 12 hours for all other activities in wine grapes.

[8] The REI is 7 days for treated table grape activities of cane tying, turning, or girdling. The REI is 12 hours for all other activities in wine grapes.

Notes on disease control recommendations

The following information is intended to provide general guidelines for use in developing a fungicide spray program for grapes in the Midwest. This spray schedule presents various fungicide options that growers can consider. The major grape diseases that generally require at least some fungicide application for control on an annual basis include black rot, powdery mildew, downy mildew, and Phomopsis blight. Several recommendations in this guide include tank mixes of different fungicides that are intended to provide a program to control all of these diseases simultaneously.

Grape Delayed Dormant through Bud Swell – Diseases

Apply just as buds are beginning to swell but before they show green.

Notes on disease management

- **Black Rot, Phomopsis, Anthracnose:** A delayed dormant application of lime-sulfur is recommended to reduce overwintering inoculum of Phomopsis and powdery mildew on canes, and it also has been shown to control anthracnose. Make the delayed-dormant spray in early spring just as buds swell but before they show green. This high rate is intended to "burn out" overwintering inoculum on infected canes. This is probably the most important spray for controlling the disease.

Effectiveness of Pesticides for Control of Grape Diseases – Delayed Dormant through Bud Swell[1]

Product and formulation	FRAC[2]	Phomopsis	Powdery mildew	REI[4]	Max amt[5] Max app[6]
Sulforix	M	1-2 gallons		48h	NA

Grape Delayed Dormant through Bud Swell – Insects

Apply just as buds are beginning to swell but before they show green.

Notes on insect pest management

- **Flea beetle (adults) and climbing cutworms:** Scout at least weekly as bud swell occurs.

Effectiveness of Insecticides for Control of Grape Insects – Delayed Dormant through Bud Swell[1]

Product and formulation Active ingredient	IRAC[2]	Grape flea beetle	REI[4] PHI[3]	Max amt[5] Max app[6]
Baythroid XL (1EC) **(RUP)**	3A	2.4-3.2 fl. oz.	12h	12.8 fl. oz.
beta-cyfluthrin		G	3d	NA
Danitol 2.4EC **(RUP)**	3A	5.3-10.7 fl. oz.	24h	42.7 fl. oz.
fenpropathrin		E	21d	NA
Imidan 70W	1B	1.3-2.1 lb.	14d	4.5 lb.
phosmet		F	7 or 14d	NA
Pyganic 5% EC	3A	4.5-15.6 fl. oz.	12h	NA
pyrethrins		F	0d	10
Sevin XLR Plus	1A	1-2 qt.	See label	10 qt.
carbaryl		E	7d	5

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Grape Bud Break to Pre-bloom – Diseases

Notes on disease management

- Begin fungicide applications at 1-3 inch new shoot growth; repeat at 7-10 day intervals or according to label instructions and environmental conditions.
- **Powdery mildew:** Primary infections of powdery mildew can occur during this period. Adding a FRAC 3 fungicides (Cevya, Mettle, Procure, Rally, Tebuzol) in the third or fourth spray during this time period improves control of powdery mildew and black rot.

Fungicide Resistance Alert

- The downy and powdery mildew pathogens are especially prone to fungicide resistance. Avoid back-to-back applications of any one systemic fungicide class. See Fungicide Resistance Management, page 140, for information about fungicide resistance development in powdery and downy mildews. See generic fungicides table for product with the same active ingredient, page 218.
- Avoid using fungicides in FRAC group 7 or 11 during this period.

Phytotoxicity Alert

- Inspire Super, Quadris Top, and Revus Top all contain the active ingredient difenoconazole. All fungicides with difenoconazole labeled for grapes have the following precaution: "On *V. labrusca, V. labrusca* hybrids, and other non-vinifera hybrids where sensitivity is not known, the use of Inspire Super, Quadris Top, or Revus Top by itself or in tank mixes with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects."
- Revus Top cannot be used on Concord, Concord Seedless, and Thomcord grapes.
- Flint 50WG should not be applied to Concord or other American type grapes, as injury may occur.
- Luna Experience is labeled for wine grapes only and should not be used on Concord grapes.
- Pristine should not be applied to Concord or other American-type grapes, as injury may occur.

Foundation program: This program contains products that are at a lower risk of resistance and serves as foundation for a grape disease management program.

Foundation Fungicide Program for Early Season Control of Grape Diseases[1]

Product and formulation Active ingredient	FRAC[2]	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[6]
Captan 80 WDG	M3	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	48h	12 lb.
captan		F	G	E	i	0d	NA
Microthiol Disperss	M	x	x	3-10 lb.	3-10 lb.	12h	NA
sulfur		x	x	F	E	0d	NA
Ridomil Gold Copper	4+M	x	2 lb.	x	x	48h	8 lb.
mefanoxam + Copper Hydroxide		x	E	x	x	42d	4
Ridomil Gold MZ	4 + M	x	2.5 lb.	x	x	48h	10 lb.
mefenoxam + mancozeb		x	E	x	x	66d	4
Roper DF Rainshield	M	1.5-4 lb.	1.5-4 lb.	1.5-4 lb.	x	24h	24 lb.
mancozeb		E	E	E	x	66d	6

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Supplemental Sprays: These fungicides provide greater activity against specific diseases and should be applied as a tank mix or in rotation with the foundation program when specific disease pressures are higher. As more green tissue develops, systemic fungicides have greater efficacy against specific pathogens.

Effectiveness of Pesticides for Control of Grape Diseases – Bud Break to Pre-Bloom[1]

Product and formulation Active ingredient	FRAC[2]	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[6]
Aliette WDG	33	x	3-5 lb.	x	x	12h	NA
fosetyl-AL		x	E	x	x	15d	3
Captan 80 WDG	M3	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	48h	12 lb.
captan		F	G	E	i	0d	NA
Elevate 50 WDG	17	x	x	x	1 lb.	12h	3 lb.
fenhexamid		x	x	x	s	0d	3
Endura (70WG)	7	x	x	x	4.5-8 oz.	12h	24 oz.
boscalid		x	x	x	E	14d	Varies
Fervent 475SC	3+7	x	x	x	8.5 fl. oz.	12h	25.5 fl. oz.
isofetamid+tebuconazole		x	x	x	E	14d	NA
Flint Extra	11	3.5-3.8 fl. oz.	3.8 fl. oz.	3.5-3.8 fl. oz.	3-3.5 fl. oz.	12h	23 fl. oz.
trifloxystrobin		E	G	F	E	14d	6
Forum	40	x	6 oz.	x	x	12h	24 oz.
dimethomorph		x	E	x	x	14d	4
Fracture	M	x	x	x	20.5-24.4 fl. oz.	4h	NA
Banda de Lupinus albus doce (BLAD)		x	x	x	E	1d	5
Gatten	U13	x	x	x	6.4 fl. oz.	12h	NA
flutianil		x	x	x	G-E	14d	4
Inspire Super (EW)	3+9	16-20 fl. oz.	x	x	16-20 fl. oz.	12h	80 fl. oz.
difenoconazole + cyprodinil		E	x	x	G	14d	See label
Intuity (SC)	11	x	x	x	6 fl. oz.	12h	18 fl. oz.
mandestrobin		x	x	x	s	10d	3
Kenja 400SC	7	x	x	x	20-22 fl. oz.	12h	66 fl. oz.
isofetamid		x	x	x	F	NA	NA
Lifegard WG	UN	x	1-4.5 oz.	x	1-4.5 oz.	4h	NA
Bacillus mycoides isolate J		x	F	x	F	0d	NA
Luna Experience (SC)	7+3	8-8.6 fl. oz.	x	8-8.6 fl. oz.	8-8.6 fl. oz.	12h/5d7	34 fl. oz
fluopyram + tebuconazole		G	x	s	E	14d	NA
Luna Privilege (SC)	7	6-6.8 fl. oz.	x	x	3.2-6.8 fl. oz.	12h	13.7 fl. oz.
fluopyram		G	x	x	G	7d	2
Luna Sensation (SC)	7+11	5-7.6 fl. oz.	7.6 fl. oz.	5-7.6 fl. oz.	4-7.6 fl. oz.	12h	27.1 fl. oz.
fluopyram + trifloxystrobin		G	s	F-G	E	14d	6
Merivon (2.09SC)	7+11	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	12h	33 fl. oz
fluxapyroxad + pyraclostrobin		G-E	s	G-E	E [r]	14d	6
Mettle 125ME	3	3-5 fl. oz.	x	x	3-5 fl. oz.	12h/7d8	10 oz.
tetraconazole		E	x	x	E [r]	14d	Varies

(continued)

Effectiveness of Pesticides for Control of Grape Diseases – Bud Break to Pre-Bloom[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[6]
Microthiol Disperss	M	x	x	3-10 lb.	3-10 lb.	12h	NA
sulfur		x	x	F	E	0d	NA
Miravis Prime	7+12	9.2-13.4 fl. oz.	x	9.2-13.4 fl. oz.	9.2-13.4 fl. oz.	12h	36.5 fl. oz.
pydiflumetofen+fludioxonil		E	x	F-G	G-E	14d	2
OSO 5%	19	x	x	x	3.75-13 fl. oz.	4h	78 fl. oz.
polyoxin D		x	x	x	G	0d	6
Pristine	11+7	8-12.5 oz.	8-12.5 oz.	8-12.5 oz.	8-12.5 oz.	12h/5d7	69 oz.
pyraclostrobin + boscalid		E	E [r]	F	E	14d	Varies
Procure 480 SC	3	x	x	x	4-8 oz.	24h	32 fl. oz.
triflumizole		x	x	x	E [r]	7d	4
ProPhyt	33	x	2-4 pt.	2-4 pt.	x	4h	NA
phosphorous acid		x	G-E	G-E	x	0d	NA
Quadris Top (SC)	11+3	12-14 fl. oz.	12-14 fl. oz.	12-14 fl. oz.	12-14 fl. oz.	12h	56 fl. oz.
azoxystrobin + difenoconazole		E	F	F	E	14d	NA
Rally 40WSP	3	3-5 oz.	x	x	3-5 oz.	24h	1.5 lb.
myclobutanil		E	x	x	E [r]	14d	NA
Ranman 400SC	21	x	2.1-2.75 fl. oz.	x	x	12h	16.5 fl. oz.
cyazofamid		x	E	x	x	30d	6
Reason 500 SC	11	x	2.7 fl. oz.	x	x	12h	8.1 fl. oz.
fenamidone		x	G [r]	x	x	30d	NA
Revus (S)	40	x	8 fl. oz.	x	x	4h	32 fl. oz.
mandipropamid		x	E	x	x	14d	NA
Revus Top (SC)	3 + 40	7 fl. oz.	7 fl. oz.	7 fl. oz.	7 fl. oz.	12h	28 fl. oz.
difenoconazole + mandipropamid		E	E	i	E	14d	NA
Ridomil Gold Copper	4+M	x	2 lb.	x	x	48h	8 lb.
mefanoxam + copper hydroxide		x	E	x	x	42d	4
Ridomil Gold MZ	4 + M	x	2.5 lb.	x	x	48h	10 lb.
mefenoxam + mancozeb		x	E	x	x	66d	4
Roper DF Rainshield	M	1.5-4 lb.	1.5-4 lb.	1.5-4 lb.	x	24h	24 lb.
mancozeb		E	E	E	x	66d	6
Sovran (50WG)	11	3.2-4.8 fl. oz.	4-6.4 fl. oz.	3.2-4.8 fl. oz.	3.2-4.8 fl. oz.	12h	25.6 oz.
kresoxim-methyl		E	G [r]	F	E [r]	14d	4
Sulforix	M	x	x	See label	See label	48h	NA
calcium polysulfide		x	x	G-E	i	NA	8
Tanos (DW)	11 + 27	x	8 oz.	x	x	12h	72 oz.
famoxadone + cymozanil		x	G [r]	x	x	30d	9
Tebustar 45 WSP	3	4 oz.	x	x	4 oz.	12h	2 lb.
tebuconazole		E	x	x	E [r]	0d	NA
Topguard EQ	3+11	5-6 fl. oz.	8 fl. oz.	8 fl. oz.	5-6 fl. oz.	12h	34 fl. oz.
azoxystrobin+flutriafol		u	u	u	E	14d	6

(continued)

Effectiveness of Pesticides for Control of Grape Diseases – Bud Break to Pre-Bloom[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[6]
Topsin-M WSB	1	0.7-1.5 lb.	x	0.7-1.5 lb.	0.7-1.5 lb.	48h	6 lb.
thiophanate methyl		F	x	G	E	7d	NA
Torino (SC)	U6	x	x	x	3.4 oz.	4h	6.8 oz.
cyflufenamid		x	x	x	E	3d	1 or 2
Vangard WG (75WG)	9	x	x	x	See label	12h	30 oz.
cyprodinil		x	x	x	s	7d	See label
Vivando (2.5F)	U8	x	x	x	10.3-15.4 fl. oz.	12h	42.6 fl. oz.
metrafenone		x	x	x	E	14d	3
Zampro	45 + 40	x	11-14 fl. oz.	x	x	12h	56 fl. oz.
ametoctradin + dimethomorph		x	E	x	x	14d	NA
Ziram 76DF	M	3-4 lb.	3-4 lb.	3-4 lb.	x	48h	28 lb.
ziram		E	G	G	x	21d	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Grape Bud Break to 4-inch Shoot – Insects

Notes on insect pest management

- **Grape phylloxera:** Admire Pro is soil-applied for systemic control. Use if there is a history of leaf galling. Apply from bud swell until the first expanded leaf to be sure the chemical is available as soon as the roots begin to take up water, as it takes several weeks for the chemical to get to the leaves.

Effectiveness of Insecticides for Control of Grape Insects – Bud Break to 4-inch Shoots[1]

Product and formulation	IRAC[2]	Grape flea beetle	Grape Phylloxera	REI[4] PHI[3]	Max amt[5] Max app[6]
Admire Pro (4.6F)	4A	x	7-14 fl. oz.	12h	2.8/14 fl. oz.
imidacloprid		x	G	0d	NA
Assail 30SG	4A	x	2.5-5.3 oz.	12h	10.6 oz.
acetamiprid		x	G	3d	2
Baythroid XL (1EC) **(RUP)**	3A	2.4-3.2 fl. oz.	x	12h	12.8 fl. oz.
beta-cyfluthrin		G	x	3d	NA
Danitol 2.4EC **(RUP)**	3A	5.3-10.7 fl. oz.	10.7-21.3 fl. oz.	24h	42.7 fl. oz.
fenpropathrin		E	E	21d	NA
Imidan 70W	1B	1.3-2.1 lb.	x	14d	4.55 lb.
phosmet		F	x	7 or 14d	NA
Movento (2SC)	23	x	6-8 fl. oz.	24h	12.5 fl. oz.
spirotetramat		x	E	7d	NA
Platinum 75SG	4A	0	2.7-5.7 oz.	12h	5.67 oz.
thiamethoxam		0	G	60d	NA
Pyganic 5% EC	3A	4.5-15.61 fl. oz.	x	12h	15.6 fl. oz.
pyrethrins		F	x	0d	10
Sevin XLR Plus	1A	1-2 qt.	x	See label	10 qt.
carbaryl		E	x	7d	5

(continued)

Effectiveness of Insecticides for Control of Grape Insects – Bud Break to 4-inch Shoots[1] *(continued)*

Product and formulation	IRAC[2]	Grape flea beetle	Grape Phylloxera	REI[4] PHI[3]	Max amt[5] Max app[6]
Venom (70SG)	4A	x	5-7.5 oz.	12h	12 oz.
dinotefuran		x	s	See label	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Grape 4- to 10-inch Shoots through Bloom – Insects

Notes on insect pest management

- **Rose chafers**: May be present any time between 4- and 10-inch shoot growth and bloom.
- Other insecticide formulations may be available. See generic insecticides table for product with the same active ingredient, pages 219-220.
- **Redbanded leafroller and grape berry moth:** Pheromone traps for grape berry moth and redbanded leafroller indicate if they are present and help determine the need for control.
- **Grape phylloxera (leaf form):** Control the root gall form of grape phylloxera by using rootstocks derived from American grapes. Native American grapes (Eastern U.S.) are highly resistant to this pest.
- Because bees do not pollinate grapes, there is little danger to bees at this time unless they are working on other blooming plants in the area being sprayed. Mow before spraying to eliminate blooms on weeds.
- Scorpion 35SL: Use low rate for foliar. Use high rate for soil application
- Movento 2SC: See label regarding adjuvants. Allow 30 days between applications. Movento is applied to leaves but moves to the roots. It is most effective if applied at this early stage of grape growth.
- **Grape scale:** Not a common pest in most of the Midwest. In southern areas, flag scale-infested vines during dormant pruning. In early May begin weekly inspections of flagged vines for scale crawlers. Lift live adult scale covers and look for yellow moving crawlers (use a hand lens with 10x magnification). Protect canes by applying sprays every 10 days as long as you see moving crawlers (2-3 week crawler emergence period).

Effectiveness of Insecticides for Control of Grape Insects – 4- to 10-inch Shoots through Bloom[1]

Product and formulation Active ingredient	IRAC	Grape flea beetle	Grape phylloxera	Rose chafer	REI[4] PHI[3]	Max amt[5] Max app[6]
Assail 30SG	4A	x	2.5-5.3 oz.	2.5-5.3 oz.	12h	10.6 oz.
acetamiprid		x	G	E	3d	2
Danitol 2.4EC **(RUP)**	3A	5.3-10.7 fl. oz.	10.7-21.3 fl. oz.	10.7-21.3 fl. oz.	24h	42.7 fl. oz.
fenpropathrin		E	E	E	21d	NA
Imidan 70W	1B	1.3-2.1 lb.	x	1.3-2.1 lb.	14d	4.55 lb.
phosmet		F	x	G	7 or 14d	NA
Movento (2SC)	23	x	6-8 fl. oz.	x	24h	12.5 fl. oz.
spirotetramat		x	E	x	7d	NA
Platinum 75SG	4A	0	2.7-5.7 oz.	x	12h	5.67 oz.
thiamethoxam		0	G	x	60d	NA
Sevin XLR Plus	1A	1-2 qt.	x	1-2 qt.	See label	10 qt.
carbaryl		E	x	E	7d	5
Venom (70SG)	4A	x	5-7.5 oz.	x	12h	12 oz.
dinotefuran		x	s	x	See label	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Grape Pre-bloom through Shatter – Diseases

Notes on disease management

Pre-bloom through bloom

- Begin pre-bloom applications when shoots are 10- to 12- inches through the bloom period.
- Critical Period for Disease Control: The period from immediate pre-bloom through four or five weeks after bloom is critical to control fruit infections by the black rot, powdery mildew, and the downy mildew pathogens.
- Fruit of the most commonly planted varieties is resistant to black rot, powdery mildew and downy mildew by four to five weeks after bloom.
- Although fruit become resistant to powdery and downy mildews, the rachises (cluster stems) and leaves remain susceptible. Fungicide protection against powdery and downy mildews is therefore required throughout the growing season.

Bloom

- Begin bloom applications when the caps start to drop.
- If wet weather persists during bloom, or if the interval between the pre-bloom and shatter spray is greater than 10 days, a fungicide application during bloom may be necessary.
- Downy mildew is the most common disease in the Midwest. Initial infections can occur as early as bloom. Leaf infections may occur throughout the summer, so it may be necessary to protect susceptible varieties from bloom to post- harvest.

Fungicide Resistance Alert

- The downy and powdery mildew pathogens are especially prone to fungicide resistance. Avoid back-to-back applications of any one systemic fungicide class (i.e. FRAC 3, 7, or 11).
- See Fungicide Resistance Management, page 140, for information about fungicide resistance development in powdery and downy mildews. See generic fungicides table for product with the same active ingredient, page 218.

Phytotoxicity Alert

- Do not apply sulfur or captan at the same time as an oil or within two weeks of an oil application.
- Do not tank mix captan with the insecticide Sevin XLR.
- The use of Revus Top on *V. labrusca* and *V. labrusca* varieties is not known. Care should be taken when using a tank-mix, adjuvants or foliar fertilizers with this product to avoid phytotoxicity.
- **Botrytis bunch rot:** A fungicide application during this period is critical on tight-clustered varieties (especially French hybrids or Vinifera) or in vineyards where Botrytis bunch rot has been a problem in the past. See Botrytis Bunch Rot, page 139.
- Begin shatter applications when unfertilized berries fall from clusters, about 7-10 days after bloom or 7-10 days after last spray.
- Pay close attention to the PHI on products that contain mancozeb or Ridomil.

Effectiveness of Pesticides for Control of Grape Diseases – Pre-bloom through Shatter[1]

Product and formulation Active ingredient	FRAC[2]	Botrytis rot	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[6]
Abound (SC)	11	10-15.5 fl. oz.	10 -15.5 fl. oz.	10-15.5 fl. oz.	10-15.5 fl. oz.	10-15.5 fl. oz.	4h	90 fl. oz.
azoxystrobin		s	E	E [r]	F	E [r]	14d	Varies
Aliette WDG	33	x	x	3-5 lb.	x	x	12h	NA
fosetyl-AL		x	x	E	x	x	15d	3
Aprovia (EC)	7	x	8.6-10.5 fl. oz.	x	8.6-10.5 fl. oz.	8.6-10.5 fl. oz.	12h	31.5 fl. oz.
benzovindiflupyr		x	G-E	x	i	G-E	21d	3
Captan 80 WDG	M3	1.25-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	48h	12 lb.
captan		F	F	G	E	i	0d	NA
Cevya	3	x	4 fl. oz.	x	3-4 fl. oz.	3-4 fl. oz.	12h	8 fl. oz.
mefentrifluconazole		x	E	x	G	G-E	14d	2
Cuprofix Ultra 40D	M	x	1.3-3 lb.	1.3-3 lb.	1.3-3 lb.	1.3-3 lb.	12hr	NA
copper sulfate		x	F	F	F	i-F	0d	NA

(continued)

Effectiveness of Pesticides for Control of Grape Diseases – Pre-bloom through Shatter[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Botrytis rot	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[6]
Elevate 50 WDG	17	1 lb.	x	x	x	1 lb.	12h	3 lb.
fenhexamid		E	x	x	x	s	0d	3
Endura (70WG)	7	4.5-8 oz.	x	x	x	4.5-8 oz.	12h	24 oz.
boscalid		G	x	x	x	E	14d	Varies
Fervent 475SC	3+7	8.5 fl. oz.	x	x	x	8.5 fl. oz.	12h	25.5 fl. oz.
isofetamid+tebuconazole		s	x	x	x	E	14d	NA
Flint Extra	11	3.8 fl. oz.	3.5-3.8 fl. oz.	3.8 fl. oz.	3.5-3.8 fl. oz.	3-3.5 fl. oz.	12h	23 fl. oz.
trifloxystrobin		G	E	G	F	E	14d	6
Forum	40	x	x	6 oz.	x	x	12h	24 oz.
dimethomorph		x	x	E	x	x	14d	4
Fracture	M	24.4-36.6 fl. oz.	x	x	x	20.5-24.4 fl. oz.	4h	NA
Banda de Lupinus albus doce (BLAD)		E	x	x	x	E	1d	5
Gatten	U13	x	x	x	x	6.4 fl. oz.	12h	NA
futianil		x	x	x	x	G-E	14d	4
Inspire Super (EW)	3+9	16-20 fl. oz.	16-20 fl. oz.	x	x	16-20 fl. oz.	12h	80 fl. oz.
difenoconazole + cyprodinil		E	E	x	x	G	14d	See label
Intuity (SC)	11	6 fl. oz	x	x	x	6 fl. oz.	12h	18 fl. oz.
mandestrobin		G-E	x	x	x	s	10d	3
JMS Stylet Oil	0	x	x	x	x	1-2.0% conc.	4h	NA
oil		x	x	x	x	s	0d	NA
Kenja 400SC	7	20-22 fl. oz.	x	x	x	20-22 fl. oz.	12h	66 fl. oz.
isofetamid		F	x	x	x	F	NA	NA
Lifegard WG	UN	x	x	1-4.5 oz.	x	1-4.5 oz.	4h	NA
Bacillus mycoides isolate J		x	x	F	x	F	0d	NA
Luna Experience (SC)	7+3	8-8.6 fl. oz.	8-8.6 fl. oz.	x	8-8.6 fl. oz.	8-8.6 fl. oz.	12h/5d7	34 fl. oz
fluopyram + tebuconazole		E	G	x	s	E	14d	NA
Luna Privilege (SC)	7	6-6.8 fl. oz.	6-6.8 fl. oz.	x	x	3.2-6.8 fl. oz.	12h	13.7 fl. oz.
fluopyram		E	G	x	x	G	7d	2
Luna Sensation (SC)	7+11	5-7.6 fl. oz.	5-7.6 fl. oz.	7.6 fl. oz.	5-7.6 fl. oz.	4-7.6 fl. oz.	12h	27.1 fl. oz.
fluopyram + trifloxystrobin		G-E	G	s	F-G	E	14d	6
Merivon (2.09SC)	7+11	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	12h	33 fl. oz
fluxapyroxad + pyraclostrobin		s	G-E	s	G-E	E [r]	14d	6
Mettle 125ME	3	x	3-5 fl. oz.	x	x	3-5 fl. oz.	12h/7d8	10 oz.
tetraconazole		x	E	x	x	E [r]	14d	Varies
Microthiol Disperss	M	x	x	x	3-10 lb.	3-10 lb.	12h	NA
sulfur		x	x	x	F	E	0d	NA
Miravis Prime	7+12	10.3-13.4 fl. oz.	9.2-13.4 fl. oz.	x	9.2-13.4 fl. oz.	9.2-13.4 fl. oz.	12h	36.5 fl. oz.
pydiflumetofen+fludioxonil		G-E	E	x	F-G	G-E	14d	2

(continued)

Effectiveness of Pesticides for Control of Grape Diseases – Pre-bloom through Shatter[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Botrytis rot	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[6]
OSO 5%	19	3.75-13 fl. oz.	x	x	x	3.75-13 fl. oz.	4h	78 fl. oz.
polyoxin D		G	x	x	x	G	0d	6
Pristine	11+7	8-12.5 oz.	8-12.5 oz.	8-12.5 oz.	8-12.5 oz.	8-12.5 oz.	12h/5d7	69 oz.
pyraclostrobin + boscalid		G	E	E [r]	F	E	14d	Varies
Procure 480 SC	3	4-8 oz.	x	x	x	4-8 oz.	24h	32 fl. oz.
triflumizole		s	x	x	x	E [r]	7d	4
ProPhyt	33	x	x	2-4 pt.	2-4 pt.	x	4h	NA
phosphorous acid		x	x	G-E	G-E	x	0d	NA
Quadris Top (SC)	11+3	12-14 fl. oz.	12-14 fl. oz.	12-14 fl. oz.	12-14 fl. oz.	12-14 fl. oz.	12h	56 fl. oz.
azoxystrobin + difenoconazole		s	E	F	F	E	14d	NA
Quintec (2.08F)	13	x	x	x	x	4-6.6 fl. oz.	12h	33 fl. oz.
quinoxyfen		x	x	x	x	E	21d	5
Rally 40WSP	3	x	3-5 oz.	x	x	3-5 oz.	24h	1.5 lb.
myclobutanil		x	E	x	x	E [r]	14d	NA
Ranman 400SC	21	x	x	2.1-2.7 fl. oz.	x	x	12h	16.5 fl. oz.
cyazofamid		x	x	E	x	x	30d	6
Reason 500 SC	11	x	x	2.7 fl. oz.	x	x	12h	8.1 fl. oz.
fenamidone		x	x	G [r]	x	x	30d	NA
Revus (S)	40	x	x	8 fl. oz.	x	x	4h	32 fl. oz.
mandipropamid		x	x	E	x	x	14d	NA
Revus Top (SC)	3 + 40	x	7 fl. oz.	7 fl. oz.	7 fl. oz.	7 fl. oz.	12h	28 fl. oz.
difenoconazole + mandipropamid		x	E	E	i	E	14d	NA
Ridomil Gold Copper	4+M	x	x	2 lb.	x	x	48h	8 lb.
mefanoxam + copper hydroxide		x	x	E	x	x	42d	4
Ridomil Gold MZ	4 + M	x	x	2.5 lb.	x	x	48h	10 lb.
mefenoxam + mancozeb		x	x	E	x	x	66d	4
Roper DF Rainshield	M	1.5-4 lb.	1.5-4 lb.	1.5-4 lb.	1.5-4 lb.	x	24h	24 lb.
mancozeb		i	E	E	E	x	66d	6
Rovral 4 F	2	1-2 pt.	x	x	x	x	48h	2 or 8 pt.
iprodione		G	x	x	x	x	7d	1 or 4
Scala (SC)	9	18 fl. oz.	x	x	x	x	12h	36 fl. oz.
pyrimethanil		G	x	x	x	x	7d	NA
Sovran (50WG)	11	3.2-6.4 fl. oz.	3.2-4.8 fl. oz.	4-6.4 fl. oz.	3.2-4.8 fl. oz.	3.2-4.8 fl. oz.	12h	25.6 oz.
kresoxim-methyl		s	E	G [r]	F	E [r]	14d	4
Sulforix	M	x	x	x	See label	See label	48h	NA
calcium polysulfide		x	x	x	G-E	i	NA	8
Switch (62.5WG)	9 + 12	11-14 oz	x	x	x	x	12h	56 oz.
cyprodinil + fludioxonil		G	x	x	x	x	7d	See label
Tanos (DW)	11 + 27	x	x	8 oz.	x	x	12h	72 oz.
famoxadone + cymozanil		x	x	G [r]	x	x	30d	9

(continued)

Effectiveness of Pesticides for Control of Grape Diseases – Pre-bloom through Shatter[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Botrytis rot	Black rot	Downy mildew	Phomopsis	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[6]
Tebustar 45 WSP	3	x	4 oz.	x	x	4 oz.	12h	2 lb.
tebuconazole		x	E	x	x	E [r]	0d	NA
Topguard EQ	3+11	8 fl. oz.	5-6 fl. oz.	8 fl. oz.	8 fl. oz.	5-6 fl. oz.	12h	34 fl. oz.
azoxystrobin+flutriafol		s	u	u	u	E	14d	6
Topsin-M WSB	1	1-1.5 lb.	0.7-1.5 lb.	x	0.7-1.5 lb.	0.7-1.5 lb.	48h	6 lb.
thiophanate methyl		G [r]	F	x	G	E	7d	NA
Torino (SC)	U6	x	x	x	x	3.4 oz.	4h	6.8 oz.
cyflufenamid		x	x	x	x	E	3d	1 or 2
Vangard WG (75WG)	9	10 oz.	x	x	x	See label	12h	30 oz.
cyprodinil		G-E	x	x	x	s	7d	See label
Vivando (2.5F)	U8	x	x	x	x	10.3-15.4 fl. oz.	12h	42.6 fl. oz.
metrafenone		x	x	x	x	E	14d	3
Zampro	45 + 40	x	x	11-14 fl. oz.	x	x	12h	56 fl. oz.
ametoctradin + dimethomorph		x	x	E	x	x	14d	NA
Ziram 76DF	M	x	3-4 lb.	3-4 lb.	3-4 lb.	x	48h	28 lb.
ziram		s	E	G	G	x	21d	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Grape Shatter – Insects

Apply when unfertilized berries fall from clusters, about 7-10 days after bloom or 7-10 days after last spray.

Notes on insect pest management

- **Grape rootworm:** Occasional problems from grape rootworm (adult beetles) are also controlled by Sevin, Imidan, Danitol, Baythroid, or Brigade applied for grape berry moth control. When found, grape rootworm is typically a perimeter problem, low in the canopy.
- **Redbanded leafroller:** Although adult moths are commonly caught in traps, the larvae of this pest are not common in grapes in the Midwest.
- **Leafhoppers (including sharpshooters):** Examining the undersides of grape leaves indicates if leafhoppers are present. See page 178.
- **Grape mealybug:** This pest is not common in the Midwest.

Effectiveness of Insecticides for Control of Grape Insects – Shatter[1]

Product and formulation Active ingredient	IRAC[2]	Grape berry moth	Japanese beetle	Rose chafer	REI[4] PHI[3]	Max amt[5] Max app[6]
Actara (25WDG	4A	x	1.5-3.5 oz.	x	12h	7 oz.
thiamethoxam		x	G	x	5d	NA
Altacor (35WDG)	28	2-4.5 oz.	x	x	4h	9 oz.
chlorantraniliprole		E	x	x	14d	4
Assail 30SG	4A	2.5-5.3 oz.	2.5-5.3 oz.	2.5-5.3 oz.	12h	10.6 oz.
acetamiprid		u	G	E	3d	2
Avaunt (30WDG)	22	5-6 oz.	3.5-6 oz.	x	12h	12 oz.
indoxacarb		G	G	x	7d	2

(continued)

Effectiveness of Insecticides for Control of Grape Insects – Shatter[1] *(continued)*

Product and formulation Active ingredient	IRAC[2]	Grape berry moth	Japanese beetle	Rose chafer	REI[4] PHI[3]	Max amt[5] Max app[6]
Baythroid XL (1EC) **(RUP)**	3A	2.4-3.2 fl. oz.	x	x	12h	12.8 fl. oz.
beta-cyfluthrin		E	x	x	3d	NA
BeetleGone!	11A	x	1-17.5 lb.	x	4h	NA
B.t. galleriae		x	G	x	0d	NA
Belay (2.13SC)	4A	6 fl. oz.	2-4 fl. oz.	x	12h	12 fl. oz.
clothianidin		F	F	x	0d or 30d	NA
Brigade 2EC **(RUP)**	3A	3.2-6.4 fl. oz.	3.2-6.4 fl. oz.	x	12h	6.4 fl. oz.
bifenthrin		G	G	x	30d	NA
Danitol 2.4EC **(RUP)**	3A	10.7-21.3 fl. oz.	10.7-21.3 fl. oz.	10.7-21.3 fl. oz.	24h	42.7 fl. oz.
fenpropathrin		E	E	E	21d	NA
Delegate WG (25WG)	5	3-5 oz.	x	x	4h	19.5 oz.
spinetoram		E	x	x	7d	5
Entrust SC (2SC)	5	4-8 fl. oz.	x	x	4h	23 fl. oz.
spinosad		G	x	x	7d	5
Imidan 70W	1B	1.3-2.1 lb.	1.3-2.1 lb.	1.3-2.1 lb.	14d	4.5 lb.
phosmet		G	G	G	7 or 14d	NA
Intrepid 2F	18	8-16 fl. oz.	x	x	4h	48 fl. oz.
methoxyfenozide		E	x	x	30d	NA
Malathion 5EC	1B	x	3 pt.	x	See label	3.8 pt.
malathion		x	G	x	3d	2
Mustang Maxx (0.83EC) **(RUP)**	3A	4 fl. oz.	4 fl. oz.	x	12h	24 fl. oz.
zeta-cypermethrin		E	E	x	1d	NA
Platinum 75SG	4A	x	2.7-5.7 oz.	x	12h	5.6 oz.
thiamethoxam		x	F	x	60d	NA
Pyganic 5% EC	3A	x	4.5-15.6 fl. oz.	x	12h	NA
pyrethrins		x	F	x	0d	10
Sevin XLR Plus	1A	2 qt.	1-2 qt.	1-2 qt.	See label	10 qt.
carbaryl		G	E	E	7d	5
Surround WP (95WP)	UN	x	25-50 lb.	x	4h	NA
kaolin		x	F	x	0d	NA
Venom (70SG)	4A	1-3 oz.	x	x	12h	12 oz.
dinotefuran		F	x	x	See label	NA
Verdepryn 100SL (0.83SL)	28	8.2-11 fl. oz.	8.2-11 fl. oz.	x	4h	27 fl. oz.
cyclaniliprole		E	u	x	7d	3

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Grape Shatter to Veraison (Berry coloring) – Diseases

Notes on disease management

- First cover applications should follow shatter by 7-10 days. Thereafter, sprays for disease control can be applied every 10-14 days until veraison. If heavy rainfall occurs, shorten the interval between sprays. Refer to labels for application timing and harvest restrictions. After bloom the threat of Phomopsis infection is greatly reduced. Fruit remain susceptible to black rot, powdery mildew, and downy mildew until about 4-5 weeks after bloom. It is critical to maintain a fungicide program that controls all three of these diseases until about 4-5 weeks after bloom. At 4-5 weeks after bloom, the fruit should be resistant to black rot, powdery mildew, and downy mildew; however, the leaves and rachises (cluster stems) remain susceptible to both powdery and downy mildew for the rest of the season. Therefore, fungicide protection against both diseases may be required throughout the growing season.
- Pay close attention to the PHI on products that contain mancozeb or Ridomil.

Fungicide Resistance Alert

- The downy and powdery mildew pathogens are especially prone to fungicide resistance. Avoid back-to-back applications of any one systemic fungicide class (i.e. FRAC 3, 7, or 11).
- See Fungicide Resistance Management, page 140, for information about fungicide resistance development in powdery and downy mildews. See generic fungicides table for product with the same active ingredient, page 218.

Effectiveness of Pesticides for Control of Grape Diseases – Shatter to Veraison[1]

Product and formulation Active ingredient	FRAC[2]	Black rot	Downy mildew	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[5]
Abound (SC)	11	10 -15.5 fl. oz.	10-15.5 fl. oz.	10-15.5 fl. oz.	4h	90 fl. oz.
azoxystrobin		E	E [r]	E [r]	14d	Varies
Aliette WDG	33	x	3-5 lb.	x	12h	NA
fosetyl-AL		x	E	x	15d	3
Aprovia (EC)	7	8.6-10.5 fl. oz.	x	8.6-10.5 fl. oz.	12h	31.5 fl. oz.
benzovindiflupyr		G-E	x	G-E	21d	3
Captan 80 WDG	M3	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	48h	12 lb.
captan		F	G	i	0d	NA
Cevya	3	4 fl. oz.	x	3-4 fl. oz.	12h	8 fl. oz.
mefentrifluconazole		E	x	G-E	14d	2
Cuprofix Ultra 40D	M	1.3-3 lb.	1.3-3 lb.	1.3-3 lb.	12hr	NA
copper sulfate		F	F	i-F	0d	NA
Elevate 50 WDG	17	x	x	1 lb.	12h	3 lb.
fenhexamid		x	x	s	0d	3
Endura (70WG)	7	x	x	4.5-8 oz.	12h	24 oz.
boscalid		x	x	E	14d	Varies
Fervent 475SC	3+7	x	x	8.5 fl. oz.	12h	25.5 fl. oz.
isofetamid+tebuconazole		x	x	E	14d	NA
Flint Extra	11	3.5-3.8 fl. oz.	3.8 fl. oz.	3-3.5 fl. oz.	12h	23 fl. oz.
trifloxystrobin		E	G	E	14d	6
Forum	40	x	6 oz.	x	12h	24 oz.
dimethomorph		x	E	x	14d	4
Fracture	M	x	x	20.5-24.4 fl. oz.	4h	NA
Banda de Lupinus albus doce (BLAD)		x	x	E	1d	5

(continued)

Effectiveness of Pesticides for Control of Grape Diseases – Shatter to Veraison[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Black rot	Downy mildew	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[5]
Gatten	U13	x	x	6.4 fl. oz.	12h	NA
flutianil		x	x	G-E	14d	4
Inspire Super (EW)	3+9	16-20 fl. oz.	x	16-20 fl. oz.	12h	80 fl. oz.
difenoconazole + cyprodinil		E	x	G	14d	See label
Intuity (SC)	11	x	x	6 fl. oz.	12h	18 fl. oz.
mandestrobin		x	x	s	10d	3
JMS Stylet Oil	UN	x	x	1-2.0% conc.	4h	NA
oil		x	x	s	0d	NA
Kenja 400SC	7	x	x	20-22 fl. oz.	12h	66 fl. oz.
isofetamid		x	x	F	NA	NA
Lifegard WG	UN	x	1-4.5 oz.	1-4.5 oz.	4h	NA
Bacillus mycoides isolate J		x	F	F	0d	NA
Luna Experience (SC)	7+3	8-8.6 fl. oz.	x	8-8.6 fl. oz.	12h/5d7	34 fl. oz
fluopyram + tebuconazole		G	x	E	14d	NA
Luna Privilege (SC)	7	6-6.8 fl. oz.	x	3.2-6.8 fl. oz.	12h	13.7 fl. oz.
fluopyram		G	x	G	7d	2
Luna Sensation (SC)	7+11	5-7.6 fl. oz.	7.6 fl. oz.	4-7.6 fl. oz.	12h	27.1 fl. oz.
fluopyram + trifloxystrobin		G	s	E	14d	6
Merivon (2.09SC)	7+11	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	12h	33 fl. oz
fluxapyroxad + pyraclostrobin		G-E	s	E [r]	14d	6
Mettle 125ME	3	3-5 fl. oz.	x	3-5 fl. oz.	12h/7d8	10 oz.
tetraconazole		E	x	E [r]	14d	Varies
Microthiol Disperss	M	x	x	3-10 lb.	12h	NA
sulfur		x	x	E	0d	NA
Miravis Prime	7+12	9.2-13.4 fl. oz.	x	9.2-13.4 fl. oz.	12h	36.5 fl. oz.
pydiflumetofen+fludioxonil		E	x	G-E	14d	2
OSO 5%	19	x	x	3.7-13 fl. oz.	4h	78 fl. oz.
polyoxin D		x	x	G	0d	6
Pristine	11+7	8-12.5 oz.	8-12.5 oz.	8-12.5 oz.	12h/5d7	69 oz.
pyraclostrobin + boscalid		E	E [r]	E	14d	Varies
Procure 480 SC	3	x	x	4-8 oz.	24h	32 fl. oz.
triflumizole		x	x	E [r]	7d	4
ProPhyt	33	x	2-4 pt.	x	4h	NA
phosphorous acid		x	G-E	x	0d	NA
Quadris Top (SC)	11+3	12-14 fl. oz.	12-14 fl. oz.	12-14 fl. oz.	12h	56 fl. oz.
azoxystrobin + difenoconazole		E	F	E	14d	NA
Quintec (2.08F)	13	x	x	4-6.6 fl. oz.	12h	33 fl. oz.
quinoxyfen		x	x	E	21d	5
Rally 40WSP	3	3-5 oz.	x	3-5 oz.	24h	1.5 lb.
myclobutanil		E	x	E [r]	14d	NA

(continued)

Effectiveness of Pesticides for Control of Grape Diseases – Shatter to Veraison[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Black rot	Downy mildew	Powdery mildew	REI[4] PHI[3]	Max amt[5] Max app[5]
Ranman 400SC	21	x	2.1-2.7 fl. oz.	x	12h	16.5 fl. oz.
cyazofamid		x	E	x	30d	6
Reason 500 SC	11	x	2.7 fl. oz.	x	12h	8.1 fl. oz.
fenamidone		x	G [r]	x	30d	NA
Revus (S)	40	x	8 fl. oz.	x	4h	32 fl. oz.
mandipropamid		x	E	x	14d	NA
Revus Top (SC)	3 + 40	7 fl. oz.	7 fl. oz.	7 fl. oz.	12h	28 fl. oz.
difenoconazole + mandipropamid		E	E	E	14d	NA
Ridomil Gold Copper	4+M	x	2 lb.	x	48h	8 lb.
mefanoxam + copper hydroxide		x	E	x	42d	4
Sovran (50WG)	11	3.2-4.8 fl. oz.	4-6.4 fl. oz.	3.2-4.8 fl. oz.	12h	25.6 oz.
kresoxim-methyl		E	G [r]	E [r]	14d	4
Tanos (DW)	11 + 27	x	8 oz.	x	12h	72 oz.
famoxadone + cymozanil		x	G [r]	x	30d	9
Tebustar 45 WSP	3	4 oz.	x	4 oz.	12h	2 lb.
tebuconazole		E	x	E [r]	0d	NA
Topguard EQ	3+11	5-6 fl. oz.	8 fl. oz.	5-6 fl. oz.	12h	34 fl. oz.
azoxystrobin+flutriafol		u	u	E	14d	6
Topsin-M WSB	1	0.7-1.5 lb.	x	0.7-1.5 lb.	48h	6 lb.
thiophanate methyl		F	x	E	7d	NA
Torino (SC)	U6	x	x	3.4 oz.	4h	6.8 oz.
cyflufenamid		x	x	E	3d	1 or 2
Vangard WG (75WG)	9	x	x	See label	12h	30 oz.
cyprodinil		x	x	s	7d	See label
Vivando (2.5F)	U8	x	x	10.3-15.4 fl. oz.	12h	42.6 fl. oz.
metrafenone		x	x	E	14d	3
Zampro	45 + 40	x	11-14 fl. oz.	x	12h	56 fl. oz.
ametoctradin + dimethomorph		x	E	x	14d	NA
Ziram 76DF	M	3-4 lb.	3-4 lb.	x	48h	28 lb.
ziram		E	G	x	21d	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Grape Shatter to Veraison (Berry coloring) – Insects

- **Grape root borer:** Lorsban Advanced, 4E, or 75WG can be applied to control grape root borer if no other applications of chlorpyrifos were made during the season. The PHI is 35 days. See page 142.

Grape Veraison to Harvest – Diseases

Notes on disease management

- **Botrytis bunch rot:** See comments under Grape Bloom for Topsin M, Rovral, Vangard, and Elevate. See Botrytis Bunch Rot, page 139. Same as for Grape Bloom, page 127.
- **Sour rot complex:** Mix Oxidate or Blight Ban 506 with an insecticide (for Drosophila control). See discussion on page 127.
- **Black rot:** Sprays for black rot should not be needed at this time.

Effectiveness of Pesticides for Control of Grape Diseases – Veraison to Harvest[1]

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Botrytis rot	Downy mildew	Powdery mildew	Ripe rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Abound (SC)	11	x	10-15.5 fl. oz.	10-15.5 fl. oz.	10-15.5 fl. oz.	x	4h	90 fl. oz.
azoxystrobin		x	s	E [r]	E [r]	x	14d	Varies
Aliette WDG	33	x	x	3-5 lb.	x	x	12h	NA
fosetyl-AL		x	x	E	x	x	15d	3
Aprovia (EC)	7	x	x	x	8.6-10.5 fl. oz.	x	12h	31.5 fl. oz.
benzovindiflupyr		x	x	x	G-E	x	21d	3
Captan 80 WDG	M3	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	1.2-2.5 lb.	48h	12 lb.
captan		G	F	G	i	G	0d	NA
Cevya	3	x	x	x	3-4 fl. oz.	x	12h	8 fl. oz.
mefentrifluconazole		x	x	x	G-E	x	14d	2
Cuprofix Ultra 40D	M	x	x	1.3-3 lb.	1.3-3 lb.	x	12hr	NA
copper sulfate		x	x	F	i-F	x	0d	NA
Elevate 50 WDG	17	x	1 lb.	x	1 lb.	x	12h	3 lb.
fenhexamid		x	E	x	s	x	0d	3
Endura (70WG)	7	x	4.5-8 oz.	x	4.5-8 oz.	x	12h	24 oz.
boscalid		x	G	x	E	x	14d	Varies
Fervent 475SC	3+7	x	8.5 fl. oz.	x	8.5 fl. oz.	x	12h	25.5 fl. oz.
isofetamid+tebuconazole		x	s	x	E	x	14d	NA
Flint Extra	11	x	3.8 fl. oz.	3.8 fl. oz.	3-3.5 fl. oz.	x	12h	23 fl. oz.
trifloxystrobin		x	G	G	E	x	14d	6
Forum	40	x	x	6 oz.	x	x	12h	24 oz.
dimethomorph		x	x	E	x	x	14d	4
Fracture	M	x	24.4-36.6 fl. oz.	x	20.5-24.4 fl. oz.	x	4h	NA
Banda de Lupinus albus doce(BLAD)		i	E	x	E	x	1d	5
Gatten	U13	x	x	x	6.4 fl. oz.	x	12h	NA
futianil		x	x	x	G-E	x	14d	4
Inspire Super (EW)	3+9	x	16-20 fl. oz.	x	16-20 fl. oz.	x	12h	80 fl. oz.
difenoconazole + cyprodinil		x	E	x	G	x	14d	See label

(continued)

Effectiveness of Pesticides for Control of Grape Diseases – Veraison to Harvest[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Botrytis rot	Downy mildew	Powdery mildew	Ripe rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Intuity (SC)	11	x	6 fl. oz	x	6 fl. oz.	x	12h	18 fl. oz.
mandestrobin		x	G-E	x	s	x	10d	3
Kenja 400SC	7	x	20-22 fl. oz.	x	20-22 fl. oz.	x	12h	66 fl. oz.
isofetamid		x	F	x	F	x	NA	NA
Lifegard WG	UN	x	x	1-4.5 oz.	1-4.5 oz.	x	4h	NA
Bacillus mycoides isolate J		x	x	F	F	x	0d	NA
Luna Experience (SC)	7+3	x	8-8.6 fl. oz.	x	8-8.6 fl. oz.	x	12h/5d7	34 fl. oz
fluopyram + tebuconazole		x	E	x	E	x	14d	NA
Luna Privilege (SC)	7	x	6-6.8 fl. oz.	x	3.2-6.8 fl. oz.	x	12h	13.7 fl. oz.
fluopyram		x	E	x	G	x	7d	2
Luna Sensation (SC)	7+11	x	5-7.6 fl. oz.	7.6 fl. oz.	4-7.6 fl. oz.	x	12h	27.1 fl. oz.
fluopyram + trifloxystrobin		x	G-E	s	E	x	14d	6
Merivon (2.09SC)	7+11	x	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	4-5.5 fl. oz.	12h	33 fl. oz
fluxapyroxad + pyraclostrobin		x	s	s	E [r]	G	14d	6
Mettle 125ME	3	x	x	x	3-5 fl. oz.	x	12h/7d[8]	10 oz.
tetraconazole		x	x	x	E [r]	x	14d	Varies
Microthiol Disperss	M	x	x	x	3-10 lb.	x	12h	NA
sulfur		x	x	x	E	x	0d	NA
Miravis Prime	7+12	x	10.3-13.4 fl. oz.	x	9.2-13.4 fl. oz.	x	12h	36.5 fl. oz.
pydiflumetofen+fludioxonil		x	G-E	x	G-E	x	14d	2
OSO 5%	19	x	3.75-13 fl. oz.	x	3.75-13 fl. oz.	x	4h	78 fl. oz.
polyoxin D		x	G	x	G	x	0d	6
Pristine	11+7	8-12.5 oz.	8-12.5 oz.	8-12.5 oz.	8-12.5 oz.	8-12.5 oz.	12h/5d[7]	69 oz.
pyraclostrobin + boscalid		u	G	E [r]	E	i	14d	Varies
Procure 480 SC	3	x	4-8 oz.	x	4-8 oz.	x	24h	32 fl. oz.
triflumizole		x	s	x	E [r]	x	7d	4
ProPhyt	33	x	x	2-4 pt.	x	x	4h	NA
phosphorous acid		x	x	G-E	x	x	0d	NA
Quadris Top (SC)	11+3	x	12-14 fl. oz.	12-14 fl. oz.	12-14 fl. oz.	x	12h	56 fl. oz.
azoxystrobin & difenoconazole		x	s	F	E	x	14d	NA
Quintec (2.08F)	13	x	x	x	4-6.6 fl. oz.	x	12h	33 fl. oz.
quinoxyfen		x	x	x	E	x	21d	5
Rally 40WSP	3	x	x	x	3-5 oz.	x	24h	1.5 lb.
myclobutanil		x	x	x	E [r]	x	14d	NA
Revus (S)	40	x	x	8 fl. oz.	x	x	4h	32 fl. oz.
mandipropamid		x	x	E	x	x	14d	NA
Revus Top (SC)	3 + 40	x	x	7 fl. oz.	7 fl. oz.	x	12h	28 fl. oz.
difenoconazole + mandipropamid		x	x	E	E	x	14d	NA

(continued)

Effectiveness of Pesticides for Control of Grape Diseases – Veraison to Harvest[1] *(continued)*

Product and formulation Active ingredient	FRAC[2]	Bitter rot	Botrytis rot	Downy mildew	Powdery mildew	Ripe rot	REI[4] PHI[3]	Max amt[5] Max app[6]
Rovral 4 F	2	x	1-2 pt.	x	x	x	48h	2 or 8 pt.
iprodione		x	G	x	x	x	7d	1 or 4
Scala (SC)	9	x	18 fl. oz.	x	x	x	12h	36 fl. oz.
pyrimethanil		x	G	x	x	x	7d	NA
Sovran (50WG)	11	x	3.2-6.4 fl. oz.	4-6.4 fl. oz.	3.2-4.8 fl. oz.	x	12h	25.6 oz.
kresoxim-methyl		x	s	G [r]	E [r]	x	14d	4
Sulforix	M	x	x	x	See label	x	48h	NA
calcium polysulfide		x	x	x	i	x	NA	8
Switch (62.5WG)	9 + 12	x	11-14 oz	x	x	x	12h	56 oz.
cyprodinil + fludioxonil		x	G	x	x	x	7d	See label
Tebustar 45 WSP	3	x	x	x	4 oz.	x	12h	2 lb.
tebuconazole		x	x	x	E [r]	x	0d	NA
Topguard EQ	3+11	x	8 fl. oz.	8 fl. oz.	5-6 fl. oz.	x	12h	34 fl. oz.
azoxystrobin+flutriafol		x	s	u	E	x	14d	6
Topsin-M WSB	1	0.75-1.5 lb.	1-1.5 lb.	x	0.75-1.5 lb.	x	48h	6 lb.
thiophanate methyl		G	G [r]	x	E	x	7d	NA
Torino (SC)	U6	x	x	x	3.4 oz.	x	4h	6.8 oz.
cyflufenamid		x	x	x	E	x	3d	1 or 2
Vangard WG (75WG)	9	x	10 oz.	x	See label	x	12h	30 oz.
cyprodinil		x	G-E	x	s	x	7d	See label
Vivando (2.5F)	U8	x	x	x	10.3-15.4 fl. oz.	x	12h	42.6 fl. oz.
metrafenone		x	x	x	E	x	14d	3
Zampro	45 + 40	x	x	11-14 fl. oz.	x	x	12h	56 fl. oz.
ametoctradin + dimethomorph		x	x	E	x	x	14d	NA
Ziram 76DF	M	x	x	3-4 lb.	x	3-4 lb.	48h	28 lb.
ziram		x	s	G	x	F	21d	NA

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Grape Veraison to Harvest – Insects

Notes on insect pest management

- Continue to monitor for insect and mite pests and apply insecticide as needed. Refer to product labels for specific insects, rates, and harvest restrictions.
- **Multicolored Asian lady beetle:** Scout vineyards several days before harvest to determine the abundance of multicolored Asian lady beetle. Additional insecticides (including Baythroid and Mustang Maxx) have short pre-harvest intervals, and although not labeled specifically for this pest, have been effective in trials and vineyard use. See Multicolored Asian Lady Beetle section on page 141.
- **RESIDUE REMINDER:** Wettable powder formulations may leave visible residues on fruit at harvest.
- Pay close attention to the PHI on products.

Effectiveness of Insecticides for Control of Grape Insects – Veraison to Harvest [1]

Product and formulation Active ingredient	IRAC[2]	Grape berry moth	Green June beetle	Japanese beetle	Multi-colored Asian lady beetle	Spotted-wing Drosophila	Stink bugs	REI[4] PHI[5]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	x	1.5-3.5 oz.	x	x	4 oz.	12h	7 oz.
thiamethoxam		x	x	G	x	x	G	5d	NA
Altacor (35WDG)	28	2-4.5 oz.	x	x	x	x	x	4h	9 oz.
chlorantraniliprole		E	x	x	x	x	x	14d	4
Assail 30SG	4A	2.5-5.3 oz.	x	2.5-5.3 oz.	x	x	x	12h	10.6 oz.
acetamiprid		u	x	G	x	x	x	3d	2
Avaunt (30WDG)	22	5-6 oz.	x	3.5-6 oz.	x	x	x	12h	12 oz.
indoxacarb		G	x	G	x	x	x	7d	2
Baythroid XL (1EC) **(RUP)**	3A	2.4-3.2 fl. oz.	x	x	x	2.4-3.2 fl. oz.	x	12h	12.8 fl. oz.
beta-cyfluthrin		E	x	x	x	E	x	3d	NA
BeetleGone!	11A	x	x	1-17.5 lb.	x	x	x	4h	NA
B.t. galleriae		x	x	G	x	x	x	0d	NA
Belay (2.13SC)	4A	6 fl. oz.	x	2-4 fl. oz.	2-4 fl. oz.	x	x	12h	12 fl. oz.
clothianidin		F	x	F	E	x	x	0d or 30d	NA
Brigade 2EC **(RUP)**	3A	3.2-6.4 fl. oz.	x	3.2-6.4 fl. oz.	x	x	6.4 fl. oz.	12h	6.4 fl. oz.
bifenthrin		G	x	G	x	x	G	30d	NA
Danitol 2.4EC **(RUP)**	3A	10.7-21.3 fl. oz.	x	10.7-21.3 fl. oz.	x	10.7-21.3 fl. oz.	10.7-21.3 fl. oz.	24h	42.7 fl. oz.
fenpropathrin		E	x	E	x	E	u	21d	NA
Delegate WG (25WG)	5	3-5 oz.	x	x	x	3-5 oz.	x	4h	19.5 oz.
spinetoram		E	x	x	x	E	x	7d	5
Entrust SC (2SC)	5	4-8 fl. oz.	x	x	x	4-8 fl. oz.	x	4h	23 fl. oz.
spinosad		G	x	x	x	G	x	7d	5
Imidan 70W	1B	1.3-2.1 lb.	x	1.3-2.1 lb.	x	1.3-2.1 lb.	x	14d	4.55 lb.
phosmet		G	x	G	x	G	x	7 or 14d	NA
Intrepid 2F	18	8-16 fl. oz.	x	x	x	x	x	4h	48 fl. oz.
methoxyfenozide		E	x	x	x	x	x	30d	NA
Malathion 5EC	1B	x	x	3 pt.	x	3 pt.	x	See label	3.8 pt.
malathion		x	x	G	x	G	x	3d	2
Mustang Maxx (0.83EC) **(RUP)**	3A	4 fl. oz.	x	4 fl. oz.	2-4 fl. oz.	4 fl. oz.	x	12h	24 fl. oz.
zeta-cypermethrin		E	x	E	G	E	x	1d	NA
Pyganic 5% EC	3A	x	x	4.5-15.61 fl. oz.	x	4.5-15.61 fl. oz.	x	12h	15.6 fl. oz.
pyrethrins		x	x	F	x	F	x	0d	10
Sevin XLR Plus	1A	2 qt.	2 qt.	1-2 qt.	x	x	x	See label	10 qt.
carbaryl		G	E	E	x	x	x	7d	5
Surround WP (95WP)	UN	x	25-50 lb.	25-50 lb.	x	x	x	4h	NA
kaolin		x	u	F	x	x	x	0d	NA

(continued)

Effectiveness of Insecticides for Control of Grape Insects – Veraison to Harvest[1] *(continued)*

Product and formulation Active ingredient	IRAC[2]	Grape berry moth	Green June beetle	Japanese beetle	Multi-colored Asian lady beetle	Spotted-wing Drosophila	Stink bugs	REI[4] PHI[5]	Max amt[5] Max app[6]
Venom (70SG)	4A	1-3 oz.	x	x	1-3 oz.	x	x	12h	12 oz.
dinotefuran		F	x	x	G	x	x	See label	NA
Verdepryn 100SL (0.83SL)	28	8.2-11 fl. oz.	x	8.2-11 fl. oz.	x	8.2-11 fl. oz.	x	4h	27 fl. oz.
cyclaniliprole		E	x	u	x	E	x	7d	3

E = excellent control **G** = good control **F** = fair control **[r]** = fungicide/insecticide resistance possible **s** = suppression only **i** = ineffective **u** = unknown efficacy **x** = pest not on the label

Grape Post Harvest – Diseases

Downy mildew, powdery mildew: In some years, these diseases may cause defoliation well before the onset of cool weather in the fall. Post-harvest early defoliation predisposes the vines to winter injury and reduces productivity for the following season. It is important to maintain at least some protection against foliar infections by these fungi. Post-harvest rates for fungicides should be the same as pre-harvest rates. Check labels for season limits on quantity of products.

Special Comments on Grape Schedule

Disease Management

Anthracnose

Early-season applications are important to keep anthracnose from spreading to new tissues. As leaves and canes mature (fully expanded), they become resistant to infection; however, new leaves and succulent cane tips are susceptible throughout the season, and berries remain susceptible until veraison.

Foliar fungicides probably do not provide satisfactory anthracnose control unless you use them in conjunction with a delayed-dormant Sulforix application.

Grape Bitter Rot

Unlike black rot, which does not infect berries late in the season, bitter rot attacks only mature berries. Both diseases result in black, shriveled (mummified) fruit, and some growers have mistaken bitter rot for black rot. A rule of thumb is that if a rot develops on mature berries (8 percent or greater sugar), it more likely to be bitter rot than black rot.

If bitter rot is a problem, pre-harvest applications of captan may be beneficial. Observe all pre-harvest restrictions.

Grape Ripe Rot

Ripe rot attacks mature berries, resulting in shriveled berries with a vinegar odor or bitter taste. Infected berries become covered in blister-like lesions (acervuli) covered in salmon-colored spore masses. Minnesota varieties Frontenac and Marquette are extremely susceptible to ripe rot.

The systemic FRAC 11 fungicides (Abound, Sovran, Flint, and products that contain a FRAC 11 fungicide such as Pristine, Merivon, Luna Sensation and Quadris Top) are effective against ripe rot. Captan may also be effective. Observe all pre-harvest restrictions.

Botrytis Bunch Rot

Botrytis bunch rot is most commonly a problem on tight-clustered French hybrid and Vitis vinifera cultivars. Infections can occur near bloom, but the disease does not appear until veraison or during harvest. Proper timing and thorough spray coverage are essential for good control.

Note: Growers in Europe and Canada have reported fungicide resistance due to overuse of Rovral over three to five years. Vangard and Elevate are also at risk for fungicide resistance development. We therefore recommend limiting Rovral, Elevate, and Vangard applications to three per year to reduce the probability of developing strains of Botrytis resistant to these materials. In addition, consider alternating applications of Rovral, Elevate, and Vangard during the growing season. Note: Removing leaves around clusters on mid- or low- wire cordon-trained vines before bunch closing has been shown to reduce Botrytis-caused losses.

Grape Sour Rot

Sour rot occurs late in the season near harvest on berries damaged from bird pecks, rain cracking, and insects. The most obvious sour rot symptom is a pre-harvest decay accompanied by a vinegar smell; that is, acetic acid, or what winemakers call volatile

acidity. The berries usually turn a tan color, soften, and eventually break down and disintegrate. The decayed berries seldom have any noticeable fungal growth or fruiting bodies on the surface like you would see with Phomopsis, Botrytis, or black rot.

A combination of yeasts and bacteria in a step-wise process cause sour rot. Yeasts convert the fruit sugar to ethanol, and then the bacteria convert the ethanol to acetic acid. The yeasts involved include the good Saccharomyces types as well as various wild types.

The bacteria are mostly species of Acetobacter and Gluconobacter.

Both yeasts and bacteria require some type of physical injury or wound to infect the berries, so bird pecks, rain cracking, compression in tight clusters, and so on are all involved in the process. While filamentous fungi (such as Botrytis) may be associated with the rotting berries, they don't appear to be the cause. Thus, traditional fungicides do not control sour rot.

Evidence shows that sour rot does not become a problem until berries reach about 15 Brix. Temperature dramatically affects the rate of development — rot develops most rapidly at high temperatures. Fruit flies of the genus Drosophila also have been shown to be a key component of the disease cycle. They somehow facilitate the conversion of ethanol to acetic acid by bacteria.

Growers can minimize the risk of sour rot by minimizing berry injury from birds, insects, and other sources. Another strategy is to provide an open canopy microclimate that is not conducive to disease development. Thinning and positioning shoots, removing leaves, managing nutrients, and using a training system can all play a role.

The most effective sour rot control is to minimize the populations of yeasts, bacteria, and fruit flies.

Research in New York has shown best results came from applying both an insecticide to control fruit flies and an antimicrobial to reduce the pathogen population starting at 15 Brix. Oxidate (hydrogen dioxide and peroxyetic acid) and Fracture [a naturally occurring seed protein from lupines, Banda de Lupinus albus doce (BLAD)] are effective antimicrobials. Both are labeled for grapes and have short PHIs: 0 days and 1 day, respectively. Mustang Maxx, Delegate, and malathion are effective insecticides against fruit flies and also have relatively short PHIs (1, 7, and 3 days, respectively).

Fungicide Resistance Management

A spray program should be thoughtfully developed to prevent and slow the evolution of fungicide-resistant pathogens in the berry patch. Fungicides that have a site-specific mode of action are classified as medium to high risk for fungicide resistance development.

Fungicides with Fungicide Resistance Action Committee (FRAC) codes or numbers 1, 2, 3, 4, 7, 9, 11, and 49, are medium to high-risk fungicides. No more than two sequential applications of a high-risk fungicide should be applied before alternating to a fungicide with a different mode of action. Do not overuse fungicides — high-risk fungicides have restrictions on how often they can be applied — and apply only at the recommended manufacturer rates. It is unlawful to apply fungicides in a manner inconsistent with the product label.

Copper Fungicides for Grape Disease Control

When different formulations of copper are dissolved in water, copper ions are released into solution. These copper ions are toxic to fungi and bacteria because of their ability to destroy proteins. However, using copper fungicides carries the risk of injuring foliage and fruit of most crops.

Factors promoting copper injury include:

1. The amount of actual copper applied
2. Cold, wet weather (slow drying conditions) that apparently increases the availability of copper ions and, thus, increases the risk of plant injury.

Because of the potential to injure pants and to accumulate in soil, copper fungicides in conventional production systems has largely been replaced with conventional fungicides that are generally safer to plant tissues and often more effective.

Several terms are used when discussing copper as a fungicide. The original material used was called copper sulfate (also known as blue vitriol or bluestone). When this material was combined with lime in the French vineyards, the combination became known as Bordeaux mixture.

Bordeaux Mixture

Bordeaux mixture is a mixture of copper sulfate and hydrated lime in water. It has long residual action and has been used for years to control many diseases, including downy mildew and powdery mildew of grape. It can be mixed on-site. It is also available as a dry wettable powder.

Fixed Copper Fungicides

Fixed copper formulations release copper ions more slowly and generally injure plant tissues less (safer to use) than Bordeaux mixture. But fixed copper use is still limited because of their potential to injure plants and lack of compatibility with other pesticides.

Some of the more common commercial formulations of fixed copper include:

Basic copper sulfate: Griffin Basicop, Basic Copper "53," Micro Flo Cuproxat, Tennessee Brand Tri-Basic Copper Sulfate, Tenn-Cop 5E, and Cuprofix Ultra 40DF.

Copper (Cupric) hydroxide: Agtrol Champion WP, Agtrol Champ flowable, Agtrol Champ 2F, Kocide 101, Kocide 3000DF, Kocide 2000D, Microflo BlueShield WP, and Microflo BlueShield DF.

Recommendations for Copper Fungicide Use on Grapes

Copper fungicides are highly effective against downy mildew and are moderately effective against powdery mildew. Copper fungicides are weak for controlling black rot, Botrytis bunch rot and Phomopsis blight.

To reduce the risk of phytotoxicity when using copper:

1. Do not make a complete season-long spray program with only copper fungicides.
2. Use fungicides other than copper whenever possible.
3. Delay copper use as late into the growing season as possible.
4. Avoid the use of copper sulfate alone. Always use a "fixed" copper formulation.
5. Use the full recommended rate of lime. Never eliminate lime use completely, unless the pesticide label indicates such.
6. Remember that cool, wet weather enhances the risk of copper injury. Be especially certain to use adequate lime levels during such periods or switch to other fungicides.
7. Some products are incompatible with copper. Do not mix copper products with anything that will acidify the spray mixture (such as phosphorus acid fungicides).
8. Avoid copper and lime sprays on fruit destined for fresh market.

Note on Insecticide Resistance Management

Insects have been known to develop resistance to insecticides after repeated exposure. For insecticide resistance management, avoid successive applications of insecticides in the same group or type of chemistry. The Insecticide Resistance Action Committee codes (IRAC codes) listed in each management section identify the various insecticide mode of action group. Rotating to insecticides with a different IRAC code should help avoid development of insecticide resistance.

Insect Management

Spotted-Wing Drosophila

Spotted-wing Drosophila (SWD) is a serious invasive pest that attacks small fruit crops, some stone fruits (cherry, nectarine, peach), high tunnel tomatoes, and wild hosts (including pokeweed, autumn olive, crabapple, nightshade, Amur honeysuckle, and wild grape).

SWD is different than other fruit flies; the female has a stout, toothed ovipositor (egg layer) that enables her to lay eggs under the skin of ripening fruits that are otherwise healthy and sound. Soft-skinned fruit generally become vulnerable to attack as they begin to soften and turn color during ripening, usually in the final 7 to 10 days before harvest. The larvae tunnel and feed under the skin of the fruit and can reach 4 millimeters long. There is often a sunken area at the site where the eggs are laid, and damaged fruit may appear to collapse from the internal damage and rots.

SWD is able to complete its life cycle in just more than a week when temperatures are optimal, and there may be 10 or more generations per year. Growers need to monitor plantings for SWD in the final weeks before harvest. Traps for monitoring and detecting SWD are available. More information about SWD is available from Michigan State University Integrated Pest Management: www.ipm.msu.edu/swd.htm.

Look for additional state labels that may allow for changes to rates and allowable number of applications of various insecticides. When applying insecticides during the harvest period, carefully watch the pre-harvest intervals for the products you choose to apply.

Multicolored Asian Lady Beetle

The multicolored Asian lady beetle (MALB), a late-season vineyard inhabitant, can significantly reduce wine quality. These beetles are attracted to ripening grapes as a source of sugars in late summer and fall. They may congregate, often by the hundreds or thousands, in and among grape clusters from August through October.

Although they may cause direct yield loss, they more often reduce wine quality when sufficient numbers become trapped in the harvested grapes and are crushed along with them at the winery. When stressed, MALB secretes a defense chemical that causes wine to smell "dirty," (a musty, damp odor), masking the flavors and smells of the grapes.

As few as two MALB per lug of grapes can alter wine flavor and bouquet enough to be detected. Excessive numbers of MALB in grape clusters are most common

in late-ripening varieties such as Cabernet Franc, Cabernet Sauvignon, Chambourcin, Riesling, Vidal, and Vignoles, but earlier grapes that are prone to cracking can also be infested.

Scout vineyards several days before harvest to determine the abundance of MALB. Belay 2.13SC, Venom 70SG, and Scorpion 35S are labeled specifically for control of this insect in grapes. Additional insecticides (including Baythroid and Mustang Maxx) have short pre-harvest intervals and, although not labeled specifically against MALB, have been effective in trials and vineyard use.

Grape Root Borer

Evaluating grape root borer damage is generally difficult. Injury is most often associated with a slow decline of vineyards, when it can be associated at all.

If grape root borer is not a problem, there is no reason to risk destroying the natural control processes (predators, parasites, diseases). A pheromone lure is available that effectively attracts grape root borer males. Set out traps in early June. We advise treatment if you detect moths.

If you believe this insect is affecting your vineyard's performance, you may wish to begin the program described below. Sampling is critical for several reasons, including:

1. The control program is relatively expensive.
2. Using insecticide can create problems, as well as solve them.

Immediately After Harvest

Sample 10 vines/acre (but not less than 50 vines). Older vines are more likely to be infested.

Examine a circular site (3 feet in diameter) around the base of each plant, concentrating on the inner 1 foot.

Look for shed pupal skins of the grape root borer moth. If you find pupal skins beneath 5 percent of the vines examined, apply an insecticide next year.

35 Days Before Harvest the Next Season

If the previous year's sample indicates a need to spray, apply Lorsban Advanced, Lorsban 4E, or Lorsban 75WG. Label directions are to use a rate of 4.5 pints of

Advanced or 4E or 3 pounds of 75WG per 100 gallons of water. Apply 2 quarts of this diluted spray mix to the soil surface on a 15-square-foot area (4.4-foot circle) around the base of each vine. Do not allow the spray to contact fruit or foliage. The pre-harvest restriction is 35 days.

Only one chlorpyrifos (i.e. Lorsban) application is allowed per year. Do not use for grape root borer control if you already used Lorsban pre-bloom for cutworm control.

Spotted Lanternfly

The spotted lanternfly is an invasive planthopper that was first detected in Pennsylvania in 2014 and has since spread to six states, most recently Ohio in 2020. It is projected to invade throughout the Midwest. This insect feeds on plant sap causing wilting, dieback, and even death.

Currently, spotted lanternfly is believed to pose the greatest threat to the blueberry, grape, hops, stone fruit, and hardwood industries. Know how to identify this pest and remain vigilant for its appearance in your vineyard and orchard systems.

Wasps in Fruit Plantings

Almost anywhere fruit is produced, wasps can become a nuisance or, in some cases, a severe pest to field workers. Unfortunately, little help is available for controlling wasps.

Wasps are generally attracted to the juice and soft fruit. Sanitation is key to preventing or at least reducing problems with wasps. Pick all ripe fruit and fruit debris regularly and thoroughly. Also remove any item that has food value (e.g., soft drinks, lunches, etc.) that pickers may bring in.

Relative Disease Susceptibility and Chemical Sensitivity Among Grape Cultivars

The relative ratings in this chart apply to an average growing season under conditions usually favorable for disease development. Any given cultivar may be more or less severely affected depending on conditions.

Cultivar	Susceptible or Sensitive to[1]											
	black rot	downy mildew	powdery mildew	Botrytis	Phomopsis	Eutypa	crown gall	anthracnose	sulfur[2]	copper[3]	2,4-D[4]	dicamba[4]
Arandell	+	+	+	+	++	?	?	+	?	?	++	?
Aromella	+	+++	+	+	++	?	?	+	?	?	+++	+++
Aurore	+++	++	++	+++	+	+++	++	+	No	++	?	?
Baco Noir	+++	+	++	++	+	++	+++	+	No	?	?	?
Brianna	?	+	?	+	?	?	?	?	Yes	+++	++	+
Cabernet Franc	+++	+++	+++	+	?	?	+++	++	No	?	+	+++
Cabernet Sauvignon	+++	+++	+++	+	+++	+++	+++	?	No	+	+	?
Catawba	+++	+++	++	+	+++	+	+	++	No	++	++	++
Cayuga White	+	++	+	+	++	+	++	+++	No	+	+	+++
Chambourcin	+++	+	+++	++	+	?	++	+	Yes	?	+++	++
Chancellor	+	+++	+++	+	+++	+	+++	++	Yes	+++	++	?
Chardonel	++	++	++	++	+++	++	++	+	No	?	++	+++
Chardonnay	++	+++	+++	+++	+++	++	+++	+++	No	+	++	+++
Concord	+++	+	++	+	+++	+++	+	+	Yes	+	+++	++
Corot noir	+	+++	+	+	++	+	+	+	No	?	++	+++
Cynthiana/Norton	+	++	+	+	+	?	+	+	Yes	?	+++	+++
DeChaunac	+	++	++	+	+++	+++	++	++	Yes	+	+	++
Delaware	++	+++[5]	++	+	+++	+	+	++	No	+	+++	?
Edelweiss	?	?	?	?	?	?	?	?	?	?	++	?
Faith	+	+	+	+	+	+	+	+	?	?	+	?
Foch	++	+	++	+	+	+++	+	++	Yes	++	+++	+++
Fredonia	++	+++	++	+	+++	?	+	+++	No	?	++	++
Frontenac	+++	+	++	++	+	?	?	+++	No	++	+	+++
Frontenac Gris	++	+	++	++	+	?	?	++	No	++	+	+
Geneva Red	+	++	++	++	+	+	+	+	No	?	+	+++
Gewürztraminer	+++	+++	+++	+++	?	?	+++	+++	No	+	?	?
Gratitude	+	+	+	+	+	+	+++	+	?	?	+	?
Hope	+	+	+	+	+	+	+	+	?	?	+	?
Joy	+	+	+	+	+	+	+	+	?	?	+	?
Jupiter	++	+++	+++	+	+	?	?	+	?	?	+	++
LaCrescent	++	+++	++	+	+++	+	+	+	No	?	+++	+++
LaCrosse	+++	++	++	+++	++	?	?	+	No	++	+++	+++
Lemberger	+++	+++	+++	+	?	+++	+++	?	No	?	++	?
Leon Millot	+	++	+++	+	+	+	?	+	Yes	++	+	?
Marquette	++	+	+	+++	+++	?	+	+++	No	++	+++	+
Marquis	+	+++	+	+	+++	?	?	+++	?	?	+	?
Mars	+	+	+	+	+	?	+	++	?	?	+	+
Merlot	++	+++	+++	++	+	+++	+++	++	No	++	?	?
Moore's Diamond	+++	+	+++	++	?	++	?	?	No	?	?	?

(continued)

Relative Disease Susceptibility and Chemical Sensitivity Among Grape Cultivars *(continued)*

Cultivar	Susceptible or Sensitive to[1]											
	black rot	downy mildew	powdery mildew	Botrytis	Phomopsis	Eutypa	crown gall	anthracnose	sulfur[2]	copper[3]	2,4-D[4]	dicamba[4]
Niagara	+++	+++	++	+	+++	+	++	++	No	+	+++	++
Noiret	+++	++	++	+	+	?	++	+	No	?	++	+++
Petite Pearl	+++	+	+	+	+	?	+	+	?	?	+	?
Pinot gris	+++	+++	+++	++	?	+++	+++	?	No	?	?	?
Pinot noir	+++	+++	+++	+++	?	?	+++	?	No	+	?	?
Reliance	+++	+++	++	+	++	?	?	+++	No	+	+	?
Riesling	+++	+++	+++	+++	++	++	+++	?	No	+	+	++
St. Croix	?	++	++	++	+++	?	?	+	No	++	++	?
Seyval	++	++	+++	+++	++	+	++	+	No	+	++	+++
Steuben	++	+	+	+	+	?	+	+++	No	?	+	++
Sunbelt	+	++	++	+	+	?	?	+	?	?	+++	++
Thompcord	+	+++	+	+	+	?	+	+	?	?	+	+
Traminette	+	++	+	+	+++	?	++	+	No	?	++	++
Valvin Muscat	++	+	++	+	+	?	+	?	No	?	+++	+
Vanessa	+++	++	++	+	+	?	+	?	?	?	+	?
Vidal blanc	+	++	+++	+	+	+	++	+++	No	?	++	+++
Vignoles	+	++	+++	+++	++	++	++	+++	No	?	+	+++

[1] + = slightly susceptible or sensitive. ++ = moderately susceptible or sensitive. +++ = highly susceptible or sensitive. No = not sensitive. Yes = sensitive. ? = relative susceptibility or sensitivity not established.

[2] Slight to moderate sulfur injury may occur even on tolerant cultivars when temperatures are 85°F or higher during, or immediately following, the application.

[3] Copper applied under cool, slow-drying conditions is likely to cause injury.

[4] Herbicide sensitivity ratings based on observation and simulated drift studies in Indiana.

[5] Berries not susceptible.

Effectiveness of Fungicides for Control of Grape Diseases[1]

Product and formulation Active Ingredient	FRAC Code[2]	Anthracnose fruit rot	Black rot	Botrytis bunch rot	Downy mildew	Phomopsis blight	Powdery mildew	Bitter rot	Ripe rot	PHI[3] REI[4]	Max amt[5] Max app[6]
Abound (SC)	11	x	E	s	E [r]	F	E [r]	x	x	14d	90 fl. oz.
azoxystrobin										4h	varies
Aliette WDG	33	x	x	x	E	x	x	x	x	15d	NA
fosetyl-AL										12h	3
Aprovia (EC)	7	i	G-E	x	x	i	G-E	x	x	21d	31.5 fl. oz.
benzovindiflupyr										12h	3
Captan 80 WDG	M	G	F	F	G	E	i	G	G	0d	12 lb.
captan										48h	NA
Cevya	3	x	E	x	x	G	G-E	x	x	14d	8 fl. oz.
mefentrifluconazole										12h	2
Cuprofix Ultra 40D	M	x	F	x	F	F	F-i	x	x	0d	NA
copper sulfate										12h	NA
Elevate 50 WDG	17	x	x	E	x	x	s	x	x	0d	3 lb.
fenhexamid										12h	3
Endura (70WG)	7	x	x	G	x	x	E	x	x	14d	24 oz.
boscalid										12h	varies
Fervent 475SC	3+7	x	x	s	x	x	E	x	x	14d	25.5 fl. oz.
isofetamid+tebuconazole										12h	NA
Flint Extra	11	x	E	G	s	F	E	x	x	14d	23 fl oz.
trifloxystrobin										12h	6
Forum	40	x	x	x	E	x	x	x	x	14d	24 oz.
dimethomorph										12h	4
Fracture	M	x	x	E	x	x	E	x	x	1d	NA
Banda de Lupinus albus doce (BLAD)										4h	5
Gatten	U13	x	x	x	x	x	G-E	x	x	14d	0.84 lb.
futianil										12h	4
Inspire Super (EW)	3+9	E	E	E	x	x	G	x	x	14d	80 fl. oz.
difenoconazole + cyprinil										12h	NA
Intuity (SC)	11	x	x	G-E	x	x	s	x	x	10d	18 fl. oz.
mandestrobin										12h	3
Kenja 400SC	7	G	x	F	x	x	F	x	x	14d	66 fl. oz.
isofetamid										12h	NA
Lifegard WG		x	x	x	F	x	F	x	x	0d	NA
Bacillus mycoides isolate J										4h	NA
Luna Experience (SC)	7+3	x	G	E	x	s	E	x	x	14d	34 fl. oz
fluopyram + tebuconazole										12h/5d7	NA
Luna Privilege (SC)	7	x	G	E	x	x	G	x	x	7d	13.7 fl oz.
fluopyram										12h	2

(continued)

Effectiveness of Fungicides for Control of Grape Diseases[1] *(continued)*

Product and formulation Active Ingredient	FRAC Code[2]	Anthracnose fruit rot	Black rot	Botrytis bunch rot	Downy mildew	Phomopsis blight	Powdery mildew	Bitter rot	Ripe rot	PHI[3] REI[4]	Max amt[5] Max app[6]
Luna Sensation (SC)	7+11	x	G	G-E	s	F-G	E	x	x	14d	27.1 fl. oz.
fluopyram + trifloxystrobin										12h	6
Merivon (2.09SC)	7+11	E	G-E	s	s	G-E	E [r]	x	G	14d	33 fl. oz
fluxapyroxad + pyraclostrobin										12h	6
Mettle 125ME	3	E	E	x	x	x	E [r]	x	x	14d	10 oz.
tetraconazole										12h/7d8	Varies
Microthiol Disperss	M	x	x	x	x	F	E	x	x	0d	NA
sulfur										24h	NA
Miravis Prime	7+12	u	E	G-E	x	F-G	G-E	x	x	14d	36.5 fl. oz.
pydiflumetofen+fludioxonil										12h	2
OSO 5% SC	19	x	x	G	x	x	G	x	x	0d	4.2 oz.
polyoxin D										4h	6
Pristine	11+7	E	E	G	E [r]	F	E	u	i	14d	69 oz.
pyraclostrobin + boscalid										12h/5d7	varies
Procure 480SC	3	x	x	s	x	x	E [r]	x	x	7d	32 fl. oz.
triflumizole										24h	4
Prophyt	33	x	x	x	G-E	G-E	x	x	x	0d	NA
phosphorous acid										4h	NA
Quadris Top (SC)	3+11	E	E	s	F	F	E	x	x	14d	56 fl. oz.
difenoconazole + azoxystrobin										12h	NA
Quintec (2.08F)	13	x	x	x	x	x	E	x	x	21d	33 fl. oz.
quinoxyfen										12h	5
Rally 40WSP	3	E	E	x	x	x	E[r]	x	x	14d	1.5 lb.
myclobutanil										24h	NA
Ranman 400SC	21	x	x	x	E	x	x	x	x	30d	16.5 fl. oz.
cyazofamid										12h	6
Reason 500SC	11	x	x	x	G[r]	x	x	x	x	30d	8.1 fl. oz.
fenamidone										12h	NA
Revus	40	x	x	x	E	x	x	x	x	14d	32 fl. oz.
mandipropamid										4h	NA
Revus Top	3+40	E	E	x	E	E	E	x	x	14d	28 fl. oz.
difenoconazole + mandipropamid										12h	NA
Ridomil Gold Copper	4+M	x	x	x	E	x	x	x	x	42d	8 lb.
mefenoxam + copper										48h	4
Ridomil Gold MZ WG	4+M	x	x	x	E	x	x	x	x	66d	10 lb.
mefenoxam + mancozeb										48h	4
Roper DF Rainshield	M	x	E	i	E	E	x	x	x	66d	24 lb.
mancozeb										24h	6

(continued)

Effectiveness of Fungicides for Control of Grape Diseases[1] *(continued)*

Product and formulation Active Ingredient	FRAC Code[2]	Anthracnose fruit rot	Black rot	Botrytis bunch rot	Downy mildew	Phomopsis blight	Powdery mildew	Bitter rot	Ripe rot	PHI[3] REI[4]	Max amt[5] Max app[6]
Rovral 4 F	2	x	x	G	x	x	x	x	x	7d	2 or 8 pts
iprodione										48h	1 or 4
Scala SC	9	x	x	G	x	x	x	x	x	7d	36 fl. oz.
pyrimethanil										12h	NA
Sovran (50WG)	11	x	E	s	F [r]	F	E [r]	x	x	14d	25.6 oz.
kresoxim-methyl										12h	4
Sulfurix	M	x	x	x	x	G-E	i	x	x	NA	NA
calcium polysulfide										48h	8
Switch 62.5 WG	9+12	x	x	G	x	x	x	x	x	7d	56 oz.
cyprodinil + fludioxonil										12h	NA
Tanos	11+27	x	x	x	G [r]	x	x	x	x	30d	72 oz.
famoxadone + cymoxanil										12h	9
Tebustar 45WSP	3	x	E	x	x	x	E [r]	x	x	0d	2 lb.
tebuconazole										12h	NA
Topguard EQ	3+11	x	u	s	u	u	E	x	x	14d	34 fl. oz.
azoxystrobin + flutriafol										12h	6
Topsin M WSB	1	x	F	G[r]	x	G	E	G	x	7d	6 lb.
thiophanate										2d	NA
Torino (SC)	U6	x	x	x	x	x	E	x	x	3d	6.8 oz.
cyflufenamid										4h	1 or 2
Vangard WG	9	x	x	G-E	x	x	s	x	x	7d	30 oz.
cyprodinil										12h	NA
Vivando 2.5F	U8	x	x	x	x	x	E	x	x	14d	42.6 fl. oz.
metrafenone										12h	3
Zampro	45+40	x	x	x	E	x	x	x	x	14d	56 fl. oz.
ametoctradin + dimethomorph										12h	NA
Ziram 76DF	M	x	E	s	G	G	x	x	F	21d	28 lb.
ziram										48h	NA

[1]Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2]FRAC code represents the mode of action of the fungicide.

[3]PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.

Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5]Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6]Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[7] The REI is 5 days for treated wine grapes when conducting cane tying, turning, or girdling on wine grape. The REI is 12 hours for all other activities in wine grapes.

[8] The REI is 7 days for treated table grape activities of cane tying, turning, or girdling. The REI is 12 hours for all other activities in wine grapes.

Effectiveness of Insecticides for Control of Grape Insects

		Major Insect Pests									Minor Insect Pests								
Product and formulation Active Ingredient	**IRAC Code[2]**	**Drosophila flies**	**grape berry moth**	**grape flea beetle**	**grape phylloxera**	**grape root borer**	**green june beetle**	**multicolored Asian lady beetle**	**rose chafer**	**Japanese beetle**	**climbing cutworms**	**eight spotted forester**	**grape cane girdler, grape cane gallmaker**	**leafhoppers**	**redbanded leafroller**	**spider mites**	**stink bugs**	**REI[3] PHI[4]**	**Max amt[5] Max app[6]**
Actara (25WDG)	4A	x	x	x	x	x	x	x	x	G	x	x	x	G	x	x	G	12h	7 oz.
thiamethoxam																		5d	NA
Admire Pro (4.6F)	4A	x	x	x	G	x	x	G	x	F	x	x	x	E	x	x	G	12h	2.8-14 fl. oz.
imidacloprid																		0-30d	NA
Agri-Mek SC (0.7SC) (RUP)	6	x	x	x	x	x	x	x	x	x	x	x	x	F	x	G	x	12h	7 fl. oz.
abamectin																		28d	2
Altacor (35WDG)	28	x	E	x	x	x	x	x	x	G	G	x	x	x	x	x	x	4h	9 oz.
chlorantraniliprole																		14d	4
Apollo SC (1SC)	10A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	E	x	12h	NA
clofentezine																		21d	NA
Assail 30SG	4A	x	u	x	G	x	G	x	E	G	x	x	u	E	x	x	x	12h	10.6 oz.
acetamiprid																		3d	2
Avaunt (30WDG)	22	x	G	x	x	x	G	x	x	G	x	x	x	x	x	x	x	12h	12 oz.
indoxacarb																		7d	2
Azera 0.21EC	3A	u	u	u	u	x	u	u	u	u	u	x	u	u	u	u	u	12h	NA
azadirachtin + pyrethrins																		0d	10
Baythroid XL (1EC) **(RUP)**	3A	E	E	G	x	x	x	x	x	x	E	x	G	G	x	x	x	12h	12.8 fl. oz.
cyfluthrin																		3d	NA
BeetleGONE! ag	11	x	x	x	x	x	x	x	x	G	x	x	x	x	x	x	x	4h	NA
B.t. galleriae																		0d	NA
Belay (2.13SC)	4A	x	F	x	G	x	x	E	x	F	x	x	x	E	x	x	x	12h	0.2 lb.
clothianidin																		0-30d	1
Brigade 2EC **(RUP**)	3A	x	G	G	x	x	x	x	x	G	G	x	x	G	x	x	G	12h	6.4 fl. oz.
bifenthrin																		30d	NA
Brigade WSB (10WP) **(RUP)**	3A	x	u	x	x	x	x	x	x	u	u	x	x	u	x	u	G	12h	0.1 lb.
bifenthrin																		30d	NA
B.t. (Agree, Dipel, etc.)	11A	x	u	x	x	x	x	x	x	x	F	x	x	x	u	x	x	NA	NA
Bacillus thuringiensis																		NA	NA
Closer SC (2SC)	4C	x	x	x	x	x	x	x	x	x	x	x	x	E	x	x	u	12h	17 fl. oz.
sulfoxaflor																		7d	4
Danitol 2.4EC **(RUP)**	3A	E	E	E	E	x	x	x	E	E	G	x	u	G	u	G	G	24h	42.7 fl. oz.
fenpropathrin																		21d	NA
Delegate WG (25WG)	5	E	E	x	x	x	x	x	x	x	G	x	x	x	E	x	x	4h	19.5 oz.
spinetoram																		7d	5

(continued)

Effectiveness of Insecticides for Control of Grape Insects *(continued)*

		Major Insect Pests									Minor Insect Pests								
Product and formulation Active Ingredient	**IRAC Code[2]**	**Drosophila flies**	**grape berry moth**	**grape flea beetle**	**grape phylloxera**	**grape root borer**	**green june beetle**	**multicolored Asian lady beetle**	**rose chafer**	**Japanese beetle**	**climbing cutworms**	**eight spotted forester**	**grape cane girdler, grape cane gallmaker**	**leafhoppers**	**redbanded leafroller**	**spider mites**	**stink bugs**	**REI[3] PHI[4]**	**Max amt[5] Max app[6]**
Dibrom 8E **(RUP)**	1B	u	x	x	x	x	x	x	x	x	x	x	x	u	x	x	x	48h	5.6 lb.
naled																		10d	NA
Entrust SC (2SC)	5	G	G	x	x	x	x	x	x	x	G	x	x	x	G	x	x	4h	23-29 fl. oz.
spinosad																		7d	5
Envidor 2SC	23	x	x	x	x	x	x	x	x	x	x	x	x	x	x	E	x	12h	34 fl. oz.
spirodiclofen																		14d	1
Imidan 70W	1B	G	G	F	x	x	G	x	G	G	x	x	u	G	G	x	x	14d	4.55 lb.
phosmet																		7-14d	NA
Intrepid 2F	18	x	E	x	x	x	x	x	x	x	x	x	x	x	G	x	x	4h	48 fl. oz.
methoxyfenozide																		30d	NA
Kanemite 15SC	20B	x	x	x	x	x	x	x	x	x	x	x	x	x	x	F	x	12h	62 fl. oz.
acequinocyl																		7d	2
Lorsban 75WG	1B	x	x	x	x	G	u	x	x	x	E	x	x	x	x	x	u	24h	NA
chlorpyrifos																		35d	1
Lorsban Advanced (4EC) **(RUP)**	1B	x	x	x	x	G	u	x	x	x	E	x	x	x	x	x	u	24h	NA
chlorpyrifos																		35d	1
Magister SC (1.7SC)	21A	x	x	x	x	x	x	x	x	x	x	x	x	u	x	u	x	12h	36 fl. oz.
fenazaquin																		7d	1
Malathion 5EC	1B	G	F	x	u	x	F	x	x	G	x	x	x	G	x	u	x	24-72h	3.75 pt.
malathion																		3d	2
Movento (2SC)	23	x	x	x	E	x	x	x	x	x	x	x	x	x	x	s	x	24h	12.5 fl. oz.
spirotetramat																		7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	E	E	G	x	x	x	G	x	E	E	x	x	E	x	x	x	12h	24 fl. oz.
zeta-cypermethrin																		1d	NA
Nealta (1.67SC)	25	x	x	x	x	x	x	x	x	x	x	x	x	x	x	G	x	12h	27.4 fl. oz.
cyflumetafen																		14d	2
Nexter (75WP), SC (3.75SC)	21A	x	x	x	x	x	x	x	x	x	x	x	x	G	x	G	x	12h	21.3-34 oz.
pyridaben																		7d	2
Onager (1EC)	10A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	E	x	12h	24 oz.
hexythiazox																		7d	1
Platinum (2SC), 75SG	4A	x	x	x	G	x	x	x	x	F	x	x	x	G	x	x	x	12h	17 fl. oz.
thiamethoxam																		60d	NA
Portal XLO (0.4EC)	21	x	x	x	x	x	x	x	x	x	x	x	x	F	x	E	x	12h	2 pts.
fenpyroximate																		14d	2

(continued)

Effectiveness of Insecticides for Control of Grape Insects *(continued)*

		Major Insect Pests									Minor Insect Pests								
Product and formulation Active Ingredient	**IRAC Code[2]**	**Drosophila flies**	**grape berry moth**	**grape flea beetle**	**grape phylloxera**	**grape root borer**	**green june beetle**	**multicolored Asian lady beetle**	**rose chafer**	**Japanese beetle**	**climbing cutworms**	**eight spotted forester**	**grape cane girdler, grape cane gallmaker**	**leafhoppers**	**redbanded leafroller**	**spider mites**	**stink bugs**	**REI[3] PHI[4]**	**Max amt[5] Max app[6]**
PQZ (1.87SC)	9B	x	x	x	x	x	x	x	x	x	x	x	x	G	x	x	x	12h	4.8 fl. oz.
pyrifluquinazon																		3d	2
Pyganic 5%EC	3A	F	F	F	u	x	x	G	x	F	x	x	x	u	u	u	u	12h	15.6 fl. oz.
pyrethrins																		0d	10
Sevin XLR Plus (4F)	1A	F	G	E	x	x	E	E	E	E	E	E	x	G	G	x	x	2d/6d	10 qt.
carbaryl																		7d	5
Sivanto Prime (1.67SC)	4D	x	x	x	x	x	x	x	x	x	x	x	x	G	x	x	x	4-48h	28 fl. oz.
flupyradifonone																		0-30d	NA
Surround WP (95WP)	UN	x	x	x	x	x	u	x	F	F	x	x	x	F	x	x	u	4h	NA
Kaolin																		0	NA
Transform	4C	x	x	x	x	x	x	x	x	x	x	x	x	u	x	x	x	24h	8.5 oz.
sulfoxaflor																		7d	4
Vendex 50WP **(RUP)**	12B	x	x	x	x	x	x	x	x	x	x	x	x	x	x	F	x	48h	4 lb.
fenbutatin-oxide (hexakis)																		28d	2
Venom (70SG)	4A	x	F	x	s	x	x	G	x	x	x	x	x	G	x	x	x	12h	12 oz.
dinotefuran																		1-28d	NA
Verdepryn 100SL (0.83SL)	28	E	E	x	x	x	x	x	x	u	u	x	x	x	u	x	s	4h	27 fl. oz.
cyclaniliprole																		7d	3
Zeal (72WP)	10B	x	x	x	x	x	x	x	x	x	x	x	x	x	x	E	x	12h	3 oz.
etoxazole																		14d	1

[1]Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2]IRAC code represents the mode of action of the insecticide.

[3]PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4]All insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.

Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5]Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6]Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Blueberry Spray Schedule

Entomology Lead: C. Welty
Pathology Lead: J. Beckerman, M. Heller-Haas
Horticulture Lead: J. Strang

Blueberry Delayed Dormant

Apply after buds begin to break.

Pest/Problem	Material	Rate/Acre	Comments
Phomopsis cane and twig blight	lime sulfur solution	See comments.	The lime sulfur label reads: Use 5-6 gal. per 100-150 gal. of spray per acre. Apply at delayed dormant stage after leaf buds begin to break. Do not use within 14 days of an oil spray or when temperature is above 75˚F as burning of foliage may occur.
	Sulforix	1-2 gal.	Dilute in 100 to 150 gallons water. Additional applications can be applied during the growing season at 2 quarts per acre. Refer to label for application rates.
Phytophthora root rot	Aliette WDG	0.5 lb.	
	phosphorous acid	See Phytophthora Root Rot, page 156. The phosphorus acid spray solution must have a pH greater than 5.5 to limit phytotoxicity. Carefully monitor fertility, because phosphorous acid applications can cause nutrient deficiencies.	
	Ridomil Gold SL	Do not exceed 1 soil application per season at 3.6 pt./A. Do not apply more than 0.9 gal/A broadcast in the 12 months before bearing, to avoid illegal residue. Apply one additional application during wet periods that favor root rot development and review label regarding PHI.	

Blueberry Green Tip

Apply when leaf buds are showing 1/16-1/4 inch green tip.

Pest/Problem	Material	Rate/Acre	Comments
mummy berry (shoot blight phase), Phomopsis stem canker and stem blight	Abound	6-15.5 fl. oz.	Not recommended at this time.
	Quilt Xcel	14-21 fl. oz.	Generics include Aframe Plus and Cover XL.
	Captan 80WDG	1.25-3 lb.	Also available as Captec 4L (0.75-1 qt./100 gal.). Do not tank mix captan with diazinon.
	CaptEvate 68WDG	4.7 lb.	For management of mummy berry and anthracnose.
	Indar 2F	6 fl. oz.	A wetting agent is recommended to improve coverage.
	Luna Privilege	4.8-6.8 fl. oz	For mummy berry and botrytis only.
	Luna Sensation	4-7.6 fl. oz.	Not recommended at this time.
	Luna Tranquility	13.6-27 fl. oz.	For mummy berry and botrytis only.
	Miravis Prime	9-13.4 fl. oz.	Recommended for later application.
	Omega 500F	1.25 pt.	For management of Phomopsis twig blight and fruit rot, anthracnose, and Botrytis fruit rot. Do not use adjuvants with this product.

(continued)

Blueberry Green Tip *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
mummy berry (shoot blight phase), Phomopsis stem canker and stem blight (continued)	Pristine	18.5-23 oz.	Do not tank mix with other pesticides except fungicides that contain only captan as the active ingredient. Do not tank mix with adjuvants, liquid fertilizers, nutrients, or other additives. Use only water as a spray carrier. See label.
	Proline 480 SC	5.7 fl. oz.	
	Quadris Top	2-14 fl. oz.	
	Quash	2.5 oz.	
	Switch 62.5WDG	11-14 oz.	
	Tilt	6 fl. oz.	For mummy berry management. Tilt is a propiconazole. Generics include Bumper, Protocol, Topaz and more.

Blueberry Pink Bud Stage and 25% Bloom

Apply when flower petals show pink and again at 25% bloom.

Pest/Problem	Material	Rate/Acre	Comments
mummy berry (shoot blight phase), Phomopsis stem canker and stem blight, anthracnose	Abound	6.2-15.5 fl. oz.	Not recommended at this time.
	Captan 80WDG	1.25-3 lb.	Also available as Captec 4L (0.75-1 qt./100 gal.). Do not tank mix captan with diazinon.
	CaptEvate 68WDG	4.7 lb.	For management of mummy berry and anthracnose.
	Indar 2F	6-8 fl. oz.	A wetting agent is recommended to improve coverage.
	Luna Privilege	4.8-6.8 fl. oz.	For mummy berry and botrytis only.
	Luna Sensation	4-7.6 fl. oz.	Controls Phomopsis and anthracnose.
	Miravis Prime	9-13.4 fl. oz.	Recommended for later application.
	Omega 500F	1.25 pt.	For management of Phomopsis twig blight and fruit rot, anthracnose, and Botrytis fruit rot. Do not use adjuvants with this product.
	Pristine	18.5-23 oz.	Do not tank mix with other pesticides except fungicides that contain only captan as the active ingredient. Do not tank mix with adjuvants, liquid fertilizers, nutrients, or other additives. Use only water as a spray carrier. See label.
	Proline 480	5.7 fl. oz.	
	Quadris Top	12-14 fl. oz.	
	Quash	2.5 oz.	
	Quilt Xcel	14-21 fl. oz.	Use lower rate earlier in the season when pressure is lower. Generics include Aframe Plus and Cover XL.
	Switch 62.5WDG	11-14 oz.	
	Tilt	6 fl. oz.	For mummy berry management. Tilt is a propiconazole. Generics include Bumper, Protocol, Topaz and more.
Botrytis blight only	CaptEvate 68WDG	3.5-4.7 lb.	
	Elevate 50 WDG	1.5 lb.	
	Kenja 400SC	13.5–15.5 fl. oz.	
	Luna Privilege	4.8-6.8 fl. oz.	
	Luna Tranquility	16-27 fl. oz.	Also labeled for powdery mildew.
	OSO 5% SC	3.75-13.0 fl. oz.	
	Pristine	18.5-23 oz.	
	Switch 62.5WG	11-14 oz.	

Blueberry Full Bloom to Early Petal Fall

Apply when all blossoms are open to when some petals begin to fall.

Pest/Problem	Material	Rate/Acre	Comments
mummy berry (blossom infection), Phomopsis stem canker and stem blight, anthracnose	Same as for Blueberry Pink Bud Stage and 25% Bloom, page 152.		
Botrytis blight	Same as for Blueberry Pink Bud Stage and 25% Bloom, page 152.		
cherry fruitworm	Intrepid 2F	10-16 fl. oz.	Cherry fruitworm control by conventional insecticides starts at petal fall, but control by Intrepid must begin earlier. First application is best at 400 degree days (base 50) after biofix (sustained catch of moths in pheromone trap). Second application at 100% petal fall.
	Esteem 0.86EC	16 fl. oz.	Apply when egg laying begins and again at petal fall.

Blueberry Petal Fall

Apply when petals are falling.

Pest/Problem	Material	Rate/Acre	Comments
cherry fruitworm	Control cherry fruitworm at petal fall and 10 days later. Insect pests of blueberry are rare in much of the region. Scout before applying insecticides. Unneeded insecticide applications can create problems where none existed.		
	Altacor 35WDG	3.0-4.5 oz.	
	Asana XL (0.66EC)	4.8-9.6 fl. oz.	
	Assail 30SG	4.5-5.3 oz.	
	Brigade 2EC	2.1-6.4 fl. oz.	
	Danitol 2.4EC	10.67-16 oz.	
	Delegate 25WG	3-6 oz.	
	Diazinon AG600	12.75 fl. oz.	
	Entrust 2SC	4-6 fl. oz.	
	Exirel 0.83SE	10-13.5 fl. oz.	
	Imidan 70W	1.33 lb.	
	Intrepid 2F	10-16 fl. oz.	
	Knack 0.83EC	16 fl. oz.	
	Lannate LV	24-48 fl. oz.	
	Lannate SP	8-16 oz.	
	Malathion	See label.	Formulations and rates vary by state. Check labels for specific information.
	Sevin XLR Plus (4F)	1.5-2 qt.	Other formulations may be available.

Blueberry First and Second Cover

Apply first cover about 7-10 days after petal fall, and second cover about 10 days later.

Pest/Problem	Material	Rate/Acre	Comments
anthracnose, Phomopsis stem canker and stem blight	Abound	6.2-15.5 fl. oz.	
	Captan 80WDG	1.25-3 lb.	Apply only if anthracnose or Phomopsis is a problem.
	CaptEvate 68WDG	3.5-4.7 lb.	
	Indar 2F	6 fl. oz.	
	Inspire Super	16-20 fl. oz.	Not labeled for Phomopsis.
	Luna Sensation	4-7.6 fl. oz.	
	Miravis Prime	9-13.4 fl. oz.	Recommended for later application.
	Omega 500F	1.25 pt.	For management of Phomopsis twig blight and fruit rot, anthracnose, and Botrytis fruit rot. Do not use adjuvants with this product.
	Pristine	18.5-23 oz.	Do not tank mix with other pesticides except fungicides that contain only captan as the active ingredient. Do not tank mix with adjuvants, liquid fertilizers, nutrients, or other additives. Use only water as a spray carrier. See label.
	Quadris Top	12-14 fl. oz.	
	Quash	2.5 oz.	
	Quilt Xcel	14-21 fl. oz.	
	Switch 62.5WDG	11-14 oz.	
cherry fruitworm, cranberry fruitworm	Same as for Blueberry Petal Fall for cherry fruitworm, above. Control cherry fruitworm at petal fall and 10 days later. Control cranberry fruitworm 10 days and 20 days after petal fall.		
	Rimon 0.83EC	20-30 fl. oz.	Cranberry fruitworm only.
plum curculio	Plum curculio adults and larvae have not been observed to damage blueberries in the most southern portions of the region.		
	Brigade 2EC	2.1-6.4 fl. oz.	
	Brigade WSB (10WP)	5.3-16 oz.	
	Danitol 2.4EC	10.67-16 oz.	
	Exirel 0.83SE	13.5-20.5 fl. oz.	
	Imidan 70W	1.33 lb.	

Blueberry Third and Additional Covers

Apply about 10 days after previous cover, and repeat as needed. Be sure to check PHIs. See Fungicide PHIs and REIs (pages 156-158) and Insecticide and Miticide PHIs and REIs tables (pages 158-160).

Pest/Problem	Material	Rate/Acre	Comments
anthracnose, Phomopsis stem canker and stem blight	Same as Blueberry First and Second Cover. Be careful of PHI. Quilt Xcel has a 30-day PHI.		
blueberry maggot	Monitor for first emergence of blueberry maggot flies with traps. Emergence usually begins around July 1 in northern areas. Insecticide applications to protect berries may be needed until harvest. See product labels for pre-harvest intervals and restrictions. Blueberry maggot is not a common pest in the southern portion of the region.		
	Admire Pro (4.6F)	2.1-2.8 fl. oz.	Adults feeding on foliage.
	Asana XL (0.66 EC)	9.6 fl. oz.	
	Assail 30SG	4.5-5.3 oz.	
	Brigade 2EC	2.1-6.4 fl. oz.	
	Brigade WSB (10WP)	5.3-16 oz.	
	Danitol 2.4EC	10.67-16 fl. oz.	
	Diazinon AG600	12.75 fl. oz.	

(continued)

Blueberry Third and Additional Covers *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
blueberry maggot (continued)	Exirel 0.83SE	13.5-20.5 fl. oz.	
	Imidan 70W	1.33 lb.	
	Lannate LV	12-24 fl. oz.	
	Lannate SP	4-8 oz.	
	Malathion	See label.	Formulations and rates vary by state. Check labels for specific information.
	Rimon 0.83EC	20-30 fl. oz.	
	Sevin XLR Plus (4F)	1.5-2 qt.	Other formulations may be available.
	Sivanto Prime	12-14 fl. oz.	
brown marmorated stink bug	Danitol 2.4EC	10.67-16 fl. oz.	
	Lannate LV	24-48 fl. oz.	
	Lannate SP	8-16 oz.	
	Brigade 2EC	6.4 fl. oz.	
Japanese beetle	See Insecticide and Miticide PHIs and REIs tables (pages 158-160) for the PHIs of these insecticides.		
	Admire Pro (4.6F)	2.1-2.8 fl. oz.	Adults feeding on foliage.
	Asana XL (0.66 EC)	4.8-9.6 fl. oz.	
	Assail 30SG	4.5-5.3 oz.	
	Aza-Direct	1-2 pt.	Acts as a repellent.
	Brigade 2EC	2.1-6.4 fl. oz.	
	Danitol 2.4EC	10.67-16 fl. oz.	
	Imidan 70W	1.33 lb.	Moderately effective and may be used until 3 days before harvest.
	Malathion	See label	Formulations and rates vary by state. Check labels for specific information.
	Neemix 4.5	7-16 fl. oz.	Acts as a repellent.
	Pyganic 1.4%EC	16-64 fl. oz.	Pyganic and Neemix provide some short-term control and may be applied until the day of harvest.
	Pyganic 5%EC	4.5-18 fl. oz.	
	Sevin XLR Plus (4F)	1-2 qt.	For Japanese beetle control on fruit, Sevin is labeled and effective, but may not be used within 7 days of harvest. Other formulations may be available.
Drosophila (fruit flies, vinegar flies), including spotted wing Drosophila	Danitol 2.4EC	10.67-16 fl. oz.	
	Delegate 25WG	3-6 oz.	
	Entrust 2SC	4-6 fl. oz.	
	Exirel 0.83SE	13.5-20.5 fl. oz.	
	Imidan 70W	1.33 lb.	
	Lannate LV	24-48 fl.oz.	
	Lannate SP	8-16 oz.	
	Malathion	See label	Formulations and rates vary by state and special local need (SLN). Check labels for specific information.
	Mustang Maxx 0.8EC	4.0 fl. oz.	
	Rimon 0.83EC	20-30 fl. oz.	

Blueberry Post-harvest

Pest/Problem	Material	Rate/Acre	Comments
Phomopsis stem canker and stem blight	Captan 80WDG	1.25-3 lb.	If canker is a problem, apply post-harvest sprays at 4- to 6-week intervals until leaf drop in the fall.

Special Comments on Blueberry Schedule

Spotted Lanternfly

The spotted lanternfly is an invasive planthopper that was first detected in Pennsylvania in 2014 and has since spread to six states — most recently Ohio in 2020. It is projected to invade throughout the Midwest.

This insect feeds on plant sap, causing wilting, dieback and even death.

Currently spotted lanternfly is believed to pose the greatest threat to the blueberry, grape, hop, stone fruit, and hardwood industries. Know how to identify this pest and remain vigilant for its appearance in your vineyard and orchard systems.

Phytophthora Root Rot

Ridomil Gold SL is labeled for control of Phytophthora root rot of blueberries. Apply to established plantings before the plants start growth in the spring. Apply to new plantings at time of planting.

Several phosphorous acid and aluminum tris fungicides are registered for Phytophthora root rot control on blueberry.

Effectiveness of Pesticides for Blueberry Diseases[1]

Compiled and Edited by J. Beckerman and M. Heller-Haas

Product and formulation Active ingredient	FRAC Code[2]	Alternaria fruit rot	anthracnose fruit rot	Botyrtis blight	Fusicoccum canker	Mummy berry	Phomopsis cane blight	Phytophthora root rot	Powdery Mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC) azoxystrobin	11	F	E	F	u	F	F	u	G	4h 0d	46 fl. oz. NA
Aftershock fluoxastrobin	11	u	G	F	u	u	u	u	G	12 h 1 d	22.8 fl oz NA
Aliette WDG aluminum tris (0-ethyl phosphonate)	33	G	G	u	u	E	G	G	G	12h 0.5d	20 lb. 4
Aprovia benzovindiflupyr	7	u	u	u	u	u	u	i	u	12 h 1 yr	10.5 oz NA
Bravo Weather Stik chlorothalonil	M3	u	G	E-G	u	E	E	i	G	12h 42d	12 pt NA
Captan 50WP captan	M 5	F	G	F	F	s-E	F	u	G	48h 0d	70 lb. NA
CaptEvate 68WDG captan + fenhexamid	M+17	F	F	E	u	E-G	F	i	u	48h 30d	21 lb. NA
Elevate 50WG fenhexamid	M+17	u	u	E	u	F	F	i	u	12h 0d	6 lb. NA
Flint Extra trifloxystrobin	11	u	s	s	u	u	s	u	E	12 h 0d	18 fl oz NA
Fontelis penthiopyrad	7	u	E	E	u	E	u	i	E	12h 0d	72 fl. oz. NA
Indar 2F fenbuconazole	3	F	u	E	u	E	G	i	E	12h 30d	24 fl. oz. 4

(continued)

Effectiveness of Pesticides for Blueberry Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Alternaria fruit rot	anthracnose fruit rot	Botyrtis blight	Fusicoccum canker	Mummy berry	Phomopsis cane blight	Phytophthora root rot	Powdery Mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Inspire Super difenoconazole + cyprodinil	3+9	u	u	u	u	u	u	i	u	12h 7d	80 fl. oz. NA
Kenja 400SC Isofetamid	7	u	u	E	u	E	u	i	u	12h 0d	54 fl. oz. NA
lime sulfur solution lime-sulfur	M	i	i	i	u	u	G	u	u	48h NA	48 gal. NA
Luna Privilege fluopyram	7	E	u	E	u	E	U	i	G	12 h 0 d	13.7 NA
Luna Sensation fluopyram + trifloxystrobin	7+11	u	G	G	u	u	G	u	E	12h 0d	27.1 fl. oz. NA
Luna Tranquility (SC) fluopyram + pyrimethanil	7+9	u	u	E	u	E-G	u	i	E	12h 0d	54.7 fl. oz. NA
Miravis Prime pydiflumetofen+fludioxanil	7+12	G	G	G	u	G	G	i	u	12 h 0 d	26.8 fl oz. NA
Omega 500F fluazinam	29	F	G	u	u	F	u	u	G	12h 30d	7.5 pt. NA
OSO 5% SC polyoxin D	19	u	G	G	u	E-G	G-F	i	G	4h 0d	4.2 oz. 6
Pristine (38WG) pyraclostrobin + boscalid	11+7	G	E	G	u	F	G	u	E	24h 0d	92 oz. 4
Procure 480SC triflumazole	3	u	u	u	u	u	u	i	E	12 h 0d	32 oz 8
Proline 480C prothioconazole	3	F	u	E	u	E	G	i	G	12h 7d	11.4 oz. 2
ProPhyt phosphorous acid	33	F	F	u	u	F	F	G	G	4h 0d	NA NA
Quadris Top azoxystrobin + difenoconazole	11+3	G	F	u	u	G	G	u	G	12 h 14 d	56 fl.oz. 4
Quash metconazole	3	u	G	G	u	E	E	i	E	12h 7d	7.5 oz. 3
Quilt Xcel azoxystrobin + propiconazole	11+3	u	G	u	u	F	G	u	E	12h 30d	82 fl. oz. NA
Ridomil Gold SL mefenoxam	4	u	u	u	u	u	u	E	i	48h 0d	3.6 pt. NA
Sulforix calcium polysulfide	M	u	F	u	u	G-F	u	u	E	48h NA	N/A 4

(continued)

Effectiveness of Pesticides for Blueberry Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Alternaria fruit rot	anthracnose fruit rot	Botyrtis blight	Fusicoccum canker	Mummy berry	Phomopsis cane blight	Phytophthora root rot	Powdery Mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Switch 62.5WG	9+12	E	G	G	u	F	F	i	i	12h	56 oz.
cyprodinil + fludioxonil										0d	NA
Tilt	3	u	u	u	u	G-F	G	i	E	12h	30 fl. oz.
propiconazole										30d	5
Torino	U6	u	u	u	u	u	u	i	E	4 h	6.8 oz
cyflufenamid										0d	2
Ziram 76DF	M3	F	G	G	F	G	G	u	u	48h	NA
ziram										30d	NA

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] FRAC code represents the mode of action of the fungicide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Efficacy of Selected Pesticides for Control of Blueberry Insects[1]

Compiled and edited by Celeste Welty

Product and formulation Active Ingredient	IRAC Code[2]	blueberry maggot	brown marmorated Stink bug	cherry fruitworm & cranberry fruitworm	Japanese beetle	plum curculio	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	x	x	G	x	x	12h	12 oz.
thiamethoxam								3d	NA
Admire Pro (4.6F)	4A	F	x	x	F	x	x	12h	14 fl. oz.
imidacloprid								3 or 7d	5
Altacor (35WDG)	28	x	x	E	i	x	x	4h	9 oz.
chlorantraniliprole								1d	NA
Apta (1.34SC)	21A	F	x	u	x	G	x	12h	81 fl. oz.
tolfenpyrad								3d	3
Asana XL (0.66EC) **(RUP)**	3A	G	x	G	G	x	x	12h	38.4 fl. oz.
esfenvalerate								14d	NA

(continued)

Efficacy of Selected Pesticides for Control of Blueberry Insects[1] *(continued)*

Product and formulation Active Ingredient	IRAC Code[2]	blueberry maggot	brown marmorated Stink bug	cherry fruitworm & cranberry fruitworm	Japanese beetle	plum curculio	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Assail 30SG acetamiprid	4A	G	x	G	G	x	x	12h 1d	26.7 oz. 5
Avaunt eVo (30WDG) indoxacarb	22	x	x	G	x	E	x	12h 7d	24 oz. 4
Beetle GONE! Ag *Bacillus thuringiensis galleriae*	UN	x	x	x	G	x	x	4h 0d	NA NA
B.t. kurstaki (DiPel, Javelin, etc.) *Bacillus thuringiensis kurstaki*	11	x	x	F	x	x	x	4h 0d	NA NA
Brigade WSB (10WP) **(RUP)** bifenthrin	3A	G	x	G	E	G	x	12h 1d	80 oz. NA
Confirm 2F tebufenozide	18	x	x	G	x	x	x	4h 14d	64 fl. oz. NA
Danitol 2.4EC **(RUP)** fenpropathrin	3A	G	G	E	E	G	E	24h 3d	32 fl. oz. 2
Delegate WG (25WG) spinetoram	5	F	x	E	x	x	E	4h 3d	19.5 oz. 6
Diazinon AG600 WBC **(RUP)** diazinon	1B	G	x	G	x	x	x	120h 7d	25.5 fl. oz. 2
Entrust SC (2SC) spinosad	5	x	x	s	x	x	G	4h 1d	29 fl. oz. 6
Esteem 35WP pyriproxyfen	7C	x	x	F	x	x	x	12h 7d	10 oz. 2
Exirel (0.83SE) cyantraniliprole	28	F	x	E	x	G	E	12h 3d	61.5 fl. oz. NA
Grandevo WDG *Chromobacterium subtsugae*	UN	x	x	G	x	x	G	4h 0d	NA NA
Imidan 70W phosmet	1B	E	x	E	G	E	E	24-72h 3d	7.1 lb. 5
Intrepid 2F methoxyfenozide	18	x	x	E	x	x	x	4h 7d	48 fl. oz. 3
Knack (0.86EC) pyriproxyfen	7C	x	x	F	x	x	x	12h 7d	32 fl. oz. 2
Lannate LV (2.4WSL) **(RUP)** methomyl	1A	G	G	E	x	x	E	48h 3d	12 pt. 4
Magister SC (1.7SC) fenazaquin	21A	x	x	x	x	x	x	12h 7d	36 fl. oz. 1

(continued)

Efficacy of Selected Pesticides for Control of Blueberry Insects[1] *(continued)*

Product and formulation Active Ingredient	IRAC Code[2]	blueberry maggot	brown marmorated Stink bug	cherry fruitworm & cranberry fruitworm	Japanese beetle	plum curculio	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Malathion 8F malathion	1B	G	x	F	F	F	x	12h 1d	NA 3
Movento (2SC) spirotetramat	23	G	x	x	x	x	x	24h 7d	30 fl. oz. NA
Mustang Maxx (0.83EC) **(RUP)** zeta-cypermethrin	3A	x	x	x	x	x	E	12h 1d	24 fl. oz. NA
Neemix 4.5 (0.39L), AzaDirect azadirachtin	UN	F	u	u	F	x	u	4h 0d	NA NA
Platinum 75SG thiamethoxam	4A	x	x	x	F	x	x	12h 75d	4 oz. NA
Portal XLO (0.4EC) fenpyroximate	21A	x	x	x	x	x	x	12h 1d	4 pt. 2
Pyganic 5EC; 1.4EC pyrethrins	3A	F	u	u	F	x	F	12h 0d	NA 10
Rimon 0.83EC novaluron	15	G	x	x	x	x	x	12h 8d	90 fl. oz. NA
Sevin XLR Plus (4F) carbaryl	1A	G	x	G	E	x	x	12h 7d	10 qt. 5
Sivanto Prime (1.67SC) flupyradifurone	4D	G	x	x	x	x	x	4h 3d	28 fl. oz. NA
Surround WP (95WP) kaolin	UN	s	x	x	s	s	x	4h 0d	NA NA
Verdepryn 100SL (0.83SL) cyclaniliprole	28	G	s	E	u	G	E	4h 1d	33 fl. oz. 3

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] IRAC code represents the mode of action of the insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

RASPBERRY and BLACKBERRY

Raspberry and Blackberry Spray Schedule

Entomology Leads: Neel Joshi, K. Athey, R. Bessin
Pathology Leads: J. Beckerman, M. Lewis Ivey, M. Heller-Haas

Raspberry and Blackberry Delayed Dormant

Apply when tips of buds show green. Sanitation is a cornerstone of disease and insect management. Remove and destroy old, infected and infested floricanes after harvest to aid in the management of anthracnose and borers.

Pest/Problem	Material	Rate/Acre	Comments
anthracnose, spur blight (reds only), cane blight	CaptEvate 68WDG	3.5-5.25 lb.	Labeled for raspberries only.
	copper hydroxide 50WP	4.0 lb.	Copper products are available in various formulations. Read labels carefully.
	Sulforix	3.0 gal./100 gal. water	Use with minimum 50 gal. carrier per acre.
Phytophthora root rot	phosphorous acid	4.5 pt.	Phosphorous acid products include ProPhyt, Phostrol, Fosphite, Fungi-fite, Confine Extra, K-phite, and Rampart.
	Ridomil Gold SL	3.6 pt.	Ridomil Gold SL has replaced Ridomil Gold EC. See Phytophthora Root Rot (page 166) for application information.
	Ridomil Gold GR	5.0 lb./1000 ft. row	At time of planting. Topdressing with this product is not recommended.
	Orondis Gold 200	4.8-9.6 fl. oz.	Apply as a banded, soil-directed spray in a minimum of 20 gal./A of water. Direct the spray along each side of the crop row, and direct the application to the soil near and under the lower leaves.
raspberry crown borer	Apply insecticides after egg hatch in late October or early November, or wait until late March. Apply as a soil drench directed at the crown of the plants in a minimum of 50 gal. of water per acre prior to a significant rainfall or irrigation.		
	Altacor 35WG	3-4.5 oz.	
	Brigade 2EC	6.4 fl. oz.	
	Brigade WSB (10WP)	16 oz.	
	Hero 1.24EC	10.3 fl. oz.	
rednecked cane borer	See Rednecked Cane Borer (page 166) about pruning to remove last year's galls.		

Raspberry and Blackberry Pre-bloom

Apply when flowers show white.

Pest/Problem	Material	Rate/Acre	Comments
anthracnose, spur blight (reds only), cane blight, raspberry leaf spot, Septoria leaf spot	Unless anthracnose, cane blight, or spur blight have been problems, fungicide applications prior to bloom are probably not required. This is especially true if you have made the delayed-dormant application of lime-sulfur. See Raspberry Leaf Spot and Septoria Leaf Spot of Blackberry and Raspberry, page 167.		
	Abound	6.0-15.5 fl. oz.	Active ingredient is azoxystrobin. Other labeled products include Satori, Trevo, AFrame, Azoxystar, Azteroid and Acadia 2Sc. Labeled rates are the same as Abound.
	Cabrio EG	14 oz.	
	Captan 80WDG	2.5 lb.	For control of anthracnose and spur blight only.
	Captec 4L	0.75-1 qt.	
	CaptEvate 68WDG	3.0-5.0 lb.	Labeled for anthracnose and spur blight in raspberries.
	Luna Tranquility	16-27 fl. oz.	
	Pristine 38WG	18.5-23 oz.	
	Quilt Xcel	14.0-21.0 fl. oz.	Not labeled for spur blight. 30-day PHI.
	Switch 62.5WG	11.0-14.0 oz.	Labeled for Botrytis, Phomopsis and anthracnose.
	Tanos	8.0-10.0 oz.	Not labeled for cane blight. Suppresses anthracnose.

(continued)

Raspberry and Blackberry Pre-bloom *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
rust diseases (orange rust and late leaf rust), powdery mildew, raspberry leaf spot, Septoria leaf spot	See Raspberry Leaf Spot and Septoria Leaf Spot of Blackberry and Raspberry, page 167.		
	Abound	6.0-15.5 fl. oz.	Use 10-15.5 fl. oz. rate for blackberry rust.
	Cabrio EG	14.0 oz.	
	Pristine	18.5-23 oz.	Suppresses rust diseases.
	Prolivo 300SC	4.0-5.0 fl. oz.	Powdery mildew only.
	Quilt Xcel	14.0-21.0 fl. oz.	30-day PHI.
	Rally 40WSP	1.25-3.0 oz.	For late leaf rust and powdery mildew, begin applications when disease first appears and repeat on a 10- to 14-day schedule. See Orange Rust, page 166.
	Tilt	6.0 fl. oz.	Active ingredient is propiconazole. Other labeled products include Topaz, Bumper ES, Bumper 41.8 EC, Propiconazole 3.6 EC, Propiconazole 41.8% EC and Propi-Star EC. See labels for application rates.
raspberry fruitworm	Early fruit is more seriously attacked than later fruit. Check for feeding damage to spring leaves, buds, and early summer fruit.		
	Delegate 25WG	3-6 oz.	
	Entrust 2SC	4-6 fl. oz.	
	Pyganic 5%EC	4.5-15.61 fl. oz.	
strawberry clipper (bud weevil)	Begin checking for the first clipped buds when buds' first flowers show white. If clipped buds are found, apply insecticide and repeat spray 10 days later if bud clipping continues.		
	Actara 25WDG	3 oz	
	Delegate WG	3-6 oz.	
	Entrust 2SC	4-6 fl. oz.	
	Sevin XLR Plus (4F)	2 qt.	Other formulations may be available.
leafrollers	Not common pests.		
	Asana XL	4.8-9.6 fl. oz.	
	Aza-Direct	1-2 pt.	
	Brigade 2EC	3.2-6.4 fl. oz.	
	Brigade WSB (10WP)	8-16 oz.	
	Bt (Bacillus thuringiensis)		See Generic Insecticides (pages 219-220) for a list of products that contain *Bacillus thuringiensis*. See individual product labels for rates and application details.
	Confirm 2F	16 fl. oz.	
	Danitol 2.4EC	10.67-16 fl. oz.	
	Delegate 25WG	3-6 oz.	Target eggs at hatching or small larvae.
	Entrust 2SC	4-6 fl. oz.	
	Intrepid 2F	10-16 fl. oz.	
	Mustang Maxx 0.8EC	4 fl. oz.	
	Neemix 4.5	7-16 fl. oz.	
	Pyganic 5%EC	4.5-15.61 fl. oz.	
	Sevin XLR Plus (4F)	1-2 qt.	Other formulations may be available.
rose chafer	Not a common pest in most areas.		
	Pyganic 5%EC	4.5-15.61 fl. oz.	
	Sevin XLR Plus (4F)	1-2 qt.	Other formulations may be available.
raspberry sawfly	Not a common pest.		
	Delegate 25WG	3-6 oz.	
	Entrust 2SC	4-6 fl. oz.	
	Sevin XLR Plus (4F)	2 qt.	Other formulations may be available.

Raspberry and Blackberry First Bloom through Petal Fall

Apply when first flowers open through when petals fall.

Pest/Problem	Material	Rate/Acre	Comments
anthracnose, spur blight (reds only), cane blight, raspberry leaf spot, Septoria leaf spot, rust diseases (orange rust and late leaf rust), powdery mildew	See Raspberry Leaf Spot and Septoria Leaf Spot of Blackberry and Raspberry Post-bloom. See page 169 for a full list of labeled fungicides. Note: Quilt Xcel and Cover XL have a 30-day PHI.		
rosette (double blossom)	See Rosette or Double Blossom, page 166.		
Botrytis fruit rot	Make 3 fungicide applications during this period. Apply the first as blooms begin to open, not later than 5% bloom. Make the second at full bloom. Follow with a third as petals begin to fall.		
	Abound	6.0-15.5 fl. oz.	Active ingredient is azoxystrobin. Other labeled products include Satori, Trevo, AFrame, Azoxystar, Azteroid and Acadia 2Sc. Labeled rates are the same as Abound.
	Cabrio	14.0 oz.	Suppression only. Not recommended.
	Captan 80WDG	2.5 lb.	Use 45-100 gal. of carrier per acre.
	Captec 4L	0.75-1qt.	
	CaptEvate 68WDG	3.5 lb.	
	Elevate 50WDG	1.5 lb.	
	Luna Tranquility	16.0-27.0 fl. oz.	
	Pristine	18.5-23.0 oz.	
	Rovral 4F	1-2 pt.	Use a minimum of 100 gal. of carrier per acre. See Fungicide Resistance Management, page 167.
	Switch 62.5WG	11.0-14.0 oz.	
	OSO 5%SC	3.75-13 fl. oz.	Generic formulations with variable rates available.

Raspberry and Blackberry Post-bloom through Harvest

Apply every 14 days after petal fall as needed.

Pest/Problem	Material	Rate/Acre	Comments
anthracnose, Botrytis fruit rot, spur blight, cane blight, raspberry leaf spot, Septoria leaf spot	Abound	6.0-15.5 fl. oz.	Active ingredient is azoxystrobin. Other labeled products include Satori, Trevo, AFrame, Azoxystar, Azteroid and Acadia 2Sc. Labeled rates are the same as Abound.
	Cabrio	14.0 oz.	Suppression only. Not recommended.
	Captan 80WDG	2.5 lb.	Use 45-100 gal. of carrier per acre.
	Captec 4L	0.75-1 qt.	
	CaptEvate 68WDG	3.5 lb.	
	Elevate 50WDG	1.5 lb.	For Botrytis only.
	Luna Tranquility	16.0-27.0 fl. oz.	
	Pristine 38WDG	18.5-23.0 oz.	
	Quilt Xcel	14-20 fl. oz.	
	Rally 40WSP	1.25-3.0 oz.	For late leaf rust and powdery mildew, begin applications when disease first appears and repeat on a 10- to 14-day schedule. See Orange Rust, page 166.
	Switch 62.5WG	11.0-14.0 oz.	Labeled for Botrytis, Phomopsis and anthracnose.
	Tanos	8-10 oz.	Must be tank-mixed with a copper fungicide.
	Tilt	6.0 fl. oz.	Active ingredient is propiconazole. Other labeled products include Topaz, Bumper ES, Bumper 41.8 EC, Propiconazole 3.6 EC, Propiconazole 41.8% EC and Propi-Star EC. See labels for application rates.
Botrytis fruit rot (only)	Same as for Raspberry and Blackberry First Bloom through Petal Fall.		

(continued)

Raspberry and Blackberry Post-bloom through Harvest *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
rust diseases (orange rust and late leaf rust), powdery mildew	Abound	6.0-15.5 fl. oz.	Active ingredient is azoxystrobin. Other labeled products include Satori, Trevo, AFrame, Azoxystar, Azteroid and Acadia 2Sc. Labeled rates are the same as Abound.
	Cabrio 20EG	14 oz.	Suppresses rust diseases.
	Luna Tranquility	13.6-27.0 fl. oz.	Powdery mildew only.
	Pristine	18.5-23 oz.	
	Prolivo 300SC	4.0-5.0 fl. oz.	Powdery mildew only.
	Quilt Xcel	14-20 fl. oz.	
	Rally 40WSP	1.25-3.0 oz.	For late leaf rust and powdery mildew, begin applications when disease first appears and repeat on a 10- to 14-day schedule. See Orange Rust, page 166.
	Switch 62.5WG	11.0-14.0 oz.	
	Tilt	6.0 fl. oz.	
rednecked cane borer	Admire Pro	10.5-14 fl. oz.	Soil applied for systemic control. Do not apply pre-bloom, during bloom, or when bees are foraging. See Rednecked Cane Borer, page 166.
	JMS Stylet Oil	0.5-1 gal.	In May and June look for RNCB adults on primocanes during midmorning. Treat foliage weekly as long as RNCB adults are detected.
sap beetles	bait buckets		Keep berries off the ground and ripe berries picked. Establish bait buckets containing overripe fruit between the berry planting and nearby wooded areas. Empty bait buckets daily. Few insecticides are registered for sap beetle control, and during picking harvest restrictions practically rule out their use.
	Assail 30SG	4.5-5.3 oz.	
Japanese beetle, green June beetle	See Insecticide and Miticide PHIs and REIs (pages 167-168).		
	Actara 25WB	4 oz.	
	Assail 30SG	4.5-5.3 oz.	
	Aza-Direct	1-2 pt.	Acts as a repellent.
	Danitol 2.4EC	10.67-16 fl. oz.	
	Malathion	See label	Formulations and rates vary by state. Check labels for specific information.
	Neemix 4.5	7-16 fl. oz.	Acts as a repellent.
	Pyganic 5%EC	4.5-15.61 fl. oz.	
	Sevin XLR Plus (4F)	1-2 qt.	Other formulations may be available.
	Transform 50WG	1.5-2.75 oz.	
tarnished plant bug, stink bugs	Actara 25WB	3 oz.	
	Assail 30SG	4.5-5.3 oz.	
	Bifenture 2EC	6.4 fl. oz.	Labeled for brown marmorated stink bug control.
	Pyganic 5%EC	4.5-15.61 fl. oz.	
	Transform 50WG	1.5-2.75 oz.	
thrips (including Eastern flower thrips)	Entrust 2SC	4-6 fl. oz.	
	Delegate 25WG	3-6 oz.	
twospotted spider mite	Acramite 50WS	0.75-1 lb.	
	Kanemite 15SC	31 fl. oz.	
	JMS Stylet Oil	3-6 qt./100 gal. water	Spider mites start infestation on leaves at the base of plants and move up as lower leaves are bronzed.
	Savey 50DF	4-6 oz.	
	Zeal 72WP	2-3 oz.	
broad mite	Agri-Mek SC	3.5 fl. oz.	Agri-Mek SC must be mixed with a nonionic surfactant activator type wetting, spreading and/or penetrating spray adjuvant at 0.1-0.5% v/v. See Broad Mite, page 165.

(continued)

Raspberry and Blackberry Post-bloom through Harvest *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
Drosophila (also known as fruit flies and vinegar flies), including spotted wing Drosophila	See Spotted Wing Drosophila, page 141.		
	Danitol 2.4EC	10.67-16 fl. oz.	
	Delegate 25WG	3-6 oz.	
	Entrust 2SC	4-6 fl. oz.	
	Malathion	See label.	Malathion formulations and rates vary by state. Check labels for specific information.
	Mustang Maxx	4.0 fl. oz.	

Raspberry and Blackberry Post-harvest

Pest/Problem	Material	Rate/Acre	Comments
raspberry leaf spot, Septoria leaf spot, rust diseases (orange rust and late leaf rust), powdery mildew	Post-harvest sprays are probably the most important for control of the leaf spot diseases. When diseases are severe, most defoliation occurs post-harvest. In exceptionally wet seasons, post-harvest fungicide applications may be required to protect first year canes from anthracnose, spur blight, cane blight, and powdery mildew. A good spray program early in the season should help minimize development of these diseases later in the season. Same as for Raspberry and Blackberry Pre-bloom, page 161. Captan is labeled for fall application.		
raspberry crown borer	Apply insecticides after eggs hatch in late October or early November, or wait until March. Apply as a soil drench directed at the crown of plants in a minimum of 50 gal. of water per acre prior to a significant rainfall or irrigation.		
	Altacor 35WG	3-4.5 oz.	
	Brigade 2EC	6.4 fl. oz.	
	Brigade WSB (10WP)	16 oz.	
	Diazinon AG600	51 fl. oz.	Minimum of 100 gal. as a drench in spring before buds break.
	Hero 1.24EC	10.3 fl. oz.	Minimum of 200 gal. of water as a drench.

Special Comments on Raspberry and Blackberry Schedule

Spotted Wing Drosophila

See page 141 (under Grapes).

Broad Mite

The broad mite damages terminal leaves, flowers, and fruit on peppers and tomato, and recently became a pest of blackberries, especially primocane-fruiting cultivars. This mite feeds by piercing the bud, leaf, or flower. This feeding injects a toxin that stunts growth, curls and bronzes leaves, and often kills terminal and lateral leaf and flower buds. These symptoms are similar to those of fire blight.

The mite overwinters under blackberry bud scales and in the soil and in litter under plants. Eggs are oval and spotted (0.08 mm long). Broad mites are oval and vary from small white immatures to amber adults (0.2mm) with white hourglass mark on back of females.

From late May through fall in Arkansas, you can find a buildup of broad mites on the terminal leaves of emerging primocanes. In more northern states, broad mite numbers increase and damage appears later in the summer or early fall.

Broad mites have damaged floricane-fruiting blackberry cultivars. Infested floricanes have delayed bud break and low vigor in spring. Broad mites can be found on terminal floricane leaves from April through harvest. Primocane terminals can also become infested.

The only recommended miticide is Agri-Mek. One application has reduced and maintained broad mite numbers to near zero for up to a month. Additional applications may be needed if mite numbers resurge. You can reapply Agri-Mek once and then you must rotate to a different mode of action. Other products that have significantly reduced broad mite on blackberry include Microthiol Disperss wettable sulfur (10 pounds per acre), 2% JMS Stylet-Oil, and 1% M-Pede. For these products, check safety to blooms by testing a few plants prior to broad application, and do not apply if temperatures are expected to exceed 90°F. See labels for use and rate recommendations.

More information about broad mites, including photos, is available on two University of Arkansas Fruit/Nut Pest Management PDFs.

Brown Marmorated Stink Bug

The brown marmorated stink bug (BMSB) has an extremely wide host range and is a pest of all small fruit. BMSB is attracted to fruits throughout much of the growing season. It has piercing sucking mouthparts, which cause injury that may appear as sunken areas on the fruit. BMSB that are hidden in grape clusters at harvest may taint juice flavor at crush.

Actara, Brigade, Danitol, and Lannate have shown good efficacy in trials; however, multiple applications may be needed for reinfestations.

Raspberry Cane Maggot

The raspberry cane maggot causes wilted tips in May. Cut off wilted tips a few inches below the girdle when first seen. Destroy the removed tips.

Rednecked Cane Borer

Scout for galls before or during the dormant period. Prune out galled canes and burn, bury, or otherwise destroy them to kill overwintered larvae. If more than 5 percent of all canes have galls, an insecticide application immediately after bloom may be warranted.

Adults begin to emerge in May or June. Begin scouting plantings during bloom by looking for adult beetles active during daylight hours. Begin insecticide application(s) after bloom has ended and bees are no longer present. Apply Admire Pro via drip or trickle chemigation or in a soil drench in a minimum of 500 gallons of water per acre. Do not apply pre-bloom or during bloom or when bees are actively foraging.

Phytophthora Root Rot

Ridomil Gold SL, Ridomil Gold GR, Ridomil/Copper, Orondis Gold B, and Orondis Gold 200 are all labeled for control of Phytophthora root rot on brambles. See the labels for more detailed information on application rates and timing.

Note: Do not apply Ridomil within 45 days before harvest, or illegal residues may result. See the label for more detailed information.

Many phosphorous acid fungicides are registered for Phytophthora root rot control on blackberry and raspberry, and they all essentially all have the same active ingredient. All are foliar sprays. They are highly systemic and move rapidly into leaves and are translocated in the plant to the crown and roots. Recommendations for use vary among products. See labels for use recommendations and restrictions.

Several other phosphite fungicides are on the market, and new ones continue to be introduced. Recommendations for use vary among products. See labels for use recommendations.

Blackberry Rosette or Double Blossom

Rosette is caused by the fungus *Cercosporella rubi*. It is a serious disease of blackberry in the southern Midwest (Arkansas, Kentucky, Missouri, and Oklahoma). It is a minor disease of raspberries. Products containing azoxystrobin (e.g., Abound, Satori, Acadia 2SC, ect.), Quilt Xcel, and Cover XL are labeled for control on blackberry; however, chemical control of this disease under heavy pressure has not been successful. One cultural practice for infected sites is to mow the planting down before flowering to eliminate spore release and infection of emerging primocanes. Although this sacrifices one year of production, the practice may provide short-term control.

Varieties vary in susceptibility. Apache, Ouachita, and Triple Crown are resistant. Chester, Hull, and Navaho are tolerant. Chickasaw, Choctaw, Kiowa, Shawnee, and Illini Hardy are highly susceptible. Other cultivars differ in susceptibility, but all become infected over time.

Blackberry Downy Mildew

Blackberry downy mildew is caused by the fungus-like (oomycete) *Peronospora sparsa*. It was first reported in Ohio, in 2018. The pathogen spreads systemically and infects both the leaves and fruit. Stunting can occur in infected plants even when foliar symptoms are not visible. The disease is most severe during wet weather with cool to warm temperatures. The cultivated varieties Chester, Arapahoe, Apache, and Navaho have been reported to be moderately resistant. Purchase plants from a reputable nursery and inspect them for signs or symptoms of downy mildew before planting. Early symptoms include light green to yellow leaves with brown to red spots, stunting, and red streaking on the stems and petioles. Fungicides containing mefenoxam, oxythiapiprolin or potassium phosphite provide the best level of control. Applications of potassium phosphite can result in phosphorous deficiencies; a balanced nutritional program therefore should be followed and monitored.

Orange Rust

All cultivars of black and purple raspberries and most erect and trailing blackberries are very susceptible to orange rust. Unlike all other fungi infecting brambles, this fungus grows systemically throughout the roots, crowns, and shoots of infected plants and is perennial in belowground plant parts. Plants do not die but become stunted and weakened, producing little to no fruit. Key control methods include cultural practices such as removing infected plants early in the spring and eradicating nearby wild brambles. Alternate Rally with Abound (or another axozystrobin product), Cabrio, or Pristine in the spray program to prevent fungicide resistance development.

Raspberry Leaf Spot and Septoria Leaf Spot of Blackberry and Raspberry

The incidence of raspberry leaf spot and Septoria leaf spot appears to be increasing across the Midwest. If not controlled, they can result in severe defoliation of the plant.

The strobilurin fungicides (Abound, Cabrio, Pristine) provide good control of both diseases. Abound is registered for control of raspberry leaf spot and Septoria leaf spot. Some fungicide trials have shown that Captan and Rally also provide some level of control. Post-harvest (late-season) applications are important for controlling these leaf diseases. Most defoliation resulting from these diseases occurs later in the season (post-harvest).

Fungicide Resistance Management

Elevate, Rovral, Switch, and Pristine should not be used alone for season-long control of Botrytis fruit rot, because some Botrytis cinerea strains may develop resistance to these fungicides. Adding (tank mixing) Captan to Elevate, Rovral, Switch, or Pristine should enhance disease control and help prevent fungicide resistance development. Rotating these fungicides in blocks of one or two sprays is a good resistance management strategy.

Effectiveness of Insecticides and Miticides for Brambles[1]

Product and formulation Active ingredient	IRAC Code[2]	broad mite	green June/Japanese beetle	leafrollers	plant bugs	raspberry crown borer	raspberry fruitworm	raspberry sawfly	rednecked cane borer	rose chafer	sap beetle	stink bugs	strawberry clipper	spotted wing Drosophila	thhrips	two-spotted spider mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS bifenazate	20D	x	x	x	x	x	x	x	x	x	x	x	x	x	x	G	12h 1d	2 lb. 2
Actara (25WDG) thiamethoxam	4A	x	G	x	G	x	x	x	x	x	x	G	x	x	x	x	12h 3d	6 oz. NA
Admire Pro (4.6F) imidacloprid	4A	x	x	x	x	x	x	x	G	x	x	x	x	x	F	x	12h 7d	14 fl. oz. NA
Agri-Mek SC (0.7SC) **(RUP)** abamectin	6	E	x	x	x	x	x	x	x	x	x	x	x	x	x	E	12h 7d	10.25 fl. oz. NA
Altacor (35WG) chlorantraniliprole	28	x	x	E	x	G	x	x	x	x	x	x	x	x	x	x	4h 3d	9 oz. NA
Asana XL (0.66EC) **(RUP)** esfenvalerate	3A	x	x	x	E	x	x	x	x	x	x	G	x	x	x	x	12h 7d	28.8 fl. oz. NA
Assail 30SG acetamiprid	4A	x	G	x	G	x	u	x	x	x	G	x	x	x	u	x	12h 1d	26.7 oz 5
Brigade WSB (10WP) **(RUP)** bifenthrin	3A	x	x	E	E	E	x	x	x	x	E	E	E	E	x	F	12h 3d	32 oz. NA
Confirm 2F tebufenozide	18	x	x	E	x	x	x	x	x	x	x	x	x	x	x	x	4h 14d	64 fl. oz. NA
Danitol 2.4EC **(RUP)** fenpropathrin	3A	x	E	E	E	x	x	x	x	x	G	E	x	E	x	F	24h 3d	32 fl. oz. NA
Delegate WG (25WG) spinetoram	5	x	x	E	x	x	E	G	x	x	F	x	x	E	E	x	4h 1d	19.5 oz. 6
Bacillus thuringiensis (B.t.) (Agree, Dipel, etc.) *B. thuringiensis*	11	x	x	F	x	x	x	x	x	x	x	x	x	x	x	x	4h 0d	NA NA

(continued)

Effectiveness of Insecticides and Miticides for Brambles[1] *(continued)*

Product and formulation Active ingredient	IRAC Code[2]	broad mite	green June/Japanese beetle	leafrollers	plant bugs	raspberry crown borer	raspberry fruitworm	raspberry sawfly	rednecked cane borer	rose chafer	sap beetle	stink bugs	strawberry clipper	spotted wing Drosophila	thhrips	two-spotted spider mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Entrust SC (2SC) spinosad	5	x	x	G	x	x	G	G	x	x	x	x	x	x	x	x	4h 1d	29 fl. oz. 6
Hero (1.24EC) bifenthrin	3A	x	x	G	x	u	x	x	x	x	x	x	x	x	x	F	12h 3d	27.4 oz. 2
Intrepid 2F methoxyfenozide	18	x	x	G	x	x	x	x	x	x	x	x	x	x	x	x	4h 3d	48 fl. oz. 3
Kanemite 15SC acequinocyl	20B	x	x	x	x	x	x	x	x	x	x	x	x	x	x	G	12h 1d	62 fl. oz. 2
Knack (0.86EC) pyriproxyfen	7C	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	12h 7d	32 fl. oz. NA
M-Pede potassium salts of fatty acids	UN	E	x	x	x	x	x	x	x	x	x		x	x	x	x	12h 0d	NA NA
Malathion malathion	1B	x	G	x	x	x	x	x	x	G	x	x	x	G	G	x	12h 1d	9 pt. 3
Mustang Maxx (0.83EC) **(RUP)** zeta-cypermethrin	3A	x	E	E	x	x	x	x	x	x	x	E	x	E	x	x	12h 1d	24 fl. oz. 6
Neemix 4.5 (0.39L) azadirachtin	UN	x	u	u	x	x	x	x	x	u	x	x	x	x	u	x	4h 0d	NA NA
Pyganic 5EC; 1.4EC pyrethrins	3A	x	i	F	F	x	F	i	x	F	x	i	x	F	i	x	12h 0d	NA NA
Savey 50DF hexythiazox	10A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	E	12h 3d	6 oz. 1
Sevin XLR Plus (4F) carbaryl	1A	x	G	G	G	x	i	G	x	G	x	i	x	G	x	x	12h 7d	10 qt. NA
Surround WP (95WP) kaolin	UN	x	u	u	x	x	x	x	x	u	x	x	x	x	u	x	4h 0d	NA NA
Zeal (72WP) etoxazole	10B	x	x	x	x	x	x	x	x	x	x	x	x	x	x	E	12h 0d	3 oz. 1

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] IRAC code represents the mode of action of the insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Effectiveness of Fungicides for Control of Bramble Diseases[1]

Product and formulation Active ingredient	FRAC Code[2]	Anthracnose	Cane blight/spur blight	Raspberry leaf spot / Septoria leaf spot	Botrytis fruit rot	Rusts (orange and late leaf)	Powdery mildew	Phytophthora root rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC) azoxystrobin	11	E	E	G	G	E	E	x	4h 0d	92.3 fl. oz. 9
Aliette WDG fosetyl-AL	33	x	x	x	x	x	x	E	12h 60d	4 app. NA
Badge SC copper sulfate + oxychloride	M	F	F	F	x	F	x	x	48h 0d	35.2 pt. NA
basic copper sulfate copper sulfate	M	F	F	F	x	x	i	x	12h 0d	varies NA
Cabrio EG (20EG) pyraclostrobin	11	E	E	E	s	s	E	x	12h 0d	56 oz. NA
Captan 80WDG captan	M4	G	F	F	G	x	x	x	48h 3d	12.5 NA
Captec 4L captan	M4	G	G	F	G	x	x	x	72h 3d	35 qt. NA
CaptEvate 68WDG captan + fenhexamid	M+17	G	G	G	E	G	x	x	48h 30d	21 lb. NA
Elevate 50WDG fenhexamid	17	x	x	x	E	x	x	x	12h 0d	6 lb. NA
Kenja 400SC Isofetamid	7	x	x	x	E	x	s	x	12h 0d	54 fl. oz. NA
Kocide 3000 copper hydroxide	M	x	F	x	x	x	x	u	48h 0d	28.6 lb. NA
Luna Privilege fluopyram	7	x	x	G	E	x	E	x	12 h 0d	13.7 fl oz. NA
Luna tranquility (SC) fluopyram + pyrimethanil	7+9	G	x	E	x	x	G	x	12h 0d	54.7 fl. oz. 0d
Nordox cuprous oxide	M	F	F	x	x	x	x	x	24h 0d	24 lb. NA
Orondis Gold 200 oxathiapiprolin	U15	x	i	x	x	x	x	E	4h 1d	19.2 fl. oz. 2
OSO 5%SC polyoxin D	19	x	x	x	E	x	G	x	4h 0d	78 fl. oz. 6
Pristine 38WG pyraclostrobin + boscalid	11+7	E	E	E	E	s	E	x	12h 0d	92 oz. 4
Prolivo 300SC pyriofenone	U8	x	u	x	x	x	E	x	4h 0d	16 fl. oz. NA

(continued)

Effectiveness of Fungicides for Control of Bramble Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Anthracnose	Cane blight/spur blight	Raspberry leaf spot / Septoria leaf spot	Botrytis fruit rot	Rusts (orange and late leaf)	Powdery mildew	Phytophthora root rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Phostrol phosphorous acid	33	x	u	x	x	x	x	E	4h 0d	varies 4
Quilt Xcel azoxystrobin + propiconazole	11+3	E	E	E	G	G	G	x	12h 30d	63 fl. oz. 3
Rally 40WSP myclobutanil	3	x	x	x	x	E	E	x	24h 0d	10 oz. NA
Ridomil Gold SL mefenoxam	4	x	x	x	x	x	x	E	48h 45d	3.6 pt. 1
Rovral 4F iprodione	2	x	x	x	E	x	x	x	24h 0d	8 pt. 4
Sulforix calcium polysulfide	M	E	G	G	x	x	x	x	48h 0d	varies NA
sulfur sulfur	M	G	x	x	x	x	F	x	24h 0d	varies NA
Switch 62.5WG cyprodinil + fludioxonil	9+12	x	u	x	E	x	x	x	12h 0d	56 oz. 2
Tanos (DW) famoxadone + cymoxanil	11+27	s	G	G	x	x	x	x	12h 0d	72 oz. NA
Tilt (EC) propiconazole	3	x	G	x	x	E	E	x	12h 30d	30 fl. oz. 5

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] FRAC code represents the mode of action of the fungicide.

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[4] All fungicides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

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STRAWBERRY

Strawberry Spray Schedule

Section Editors: Entomology: R. Bessin, E. Long and C. Welty
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Strawberry Pre-plant

Pest/Problem	Material	Rate/Acre	Comments
anthracnose, crown rot	Abound	5-8 oz./100 gal. water	Dip entire plants for 2-5 minutes, and transplant as quickly as possible. Do not reuse solution. Delayed planting may cause plant stunting.
	Switch	5-8 fl. oz./100 gal. water	
Phytophthora crown rot, Pythium root rot	Aliette	2 pt./100 gal. water	Dip entire plants for 15-30 minutes and transplant as quickly as possible. Do not reuse solution. Delayed planting may stunt plants.
	Phostrol	2-4 pt.	
	ProPhyt	2.5-5 lb.	
	Rampart	1-3 qt.	

Strawberry Early Spring (Pre-bloom)

Apply when new leaves are expanding and blossom buds are visible.

Pest/Problem	Material	Rate/Acre	Comments
powdery mildew, leaf spot, leaf scorch, leaf blight, anthracnose	Abound	6.0-15.5 fl. oz.	Registered for control of leaf spot, powdery mildew, and anthracnose. Generic azoxystrobin products include Acadia, Aframe, AzoxyStar, and more.
	Aftershock	2.0-5.7 fl. oz.	Not labeled for leaf spots, scorch, or blight. For anthracnose and powdery mildew. Suppresses Botrytis. Also available as Evito 480SC.
	Cabrio 20EG	12-14 oz.	
	Captan 80WP	1.87-3.75 lb.	
	Captec 4L	1.5-3.0 qt.	
	Flint Extra	2.5-3.0 fl. oz.	Controls powdery mildew and Phomopsis. Suppresses anthracnose.
	Fontelis	16-24 oz.	For powdery mildew only. Do not use on Clancy, Jewel and L'amour varieties.
	Luna Privilege	3.2-6.84 fl. oz.	Not labeled for anthracnose or leaf blight.
	Luna Sensation	4-7.6 fl. oz.	Controls powdery mildew, leaf spot, anthracnose, and Phomopsis leaf blight.
	Luna Tranquility	16-27 fl. oz.	Controls powdery mildew. Suppresses leaf spot and Phomopsis blight.
	Merivon	4-8 fl. oz.	Higher rates are needed for control of anthracnose.
	Mettle	3-5 fl. oz.	Does not control anthracnose.
	Miravis Prime	9.1-13.4 oz.	
	Pristine	18.5-23 oz.	Registered for control of leaf spot, powdery mildew, and anthracnose.
	Procure 480SC	4-8 fl. oz.	Highly effective for control of powdery mildew only.
	Quadris Top	12-14 fl. oz.	Not labeled for leaf spot, scorch, or blight.
	Quilt Xcel	14 fl. oz.	Generics include Aframe Plus and Cover XL.
	Quintec 2.08F	4-6 fl. oz.	Controls powdery mildew only and must be used in a protectant program.
	Rally 40WSP	2.5-5 oz.	Highly effective for control of powdery mildew and leaf blight. Does not control anthracnose.
	Switch	11.0-14 oz.	Not labeled for leaf spots, scorch, or blight.
	Tilt	4 fl. oz.	Tilt is a propiconazole. Generics include Bumper, Protocol, Topaz, and more.
	Topguard EQ	5-8 oz.	Do not use with silicone surfactants.
	Torino	3.4 fl. oz.	Controls powdery mildew only and must be used in a protectant program.

(continued)

Strawberry Early Spring (Pre-bloom) *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
red stele	See Leather Rot and Red Stele, page 177.		
strawberry clipper (bud weevil)	Watch for clipper when flower buds start coming out of the crown and when temperatures approach 65˚F. Treat if the number of clipped buds per meter of row is 3 or more primary buds, or 30 or more secondary or tertiary buds. Infestations begin at field edge so border spray is often sufficient.		
	Actara 25WG	4 oz.	
	Brigade WSB (10WP)	6.4-32 oz.	
	Danitol 2.4EC	16-21.33 fl. oz.	
	Lorsban 4EC	1 qt.	
	Lorsban 75WG	1.33 lb.	
	Sevin XLR Plus (4F)	1-2 qt.	
eastern flower thrips	Sample when first blossom buds begin to open. Threshold is 2-10 thrips per blossom. Treat before widespread bloom draws pollinators. Lorsban, Danitol, and Brigade are not labeled specifically for thrips control in strawberries but have been effective in field use at rates listed for clipper or spittlebug and tarnished plant bug.		
	Assail 30SG	4-6.9 oz.	
	Entrust 2SC	4-6 fl. oz.	Not for use against this pest in Indiana.
	Radiant 1SC	6-10 fl. oz.	
	Sivanto Prime	10.5-14 fl. oz.	
spittlebug, tarnished plant bug (adults)	If a problem, apply when buds first become visible, and make a second application just before the first bloom opens.		
	Admire Pro (4.6F)	1.3 fl. oz.	Foliar spray for spittlebug.
	Assail 30SG	1.9-6.9 oz.	Low rate for spittlebug only.
	Beleaf 50SG	2.8 oz.	For plant bugs only.
	Brigade WSB (10WP)	6.4-32 oz.	
	Closer 2SC	2.75-4.5 fl. oz.	For plant bugs only.
	Danitol 2.4EC	10.67 fl. oz.	
	Rimon 0.83EC	9-12 fl. oz.	Only for plant bug control.
	Sevin XLR Plus (4F)	1.5-2 qt.	Other formulations may be available.
	Transform 50WG	1.5-2.25 oz.	
spider mites	Acramite 50WS	0.75-1.0 lb.	
	Agri-Mek SC	3.5 fl. oz.	Must use an adjuvant.
	Danitol 2.4EC	16-21.33 fl. oz.	
	Kanemite 15SC	21-31 fl. oz.	
	Nealta 1.67SC	13.7 fl. oz.	
	Nexter 75WP	4.4-10.67 oz.	
	Oberon 2SC	12-16 fl. oz.	
	Portal XLO	2 pt.	
	Savey 50DF	6 oz.	Kills eggs and young nymphs, not adults.
	Zeal 72WP	2-3 oz.	Zeal is primarily an ovicide/larvicide and, if needed, should be used early in the season.
cyclamen mite	Portal XLO	2 pt.	

Strawberry Early Bloom through Bloom

Apply from 5-10% bloom until flowers have finished blooming.

Pest/Problem	Material	Rate/Acre	Comments
Botrytis blossom blight and fruit rot	The most critical period for control of Botrytis fruit rot is during bloom.		
	Captan 80WDG	1.9 to 3.75 lb.	
	Captec 4L	1.5-3.0 qt./100 gal. water	
	CaptEvate 68WG	3.5-5.25 lb.	A combination of Captan plus Elevate. At the high rate of CaptEvate, the amount of active ingredient of Captan and Elevate are equal to each product used alone.
	Elevate 50WG	1.5 lb.	Never use alone for seasonlong Botrytis control because of the potential for pathogen strains to develop resistance. Use 1.0-1.5 lb. rate in a tank mix.
	Flint Extra	2.5-3.0 fl. oz.	Also controls powdery mildew and Phomopsis. Suppresses anthracnose.
Botrytis blossom blight and fruit rot	Fontelis	16-24 fl. oz.	The label states: For use on strawberry (except Clancy, Jewel, and L'Amour varieties). Note: Foliar reddening may occur if applied to some matted row varieties such as Clancy, Jewel, and L'Amour under certain environmental conditions. Discontinue applications if signs of crop injury appear. Not all varieties have been tested.
	Intuity	6 fl. oz.	Controls Botrytis. Suppresses powdery mildew.
	Kenja 400SC	13.5-15.5 fl. oz.	Also for powdery mildew and anthracnose.
	Luna Privilege	6.84 fl. oz.	
	Luna Sensation	6-7.6 fl. oz.	Higher rate controls Botrtytis, powdery mildew, leaf spot, anthracnose, and Phomopsis leaf blight.
	Luna Tranquility	16-27 fl. oz.	Controls Botrytis, powdery mildew. Suppresses leaf spot and Phomopsis blight.
	Merivon	8-11 fl. oz.	Begin applications no later than 10% bloom.
	Miravis Prime	9.1-13.4 oz.	Effective against botrytis, powdery mildew and anthracnose.
	PhD	3.75-13 oz.	Also available as OSO 5%WDG.
	Pristine	18.5-23 oz.	Begin applications no later than 10% bloom.
	Rovral 4F	2.0 pt.	For control of anthracnose leaf spot, Phomposis rot, and grey mold. This is the best timing for the application of this fungicide. Do not exceed 1 application per season. Use rate of 1.0 pt. in tank mix. Use 100 gal/A carrier. Generics available.
	Scala SC	18 fl. oz.	Use 9-18 fl. oz. rate in tank mix.
	Switch 62.5WG	11-14 oz.	Never use alone for season-long Botrytis control because of the potential for pathogen strains to develop resistance. Provides excellent control of Botrytis fruit rot (gray mold) and has been reported to have good activity against anthracnose fruit rot.
	Thiram 24/7	2-6 qt.	
	Tilt	4 fl. oz.	Generic propiconazole products include Bumper, Propicure, Propimax, Protocol and more.
	Topsin M WSB **PLUS**	0.75-1 lb.	Never use alone for season long Botrytis control because of the potential for pathogen strains to develop resistance.
	Captan 80WDG **OR** Thiram 65WP	1.9 to 3.75 lb. 4 lb.	
powdery mildew, leaf spot, leaf blight, leaf scorch	Abound	6.0-15.5 fl. oz.	Registered for control of powdery mildew and anthracnose. Generic azoxystrobin products include Acadia, Aframe, AzoxyStar, and more.
	Aftershock	2-5.7 fl. oz.	Labeled for powdery mildew. Generics available.
	Cabrio 20EG	14 oz.	Registered for control of leaf spot, powdery mildew, and anthracnose.
	Captan 80WDG	1.9 to 3.75 lb.	
	Captec 4L	1.5-3.0 qt./100 gal. water	

(continued)

Strawberry Early Bloom through Bloom *(continued)*

Pest/Problem	Material	Rate/Acre	Comments
powdery mildew, leaf spot, leaf blight, leaf scorch (continued)	Kenja 400SC	13.5-15.5 fl. oz.	Labeled for powdery mildew.
	Luna Privilege	4-6.84 fl. oz.	
	Luna Sensation	4-7.6 fl. oz.	
	Luna Tranquility	16-27 fl. oz.	
	Merivon	4-8 fl. oz.	
	Miravis Prime	9.1-13.4 oz	
	Mettle	3-5 fl. oz.	Does not control anthracnose.
	Pristine	18.5-23 oz.	
	Procure 480SC	4-8 fl. oz.	Controls powdery mildew only.
	Quadris Top	12-14 fl. oz.	
	Quilt Xcel	14 fl. oz.	
	Quintec 2.08F	4-6 fl. oz.	
	Rally 40WSP	2.5-5 oz.	Very effective for control of powdery mildew and Phomopsis leaf blight. Leaf spot is also listed on the label. Not effective for control of Botrytis fruit rot (gray mold).
	Syllit	1.5-2.0 lb.	
	Tilt	4 fl. oz.	
	Topsin M	0.75-1.0 lb.	Fungicide resistance may be an issue.
	Torino	3.4 oz.	
anthracnose fruit rot	Abound	6.0-15.5 fl. oz.	Generic azoxystrobin products include Acadia, Aframe, AzoxyStar, and more.
	Aftershock	2.0-5.7 fl. oz.	
	Cabrio 20EG	12-14 oz.	
	Captan 50WP	3-6 lb.	
	Captan 80WDG	1.9 to 3.75 lb.	
	Captec 4L	1.5-3.0 qt./100 gal. water	
	CaptEvate	5.25 lb.	
	Flint Extra	2.5-3 fl. oz.	0-day PHI.
	Kenja 400SC	13.5-15.5 fl. oz.	
	Luna Privilege	4-6.84 fl. oz.	
	Luna Sensation	6-7.6 fl. oz.	Higher rate controls Botrtytis, along with powdery mildew, leaf spot, anthracnose, and Phomopsis leaf blight.
	Miravis Prime	9.1-13.4 oz.	
	PhD	3.75-13 oz.	
	Pristine 38WG	18.5-23 oz.	
	Quadris Top	12-14 fl. oz.	
	Quilt Xcel	14 fl. oz.	
	Switch 62.5WG	11-14 oz.	
	Tilt	4 fl. oz.	Tilt is a propiconazole. Generics include Bumper, Protocol, Topaz, and more.
	Topguard EQ	5-8 oz.	21-day PHI. For anthracnose fruit rot, powdery mildew, and leather rot. Suppresses Botrytis on foliage.
	Topsin M WSB	0.75-1.0 lb.	
	OR ANY OF THE ABOVE PLUS:		
	Captan 80WDG	1.9 to 3.75 lb.	Under heavy disease pressure for anthracnose, all fungicides should be combined with Captan. Using Captan close to harvest may result in visible fungicide residues on the fruit and should be avoided.
insects	**SAVE THE BEES!** Do not apply insecticides during bloom.		

Strawberry Post-bloom to Harvest

Apply every 7-10 days as needed. Be sure to check PHIs. See Fungicide PHIs and REIs (pages 180-181) and Insecticide and Miticide PHIs and REIs tables (pages 182-184).

Pest/Problem	Material	Rate/Acre	Comments
Botrytis fruit rot	Same as for Strawberry Early Bloom through Bloom, page 173. A good layer of straw mulch reduces berry contact with soil and lessens fruit rot problems, especially leather rot. The wetter the season, the more necessary it is to maintain a thorough spray program. The use of Captan, Thiram or CaptEvate close to harvest may result in visible fungicide residues on the fruit. Elevate, Merivon, Pristine, Switch, or Topsin M alone result in little or no visible residues.		
anthracnose fruit rot	Same as for Strawberry Early Bloom through Bloom, page 174. See note about visible fungicide residue on fruit. See Anthracnose Fruit Rot page 177.		
leather rot	Annual plantings: Apply up to 3 times per crop. Make the first application after transplanting. Make the second application 30 days before the beginning of harvest or at fruit set. Apply the third application during harvest, depending on disease pressure and environmental conditions. Established plantings: Apply up to 3 times per crop. Make the first application in the spring after the ground thaws and before first bloom. Make a second application after harvest in the fall. For control of leather rot, make an additional application during the growing season at fruit set.		
	Abound	6.0-15.5 fl. oz.	Generic azoxystrobin products include Acadia, Aframe, AzoxyStar, and more.
	Aliette	2 pt./100 gal. water	
	Cabrio 20EG	12-14 oz.	
	phosphorous acid products	See label	See Leather Rot and Red Stele (page 177) for rates and timing.
	Ridomil Gold SL	1 pt.	
powdery mildew, leaf spot, leaf blight, leaf scorch	Same as for Strawberry Early Bloom through Bloom, page 174.		
spittlebug, tarnished plant bug (nymphs)	Make every effort to protect bees by spraying when bees are not active. Follow all harvest restrictions.		
	Admire Pro (4.6F)	1.3 fl. oz.	Foliar spray for spittlebug.
	Assail 30SG	1.9-6.9 oz.	Low rate for spittlebug only.
	Beleaf 50SG	2.8 oz.	For plant bugs only.
	Brigade WSB (10WP)	6.4-32 oz.	
	Danitol 2.4EC	10.67 fl. oz.	
	Rimon 0.83EC	9-12 fl. oz.	For plant bug control only.
	Sevin XLR Plus (4F)	1.5-2 qt.	Other formulations may be available.
	Transform 50WG	1.5-2.25 oz.	
leafrollers, other caterpillars	Assail 30SG	4-6.9 oz.	
	Brigade 10WP (WSB)	6.4-32 oz.	
	Bt (Bacillus thuringiensis)		See Generic Insecticides (pages 219-220) for a list of products that contain *Bacillus thuringiensis.* See individual product labels for rates and application details.
	Coragen 1.67SC	3.5-7.5 fl. oz.	
	Danitol 2.4 EC	10.67-21.33 fl. oz.	
	Entrust 2SC	4-6 fl. oz.	
	Harvanta 50SL	10.9-16.4 fl. oz.	
	Radiant 1SC	6-10 oz.	
	Rimon 0.83EC	9-12 fl. oz.	
strawberry sap beetle	As an alternative to insecticides to control sap beetle during harvest, use bait buckets containing over-ripe fruit placed in field between berry patch and wooded area.		
	Assail 30SG	4-6.9 oz.	
	Brigade WSB (10WP)	6.4-32 oz.	
	Danitol 2.4EC	16-21.33 fl. oz.	2-day PHI.
	Rimon 0.83EC	12 fl. oz.	Apply when adults appear and prior to egg hatch.

(continued)

Strawberry Post-bloom to Harvest *(continued)*

Drosophila (also known as fruit flies and vinegar flies), including spotted wing Drosophila	Brigade WSB (10WP)	5.3-16 oz.	
	Danitol 2.4EC	16-21.33 fl. oz.	
	Exirel 0.83SE	13.5-20.5 fl. oz.	
	Radiant 1SC	6-10 fl. oz.	
slugs	Broadcast baits before berries form, or apply to soil surface in band between rows after berries form. Best if applied in the evening after rain or irrigation.		
	Deadline MP's (4% bait)	25 lb.	
	Sluggo	20-44 lb.	
crickets	Sevin 5 Bait	40 lb.	7-day PHI.
strawberry rootworm (adult beetles)	Insecticides used for control of other strawberry pests are likely to control this pest as well. It builds up in perennially grown strawberries, not those replanted yearly and grown on plastic mulch.		

Strawberry Harvest

Apply during fruit harvest season.

Pest/Problem	Material	Rate/Acre	Comments
Botrytis fruit rot	Note: Controlling Botrytis during bloom greatly reduces or eliminates the need for additional fungicide applications during harvest. Using some products (such as Captan and Thiram) immediately prior to or during harvest may result in unsightly residues on fruit.		
	Elevate 50WG	1.5 lb.	0-day PHI.
	Fontelis	16-24 fl. oz.	The Fontelis label states: For use on strawberry (except Clancy, Jewel, and L'Amour varieties). Note: Foliar reddening may occur if applied to some matted row varieties such as Clancy, Jewel, and L'Amour under certain environmental conditions. Discontinue applications if signs of crop injury appear. Not all varieties have been tested. Also effective on anthracnose fruit rot.
	Luna Privilege	4-6.8 fl. oz.	
	Luna Sensation	6-7.6 fl. oz.	Can be used up to day of harvest. Also effective on anthracnose fruit rot.
	Luna Tranquility	16-27 fl. oz.	1-day PHI.
	Merivon	8-11 fl. oz.	0-day PHI. Also effective on anthracnose fruit rot.
	Miravis Prime	9.1-13-4 oz.	Also effective on anthracnose fruit rot.
	PhD	3.75-13.0 fl. oz.	0-day PHI. Also effective on anthracnose fruit rot.
	Pristine	18.5-23 oz.	Also effective on anthracnose fruit rot.
	Scala SC	18 fl. oz.	
	Switch 62.5WG	11-14 oz.	0-day PHI.
	Topsin M WSB	0.75-1 lb.	1-day PHI.
	OR ANY OF THE ABOVE PLUS:		
	Captan 80WDG	1.9 to 3.75 lb.	Adding Captan should result in a higher level of disease control; however, Captan used at higher rates and closer to harvest may leave visible residues on fruit.
anthracnose fruit rot	See Anthracnose Fruit Rot, page 177. See note on visible fungicide residue on fruit.		
leather rot	See Leather Rot and Red Stele, page 177.		

Strawberry Post-harvest and New Plantings

Apply every 10-14 days as needed.

Pest/Problem	Material	Rate/Acre	Comments
anthracnose crown rot	If weather is warm and wet during planting or establishment, apply Abound, Cabrio, or Pristine as protectants. These fungicides may also be used to protect plugs prior to planting. Scout for anthracnose crown rot during autumn and spring when weather is conducive to disease. See section below on annual plasticulture production.		
leaf spot, leaf scorch, leaf blight	Maintaining healthy plant foliage late into fall results in better spring yields. Leaf diseases can increase, resulting in weak plants and increased primary inoculum for the next season. Extra fungicide sprays after harvest may be required.		
	Captan 80WDG	1.9 to 3.75 lb.	
	Thiram 24/7	2-6 qt.	
	Topsin M WSB	0.75-1 lb.	
powdery mildew, leaf blight, leaf spot, leaf scorch	Same as for Strawberry Early Bloom through Bloom, page 173.		
white grubs	Admire Pro	7-10.5 fl. oz.	Admire Pro and Platinum are for post-harvest soil application on perennial strawberries during renovation.
	Platinum 2SC	5-12 fl. oz.	
insects in new plantings, including strawberry root weevils	See notes on page 178.		
leather rot, red stele	See Leather Rot and Red Stele, page 177.		

Special Comments on the Strawberry Schedule

Annual Plasticulture Strawberry

Timely planting of healthy plugs is key to establishing a successful planting. Planting date influences runner and branch crown formation. Too early is better than too late. If planted too early, energy is directed toward runner formation; if planted too late, the 4-5 branch crowns that are desired at flowering may not develop in time. Research in Ohio and central Kentucky has identified early to mid-September as best for plugs in most years. Growers further north or at higher elevations in the Appalachian Mountains may be able to plant in late August, while growers further south or west may be able to plant slightly later. On-farm research over a number of years gives growers the best planting window for their particular location. Weed management in the row is usually accomplished by applying a pre-emergent herbicide beneath the plastic prior to laying the plastic to control winter annuals. Growers use different strategies to manage weeds between rows. Many have had success by simply planting a cover crop of annual ryegrass or cereal rye to suppress weeds and then killing it with a graminicide in the spring. Insect management is usually not a significant issue. All growers should plant disease-free plugs; however, it's also a good idea to make a fungicide application for anthracnose crown rot to the plug trays or to the plants in the field after planting, especially since infections may be present but symptoms can be delayed or go unnoticed until they become more serious.

Leather Rot and Red Stele

Ridomil is labeled for control of red stele, caused by *Phytophthora fragariae*, and leather rot, caused by *Phytophthora cactorum*. Treatment for perennial strawberries includes one application in the spring after the ground thaws and before first bloom, and a second application in the fall. For supplemental control of leather rot, an application may be made at fruit set.

Several phosphorous acid fungicides are labeled for control of red stele and leather rot. They all have essentially the same active ingredient. These products include Agri-Fos, Aliette, ProPhyt, Phostrol, and Rampart.

These materials are highly systemic as foliar sprays for leather rot control or as root dip for red stele control. Rates, recommendations for use, and prices vary among products.

Abound, Cabrio, and Pristine are all effective for control of leather rot when applied in a protectant program.

Anthracnose Fruit Rot

Anthracnose can be severe on both green and ripe (red) strawberry fruit. The disease is favored by high temperatures accompanied by rainfall before and

during harvest. If anthracnose was a problem last year, or is detected this growing season, consider an intensified fungicide spray program.

Abound, Cabrio 20EG, Luna Sensation, Merivon, Miravis Prime, Pristine and Quilt Xcel are registered for control of anthracnose. These fungicides are reported to have good to excellent activity against anthracnose and are recommended.

The risk for fungicide resistance is high in the fungi that cause anthracnose. To prevent or delay fungicide resistance, follow label recommendations on rotations and maximum numbers of applications per season. Abound, Cabrio, Pristine, Luna Sensation, Merivon and one component of Quilt Xcel are all in the same class of chemistry (FRAC 11) and cannot be alternated with each other as a fungicide resistance management strategy. The same holds true for the many FRAC 7 fungicides (Fontelis, Kenja, all Luna products and Miravis Prime), and the premix (FRAC 7+11) fungicides Luna Sensation, Pristine and Merivon.

Captan is the standard for anthracnose control but is not as effective as Abound, Cabrio, or Pristine. However, little to no risk of fungicide resistance is associated with it. Switch is also reported to have some activity against anthracnose. Therefore, alternate Captan or Switch with Abound, Cabrio, Luna Sensation, Merivon, Miravis Prime, Pristine or Quilt Xcel. Under heavy disease pressure, consider using a combination (tank mix) of Abound, Cabrio, Pristine, Merivon, Miravis Prime, or Quilt Xcel plus Captan. These materials must be used in a protectant program. Once the disease is in the field, it is difficult to control with fungicides.

Strawberry Root Weevil or Black Vine Weevil

The larvae of these pests damage strawberry roots. The weevils lack mobility, so infestations do not spread rapidly. Be sure that nursery stock is not infested before planting. Plow under old plantings soon after harvest, and locate new plantings 300 feet away.

Adult weevils can be killed by one or more foliar sprays of Brigade 10WP. Platinum 2SC is labeled for soil application to control root weevil larvae.

Potato Leafhopper

Strawberry foliage can be damaged by adult potato leafhoppers that feed for a short time, then leave. Damaged leaves become crinkled and turn yellow to brown at the margins. Damage is often detected after leafhoppers have left the field.

Carbaryl (Sevin) is labeled for control of this pest. Courier can be used for leafhopper control but affects only immature leafhoppers. Brigade, Danitol, and Diazinon do not list leafhoppers on their labels but should also provide control.

Disease Resistance of Strawberry Cultivars Commonly Grown in the Midwest[1]

Cultivar	Verticillium wilt	red stele	leaf disease[2]	powdery mildew
June Bearing				
AC Valley Sunset	R	R	R	U
Allstar	T	R	T	T
Annapolis	I	R	S	S
Brunswick	U	R	U	U
Cabot	U	R	T	R
Cavendish	I	R	PR	S
Clancy	U	R	R	R
DarSelect	U	U	T	VS
Daroyal	U	U	U	U
Donna	U	U	U	U
Earliglow	R	R	R	PR
Flavorfest	T	R	R	T
Galletta	U	U	U	U
Glooscap	S	VS	T	T
Guardian	R	R	R	S
Herriot	R	U	PR	U
Honeoye	S	S	PR	T
Itasca	U	R	R	U
Jewel	S	S	PR	R
Kent	S	S	S	T
L'Amour	U	R	PR	T
Lateglow	R	R	R	U
Mayflower	U	U	U	U
Mesabi	R	R	R	R
Mira	U	R	S	R
Northeaster	R	R	I	S
Ovation	U	R	R	VS
Redchief	PR	R	R	R
Seneca	S	S	U	U
Sonata	U	S	U	PR
Surecrop	R	R	T	R
AC Wendy	S	R	T	MR
Winona	T	R	R	T
Day Neutral				
Albion	R	R	T	R
Tribute	PR	R	T	R
Tristar	R	R	T	R
Seascape	U	R	S	R
San Andreas	T	U	S	R
Plasticulture System				
Camarosa	U	U	S	S
Chandler	U	S	S	S
Sweet Charlie	U	U	U	R

[1] I = intermediate. PR = partially resistant. R = resistant. S = susceptible. T = tolerant. U = unknown.

[2] Includes leaf spot and leaf scorch.

Effectiveness of Fungicides for Control of Strawberry Diseases[1]

Data collated and compiled by Janna Beckerman

Product and formulation Active ingredient	FRAC Code[2]	Anthracnose crown	Anthracnose fruit rot	Gray mold (Botrytis)	Leaf blight (Phomopsis)	Leaf Scorch (Diplocarpon)	Leaf spot (Mycosphaerella)	Powdery mildew	Leather rot / red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC) azoxystrobin	11	G[r]	x	G[r]	x	x	x	G	E	4h 0d	61.5 fl. oz. NA
Aftershock/Evito 480SC fluoxystrobin	11	G	G	s	x	x	x	G	x	12h 1d	22.8 fl. oz. 4
Aliette WDG fosetyl-AL	33	x	x	x	x	x	x	x	E	12h 1d	30 lb. NA
Cabrio EG (20EG) pyraclostrobin	11	E	G	G	x	x	G	E	E	12h 0d	70 oz. NA
Captan (80WDG) captan	M	G	F	G	G	G	G	G	F	24h 0d	30 lb. NA
CaptEvate (68WG) captan + fenhexamid	M	G	F	E	F	x	G	x	x	48h 30d	21 lb. NA
Copper, assorted copper	M1	x	x	x	F	F	F	x	x	See label NA	NA NA
Elevate 50WDG fenhexamid	17	x	x	E[r]	x	x	x	x	x	4h 0d	6 lb. NA
Flint Extra trifloxystrobin (higher rate)	11	G	E	G	G	x	x	G	x	12h 0d	18 fl. oz. 6
Fontelis (SC) penthiopyrad	7	G	E	E	x	x	x	E	x	12h 0d	72 fl. oz. NA
Fracture Banda de Lupinus alba doce	M12	x	x	G	x	x	x	G	x	4 h 1d	NA 5
Intuity (SC) mandistrobin	11	x	x	E	x	x	x	s-E	x	12h 0d	12 fl. oz. 2
Kenja 400SC isofetamid	7	i	i	E	x	x	x	x	x	12h 0d	54 fl. oz. NA
Luna Privilege fluopyram	7	G	G	E	x	x	G	G	x	12 h NL	13.7 fl. oz 2
Luna Sensation (SC) fluopyram + trifloxystrobin	7+11	E	E	G	x	x	G	E	E	12h 0d	27.1 fl. oz. NA
Luna Tranquility (SC) fluopyram + pyrimethanil	7+9	x	x	E	G	x	G	E	x	12h 1d	54.7 fl. oz. NA
Merivon fluxapyroxad + pyraclostobin	7+11	E	E	E	E	G	E	F	x	12h 0d	33 fl. oz. 3

(continued)

Effectiveness of Fungicides for Control of Strawberry Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Anthracnose crown	Anthracnose fruit rot	Gray mold (Botrytis)	Leaf blight (Phomopsis)	Leaf Scorch (Diplocarpon)	Leaf spot (Mycosphaerella)	Powdery mildew	Leather rot / red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Mettle 125ME tetraconazole	3	x	x	x	G	G	G	E	x	12h 0d	20 fl. oz. 4
Miravis Prime Pydiflumetofen + fludioxanil	7+12	E	E	E	G	x	x	G	x	12 h 0 d	27.2 oz 4
OSO 5% Polyoxin D	19	G	G	E	x	x	x	G	s	4h 0d	78 fl. oz. NA
Phosphorous acid: Agrifos, Phostrol, Rampart, etc. phosphorous acid	33	x	x	x	x	x	x	x	E-F	4h 0d	NA NA
Protocol (L) thiophanate-methyl + propiconazole	1+3	G	G	G	x	x	G	G	x	24h 1d	5.3 pt. NA
Pristine pyraclostrobin + boscalid	7+11	G	E	E	G	x	G	E	E	12h 0d	115 oz. 5
Procure 480SC triflumizole	3	x	x	x	x	x	x	G	i	12h 1d	32 fl. oz. NA
Quadris Top (SC) difenoconazole + azoxystrobin	3+11	G	E	G	x	x	G	G	x	12h 0d	56 fl. oz. 4
Quilt Xcel (SE) azoxystrobin + propiconazole	11+3	G	G	F	x	x	x	E	x	12h 0d	56 fl. oz. 4
Quintec 2.08F quinoxyfen	13	x	x	x	x	x	x	E	x	24h 1d	24 fl. oz. 4
Rally 40WSP myclobutanil	3	x	x	x	F	x	G	E	x	24h 0d	30 oz. NA
Ridomil Gold SL mefenoxam	4	x	x	x	x	x	x	x	E[r]	48h 0d	1.5 lb. 3
Rovral 4F iprodione	2	x	x	G[r]	x	x	G	x	x	24h 0d	N/A 1
Scala SC pyrimethanil	9	x	x	E[r]	x	x	x	x	x	12h 1d	54 fl. oz. NA
Switch 62.5WG cyprodinil + fludioxonil	9+12	G	E	E	x	x	F	x	x	12h 0d	56 oz. NA
Thiram (65WP), Thiram Granuflow thiram	M	F	F	G	x	x	x	G	x	24h 1d	NA 12
Tilt (EC) propiconazole	3	x	x	x	x	x	x	G	x	12h 0d	16 fl. oz. NA
Topguard EQ (SC) azoxystrobin + flutriafol	3+11	G	G	x	x	x	x	E	G	12h 0d	32 fl. oz. 4

(continued)

Effectiveness of Fungicides for Control of Strawberry Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Anthracnose crown	Anthracnose fruit rot	Gray mold (Botrytis)	Leaf blight (Phomopsis)	Leaf Scorch (Diplocarpon)	Leaf spot (Mycosphaerella)	Powdery mildew	Leather rot / red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Topsin-M WSB6	1	G	E	G[r]	i	x	G	X	x	24h	4 lb.
thiophanate-methyl										1d	NA
Torino (SC)	U6	x	x	x	x	x	x	E	x	4h	7.2 oz.
cyflufenamid										3d	2

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] FRAC code represents the mode of action of the fungicide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All fungicides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Effectiveness of Pesticides for Control of Strawberry Insects and Mites[1]

Product and formulation Active Ingredient	IRAC Code[2]	clipper	cyclamen mite	eastern flower thrips	leafhoppers	Leafrollers	root weevils	rootworms	slugs	sap beetles	spider mites	spittlebug	tarnished plant bug	white grubs	Spotted-wing drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	UN	x	x	x	x	x	x	x	x	x	E	x	x	x	x	12h	NA
bifenazate																1d	1
Actara (25WDG)	4A	x	x	x	E	x	E	x	x	x	x	x	s	x	x	12h	12 oz.
thiamethoxam																3d	NA
Admire Pro (4.6F)	4A	x	x	x	x	x	x	x	x	x	x	G	x	E	x	12h	3.9-14 fl. oz.
imidacloprid																7 or 14d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	G	x	G	x	x	x	x	x	E	x	x	x	x	12h	14 fl. oz.
abamectin																3d	NA
Assail 30SG	4A	x	x	G	G	G	x	x	x	G	G	G	G	x	x	12h	13.8 oz.
acetamiprid																1d	2
Beleaf 50SG	9C	x	x	x	x	x	x	x	x	x	x	x	E	x	x	12h	8.4 oz.
flonicamid																0d	3
Brigade WSB (10WP) **(RUP)**	3A	E	x	x	x	G	G	x	x	E	F	E	E	x	x	12h	80 oz.
bifenthrin																0d	NA

(continued)

Effectiveness of Pesticides for Control of Strawberry Insects and Mites[1] *(continued)*

Product and formulation Active Ingredient	IRAC Code[2]	clipper	cyclamen mite	eastern flower thrips	leafhoppers	Leafrollers	root weevils	rootworms	slugs	sap beetles	spider mites	spittlebug	tarnished plant bug	white grubs	Spotted-wing drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Bt (Bacillus thuringiensis) *Bacillus thuringiensis*	11A	x	x	x	x	G	x	x	x	x	x	x	x	x	x	4h 0d	UN UN
Coragen (1.67SC) chlorantraniliprole	28	x	x	x	x	x	x	x	x	x	x	x	x	x	x	4h 1d	30.8 fl. oz. 8
Courier SC (3.6SC) buprofezin	16	x	x	x	F	x	x	x	x	x	x	x	x	x	x	12h 3d	27.2 fl. oz. 2
Closer sulfoxaflor	4C	x	x	s	x	x	x	x	x	x	x	x	u	x	x	12h 1d	17 oz. 4
Danitol 2.4EC **(RUP)** fenpropathrin	3A	E	u	x	G	E	G	x	x	x	F	x	x	x	E	24h 3d	32 fl. oz. NA
Deadline MP's (4% bait) metaldehyde	UN	x	x	x	x	x	x	x	G	x	x	x	x	x	x	12h 0d	75 lb. 3
Diazinon AG600 WBC **(RUP)** diazinon	1B	x	G	x	x	G	x	x	x	x	F	x	x	x	G	3d 5d	50.5 fl. oz. 2
Dicofol dicofol	UN	x	x	x	x	x	x	x	x	x	F	x	x	x	x	31d 2d	NA 1
Dibrom 8E **(RUP)** naled	1B	x	x	u	x	u	x	x	x	x	u	u	u	x	x	2d 1d	4.7 lb. 5
Entrust SC (2SC) spinosad	5	x	x	G	x	G	x	x	x	x	x	x	x	x	x	4h 1d	18 fl. oz. 3
Exirel (0.83SE) cyantraniliprole	28	x	x	u	x	x	x	x	x	x	x	x	x	x	E	12h 1d	61.5 fl. oz. 1d
Grandevo Chromobacterium	UN	x	u	u	x	G	x	x	x	x	u	x	u	x	x	4h 0d	NA NA
Harvanta 50SL cyclaniliprole	28	x	x	x	x	x	x	x	x	x	x	x	x	x	x	4h 1d	49.2 fl. oz. 3
Intrepid 2F methoxyfenozide	18	x	x	x	x	x	x	x	x	x	x	x	x	x	x	4h 3d	64 fl. oz. NA
Kanemite 15SC acequinocyl	20B	x	x	x	x	x	x	x	x	x	E	x	x	x	x	12h 1d	62 fl. oz. 2
Lorsban 4E **(RUP)** chlorpyrifos	1B	E	x	x	x	x	x	x	x	x	x	x	x	x	x	24h 21d	NA 1
Malathion malathion	1B	x	x	x	G	u	x	x	x	x	x	x	x	x	x	12h 3d	8 pt. 4
Nealta (1.67SC) cyflumetofen	25	x	x	x	x	x	x	x	x	x	G	x	x	x	x	12h 1d	27.4 fl. oz. 2

(continued)

Effectiveness of Pesticides for Control of Strawberry Insects and Mites[1] *(continued)*

Product and formulation Active Ingredient	IRAC Code[2]	clipper	cyclamen mite	eastern flower thrips	leafhoppers	Leafrollers	root weevils	rootworms	slugs	sap beetles	spider mites	spittlebug	tarnished plant bug	white grubs	Spotted-wing drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Nexter (75WP) pyridaben	21A	x	x	x	x	x	x	x	x	x	G	x	x	x	x	12h 1d	21.34 oz. 2
Oberon 2SC spiromesifen	23	x	x	x	x	x	x	x	x	x	G	x	x	x	x	12h 3d	48 fl. oz. 3
Platinum (2SC) thiamethoxam	4A	x	x	x	E	x	G	x	x	x	x	x	x	E	x	12h 50d	12 fl. oz. NA
Portal XLO (0.4EC) fenpyroximate	21	x	G	x	x	x	x	x	x	x	E	x	x	x	x	12h 1d	4 pt. 2
Radiant SC (1SC) spinetoram	5	x	x	G	x	E	x	x	x	x	x	x	x	x	E	4h 1d	30 fl. oz. 3
Rimon 0.83EC novaluron	15	x	x	u	x	x	x	x	x	E	x	x	E	x	x	12h 1d	36 fl. oz. NA
Savey 50DF hexythiazox	10A	x	x	x	x	x	x	x	x	x	E	x	x	x	x	12h 3d	6 oz. 1
Sevin XLR Plus (4F) carbaryl	1A	G	x	x	G	F	x	x	x	x	x	x	G	x	x	12h 7d	10 qt. 5
Sivanto Prime (1.67SC) flupyradifurone	4D	x	x	x	x	x	x	x	x	x	x	x	x	x	x	4h 0d	28 fl. oz. NA
Sluggo iron phosphate	UN	x	x	x	x	x	x	x	G	x	x	x	x	x	x	0d 0d	UN UN
Transform WG sulfoxaflor	4C	x	x	s	x	x	x	x	x	x	x	x	u	x	x	24h 1d	8.5 oz. 4
Vendex 50WP **(RUP)** fenbutatin-oxide (hexakis)	12B	x	x	x	x	x	x	x	x	x	G	x	x	x	x	2d 1d	4 lb. 1d
Zeal (72WP) etoxazole	10B	x	x	x	x	x	x	x	x	x	E	x	x	x	x	12h 1d	3 oz. 1

[1] Efficacy data in this publication are based on trials conducted across various regions and does not necessarily reflect local efficacy differences or changes over time. Growers should contact their Extension specialist for the most recent or for state-specific information. The information on this publication is only a guide; the authors and their institutions assume no liability for practices implemented based on this information. Always read and follow pesticide labels. The label is the law. Product registration may vary by state. E= excellent control; G=good control; F= fair control. [r] = Fungicide/Insecticide resistance possible. s= suppression only, i= not effective, u= effectiveness unknown, x= pest not on the label.

[2] IRAC code represents the mode of action of the insecticide.

[3] PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

[4] All insecticides have a Restricted-Entry Interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI. Restrictions in REI may prohibit the use of certain pesticides during harvest.
Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[5] Max amt refers to the product's maximum amount/ acre/year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

[6] Max app refers to the product's maximum number of applications per year. Applicators must abide by both maximum amount of product per season AND maximum number of applications.

Vole Control

Mice, known as voles, can cause serious damage to tree fruit plantings. Frequently, damage occurs but growers do not notice it until trees become weak, die, or are removed.

You can anticipate vole damage each year, particularly from late summer to early spring, as mice eat bark from the base of small saplings. Such damage can girdle and kill a tree. Apple trees are most susceptible, but hungry voles will attack other fruit trees. Apple trees on dwarfing rootstocks are particularly palatable to them.

Many plantings are made in a hedgerow pattern, which does not permit cultivation between trees. Such plantings favor vole migration, as do mulches and vigorous sods. High populations also favor vole migrations.

Voles can be a problem in blueberry plantings but almost never feed on grapes, blackberries, raspberries, or strawberries.

General Orchard Management Practices

You can employ several general orchard management practices to reduce the risk of injury and improve control. No single material or technique is effective for complete control of voles. We therefore suggest you vary both the materials and methods of control during the season.

You can construct tree guards from "hardware cloth" or similar materials with a mesh no larger than 0.25 inch. These guards should enclose the tree and extend from several inches below soil surface — voles dig in the top 2 to 3 inches of soil — to several inches above maximum snow line (about 18 inches).

Placing pea-sized gravel or cinders around the trees in a circle 4 to 6 inches wide and at the same depth tends to discourage meadow voles from attacking crowns of trees, but does not discourage other mouse species.

Voles need abundant cover to proliferate. Maintaining a clean area 1 to 2 feet around the base of each tree discourages surface feeding and also regulates vole populations long term. Chemical weed control in early spring significantly reduces the amount of labor involved in keeping the area around the tree clean.

Mow short the orchard cover or sod in late August and again after harvest to reduce runway cover and aid baiting. Cleaning out drainage ditches and fencerows, and picking up or crushing all dropped fruit, discourages large vole populations.

Orchard Vole Control Program

Essential Knowledge

The first thing you must do to control voles is to determine the problem species. Use snap traps for this. The three common species are meadow vole (*Microtus pennsylvanicus*), prairie vole (*Microtus ochrogaster*), and pine vole (*Pitymys pinetorum*). While the control materials for these species may be the same, the control methods differ.

You can make quick field identifications of vole species (for both juveniles and adults) based on the length of their tails:

Pine vole: Tail is about as long as its hind foot.

Meadow and prairie vole: Tail is about twice as long as its hind foot.

Determine timing and site of infestations with snap traps. Knowing when and where mice are most abundant makes control easier.

Control

You can control voles in orchards by using either zinc phosphide or chlorophacinone baits. You must use both baits according to label directions.

Zinc phosphide, a restricted use pesticide, is an acutely toxic bait that kills mice within 24 hours. It is available either as a weather-resistant pellet bait or mixed with prepared grains such as oats and corn. Zinc phosphide is usually well accepted by mice. However, it is not effective if applied more than twice.

Chlorophacinone (e.g., RoZol) is an anticoagulant bait available as a weather-resistant, pellet-style bait. It is highly accepted by rodents but does not kill them for several days. For effective control, make a second application of chlorophacinone within 20 to 40 days.

Use caution: Baits can be attractive to other wildlife, including birds, and domestic pets. You must apply bait directly in runways or bait stations (see below) or broadcast. Pick up all spilled materials to avoid consumption by non-target animals.

Efficacy of Baits Against Meadow and Pine Voles

Chlorophacinone is more effective against pine voles than meadow voles. Zinc phosphide is more effective against meadow voles than pine voles. Consistently using just one of these chemicals results in population shifts from one vole species to another. Therefore, alternate baiting using zinc phosphide in the first application, followed by chlorophacinone in the second application, to reduce populations of both species.

Baiting Techniques

There are three main baiting techniques.

1. **Machine baiting.** You expose bait in an artificial trail (Trail Builder).
2. **Trail baiting.** You expose bait only in natural, active runways.
3. **Broadcast baiting.** You broadcast bait by hand, cyclone-type seeder, or tractor-drawn equipment at recommended rates. *This technique is not recommended for pine vole control*. When using zinc phosphide baits, the 2% concentration is recommended.

Observe safety precautions: Zinc phosphide is a restricted use material. Read and follow all label directions and precautions.

Comparison of Baiting Techniques

Baiting Technique	Meadow or Prairie Vole Control (%)	Pine Vole Control (%)
Machine	90-95	80-85
Trail	80-85	70-75
Broadcast	78	not recommended

Timing

Apply rodenticides on a sunny day in late fall when voles are active. Voles begin to build up in early August, but delay baiting as late as possible in the fall. The most effective application period is just before snow cover, after frost reduces the grass cover and the fruit is rotted. Spot treatment during the winter and into early spring is recommended. Treat marginal lands to prevent re-invasion.

Pre-harvest Baiting Is Not Recommended

Applying poisoned bait before harvest to prevent vole damage to fruit in cold storage is not a sound practice for the following reasons:

1. The recommended methods of orchard vole control do not always provide 100 percent control. Some voles survive the pre-harvest control and enter fruit boxes on the ground that are carried into cold storage.
2. The pre-harvest poison application reduces the population of voles in the orchard, which greatly reduces competition among survivors, making food and cover ample. Under these favorable conditions, survivors breed, with as many as eight young per litter. In a very short time, populations may recover to original levels, and are not be exposed to poison baits applied during the normal control season.
3. The recommended control season for voles in orchard and winter storage facilities is just prior to freezing conditions. Note: Check your control program with snap traps. Lack of visible damage does not indicate the efficacy of your program.

Control in Storage

To protect fruit in storage from rodents, pay attention to what you do before and during harvest.

Before harvest

- Poison rats and mice in storage one month before picking. Keep storage area baited and free of debris.
- Clean up outside debris one week before picking. Pay special attention near loading areas.
- Use rodent-proof storage. Seal all holes and cracks. Mice can fit through a hole the size of a dime.

During harvest

- Move filled boxes into storage quickly. Any box left overnight may have mice.
- As you load fruit into storage, bait the storage area. Place teaspoonful amounts in bait stations, on floor, along alleys, between rows of boxes, and under pallets. Do not place open baits on floors or any areas where contamination might occur. Commercial bait stations are available from agricultural supply companies. Always prevent contact with fruit.

Bait Stations in the Orchard

You can prepare bait stations in several ways and eliminate or reduce the opportunity for non-target animals to contact the bait. Squares of heavy roofing shingles (or other weather-resistant materials) placed out of traffic areas between trees can serve as bait stations to protect the bait and hiding of rodents.

Some growers have constructed bait stations that require less refilling by building inverted T-shaped stations from PVC tubing and fittings that provide bait storage and a protected feeding area. Place bait stations in the field two or three weeks before adding the bait.

Vole Control for Small Fruit

Prozap zinc phosphide pellets are a restricted use pesticide labeled for vole control in highbush blueberries, blackberries, and red and black raspberries. Apply this product only in the dormant season after final harvest and not later than the beginning of leaf emergence in the spring. The minimum preharvest interval is 70 days. Do not apply when the ground is snow-covered.

You may broadcast bait with a cyclone seeder or by hand. When applying by hand, throw a tablespoon (12 grams) into heavy cover along bushes, rocky outcrops, and fence lines. Make two applications at a rate of 6 to 10 lb. per acre per application at a minimum interval of 21 days. The maximum application per growing season is 20 lb. per acre.

Fungicide PHIs and REIs

Fungicide Pre-harvest Intervals and Restricted Entry Intervals for Tree Fruit[1]

Consult product labels for complete restrictions and limitations.

Trade Names	Common Names	Pre-harvest Interval (days)					FRAC Code[2]	REI[3] (hours)
		Apple	Pear	Peach	Cherry	Plum		
Abound, AFrame	azoxystrobin	—	—	0	0	0	11	4
Aframe Plus	azoxystrobin+propiconazole	—	—	0	0	0	11+3	12
Aliette, Legion	fosetyl-AL	14*	14*	—	—	—	33	12
Agri-Fos, Phostrol, ProPhyt, Rampart	phosphorous acid	0	0	0	0	0	33	4
Agri-strep	streptomycin	50	30	—	—	—	25	12
Aprovia	benzovindiflupyr	30	30	—	—	—	7	12
Bayleton	triadimefon	0	0	—	—	—	3	12
Bravo and many generics	chlorothalonil	—	—	*SS	SS*	SS*	M	48
Captan	captan	0	—	0	0	0	M	4
CaptEvate	captan + fenhexamid	—	—	—	0	—	M+17	24
Carbamate	ferbam	7	7	21	4	7	M	24
Elevate	fenhexamid	—	0	0	0	0	17	12
Flint	trifloxystrobin	14*	14*	—	—	—	11	12
Flint Extra	Trifloxystrobin(higher rate)	14*	14*	—	—	—	11	12
Fontelis	penthiopyrad	28	28	0	0	0	7	12
Gem	trifloxystrobin	—	—	1	1	1	11	12
Indar	fenbuconazole	14*	—	0	0	0	3	12
Inspire Super	difenoconazole + cyprodinil	14	14*	2*	2*	—	3+9	12
Luna Experience	fluopyram + tebuconazole	—	—	0	0	0	7+3	12
Luna Sensation	fluopyram + trifloxystrobin	14	14	1	1	1	7+11	12
Luna Tranquility	fluopyram + pyrimethanil	72	—	—	—	—	7+9	12
Mancozeb: Penncozeb, Dithane M-45, Manzate	mancozeb	77*	77*	—	—	—	M	24
Merivon	fluxapyroxad + pyraclostrobin	0	0	0	0	0	7+11	12
Mycoshield, FireLine	oxytetracycline	—	60	21	—	—	—	*
Orbit	propiconazole	—	—	0*	0*	0*	3	24
OSO, Ph-d	Polyoxin D	0	0	0	0	0	19	4
Polyram	metiram	77*	—	—	—	—	M	24
Pristine	pyraclostrobin + boscalid	0*	0*	0*	0*	0*	11+7	12
Procure/Trionic	triflumizole	14	14	—	1	—	3	12
Quadris Top	azoxystrobin + difenoconazole	—	—	0	0	0	11+3	12
Quash	metconazole	—	—	14	14	14	3	12
Quintec	quinoxyfen	—	—	7*	7*	7*	13	12
Rally	myclobutanil	14	—	0	0	0	3	24
Rhyme	flutriofol	14	14	7	7	7	3	12
Ridomil Gold SL	mefenoxam	*	*	*	*	*	4	48
Rovral	iprodione	—	—	*	*	*	2	24
Scala	pyrimethanil	72	72	2*	—	2*	9	12
Sovran	kresoxim-methyl	30*	30*	—	—	—	11	12
Sulfur	sulfur	0	0	0	0	0	M	24

(continued)

Fungicide Pre-harvest Intervals and Restricted Entry Intervals for Tree Fruit *(continued)*

Trade Names	Common Names	Pre-harvest Interval (days)					FRAC Code[2]	REI[3] (hours)
		Apple	Pear	Peach	Cherry	Plum		
Syllit	dodine	7*	7*	15*	7	—	U12	48
Topguard/Topguard Specialty Crop	flutriafol	14*	14*	7*	7*	7*	3	12
Topguard EQ	azoxystrobin+ flutriafol	--	--	7	7	7	3+11	12
Topsin-M	thiophanate-methyl	0	1*	1	1	1	1	12
Torino	cyflufenamid	14	14	—	—	—	U6	4
Vangard	cyprodinil	0	0	2	2	2	9	12
Vintage	fenarimol	30	30	—	0	—	3	12
Ziram	ziram	14	14	14	14	—	M	48

[1] — = not registered or not recommended. * = Limited number of applications allowed or other restrictions apply — refer to label directions. SS= shucks-split
[2] FRAC Code represents the fungicide mode of action. For fungicide resistance management, do not tank mix or alternate fungicides with the same FRAC number in the spray program. M = multi-site inhibitors.
[3] All fungicides have an REI, which is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REIs. REI restrictions may prohibit the use of certain pesticides during harvest.
[4] The REI for most Captan formulations is 24 hours; however, some product labels still have a 4-day REI. See Use of Captan Fungicide on Tree Fruit-Restricted Entry Intervals (REI), page 50.

Insecticide and Miticide PHIs and REIs

Insecticide and Miticide Pre-harvest Intervals and Restricted Entry Intervals on Tree Fruit[1]

See Generic Insecticides, pages 219-220. *Consult product labels for complete restrictions and limitations.*

Trade Name	Common Name	Pre-harvest Interval (days)					IRAC[2]	REI[3] (hours)	Repirator required
		Apple	Pear	Peach	Cherry	Plum			
Acramite	bifenazate	7	7	3	3	3	20	12	
Actara	thiamethoxam	14/35	14/35	14	14	14	4A	12	
Admire Pro (foliar)	imidacloprid	7	7	0	7	7	4A	12	
Admire Pro (soil)	imidacloprid	21	21	21	21	21	4A	12	
Agri-Mek (RUP)	abamectin	28	28	21	21	21	6	12	
Altacor	chlorantraniliprole	5	5	10	10	10	28	4	
Apollo	clofentezine	45	21	21	21	—	10A	12	
Apta	tolfenpyrad	—	—	14	14	14	21A	12	Yes
Asana (RUP)	esfenvalerate	21*	28*	14*	14*	14*	3A	12	
Assail	acetamiprid	7	7	7	7	7	4A	12	Yes*
Avaunt	indoxacarb	14	28	14	14	14	22	12	
Baythroid XL (RUP)	beta-cyfluthrin	7	7	7	7	7	3A	12	No*
BeetleGONE!	*B. thuringiensis galleriae*	0	0	0	0	0	11A	4	Yes
Belay	clothianidin	7	7	21	—	—	4A	12	
Beleaf 50 SG	flonicamid	21	21	14	14	14	29	12	
Brigade (RUP)	bifenthrin	—	14	—	—	—	3A	12	
Centaur	buprofezin	14	14	14	14	14	16	12	
Closer	sulfoxaflor	7	7	7	7	7	4c	4	
Confirm	tebufenozide	14	14	—	—	—	18	4	
Cyd-X (OMRI)	codling moth granulovirus	0	0	—	—	—	—	4	Yes
Danitol (RUP)	fenpropathrin	14	14	3	3	3	3A	24	
Delegate	spinetoram	7	7	1	7	1	5	4	

(continued)

Insecticide and Miticide Pre-harvest Intervals and Restricted Entry Intervals on Tree Fruit[1] *(continued)*

Trade Name	Common Name	Pre-harvest Interval (days)					IRAC[2]	REI[3] (hours)	Repirator required
		Apple	Pear	Peach	Cherry	Plum			
Delta Gold (RUP)	deltamethrin	21	21	—	—	—	3A	12	
Dimethoate	dimethoate	—	28	—	—	—	1B	48	Yes
Dimilin* (RUP)	diflubenzuron	—	14	UPF	UPF	UPF	15	12	No*
Diazinon (RUP)	diazinon	21	21	21	21	21	1B	5 days	Yes
Dicofol	dicofol	7	7	—	—	—	—	35 days	Yes
Dipel (OMRI)	*Bacillus thuringiensis*	0	0	0	0	0	11A	4-12	Yes
Entrust (OMRI)	spinosad	7	7	1	7	1	5	4	Yes
Envidor	spirodiclofen	7	7	7	7	7	23	12	
Esteem	pyriproxyfen	45	45	14	14	14	7C	12	
Exirel	cyantraniliprole	3	3	3	3	3	28	12	
Imidan	phosmet	7	7	14	7	7	1B	72	Yes
Intrepid	methoxyfenozide	14	14	7	7	7	18	4	
Kanemite	acequinocyl	14	14	—	—	—	20B	12	
Lannate (RUP)	methomyl	14	7	4	—	—	1A	*	Yes
Lorsban (RUP, EC only)	chlorpyrifos	UPF*	*	14*	21	14	1B	4 days	Yes
Magister	fenazaquin	—	—	—	3	—	21	12	
Malathion	malathion	—	—	7	3	—	1B	12-24	
Movento	spirotetramat	7	7	7	7	7	23	24	
M-Pede (OMRI)	potassium salts of fatty acids	0	0	0	0	0	—	12	
Mustang Maxx (RUP)	zeta-cypermethrin	14	14	14	14	14	3A	12	
Nealta	cyflumetofen	7	7	—	—	—	25	12	
Neemix (OMRI)	azadirachtin	0	0	0	0	0	UN	12	
Nexter	pyridaben	25	7/10	7/10	7/10	7/10	21A	12	Yes
Onager	hexythiazox	28	28	7	7	7	10A	12	
Portal	fenpyroximate	14	14	7	7	7	21A	12	
Pounce (RUP)	permethrin	*	*	14*	3*	—	3A	12	
Proaxis (RUP)	gamma cyhalothrin	21	21	14	14	14	3A	24	
Proclaim (RUP)	emamectin benzoate	14	14	—	—	—	6	12	No*
Rimon	novaluron	14	—	8	—	8	15	12	
Saf-T-Side	horticultural oil	0	0	0	0	0	—	12	
Savey	hexythiazox	28	28	28	28	28	10A	12	
Sevin	carbaryl	3	3	3	3	3	1A	12	Yes
Sivanto Prime	flupyradifurone	14	14	14	14	14	4D	4	
Sunspray	horticultural oil	0	0	0	0	0	—	12	
Superior oil (some OMRI)	horticultural oil	*	*	*	*	*	—	12	
Supracide (RUP)	methidathion	*	*	*	*	*	1B	72	Yes
Surround (OMRI)	kaolin	0	0	0	0	0	—	4	Yes
Vendex (RUP)	fenbutatin-oxide	14	14	14	14	14	12B	48	Yes
Venom, Scorpion	dinotefuran	—	—	3/21	—	—	4A	12	
Vydate (RUP)	oxamyl	14	14	—	—	—	1A	48	Yes
Versys Inscalis	afidopyropen	7	7	7	7	7	9D	12	
Warrior (RUP)	lambda-cyhalothrin	21	21	14	14	14	3A	24	
Zeal	etoxazole	14	14	7	7	7	10B	12	

[1] — = not registered or not recommended. * = specific pre-harvest intervals or restricted entry intervals vary for different formulation, application rates, crops, or geographical location — refer to label directions. RUP = restricted use pesticide. OMRI = Organic Materials Review Institute — approved for use in organic production. UPF = until petal fall.
[2] IRAC code represents the mode of action of the insecticide.
[3] All insecticides have a restricted entry interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI and personal protection equipment (PPE) required for early re-entry. Restrictions in REI may prohibit the use of certain pesticides during harvest.

Note on Insecticide Resistance Management

Insects have been known to develop resistance to insecticides after repeated exposure. For insecticide resistance management, avoid successive applications of insecticides in the same group or type of chemistry. The Insecticide Resistance Action Committee codes (IRAC codes) listed in the tables above identify the various insecticide mode of action groups. Rotating to insecticides with a different IRAC code should help avoid development of insecticide resistance.

Fungicide Pre-harvest Intervals and Restricted Entry Intervals for Small Fruit[1]

See Generic Fungicides, page 218. *Consult product labels for complete restrictions and limitations*.

Trade Name	Common Name	Pre-harvest Intervals (days) (Maximum amount/acre/season)[2]				FRAC[3] Code	REI[4] (hours)
		Grape	Blueberry	Brambles	Strawberry		
Abound, AFrame	azoxystrobin	14 (92.3 fl. oz.)	0 (48 fl. oz.)	0 (92.3 fl. oz.)	0 (61.5 fl. oz)	11	4
AFrame Plus	azoxystrobin + propiconazole	—	30 (82 fl.oz.)	30 (105 fl. oz)	0 (56 fl. oz.)	11 + 3	12
Aftershock	fluoxystrobin	—	—	—	1	11	12
Aliette	fosetyl-AL	15*	0*(20 lb)	60(*)	12 hr.(30 lb)	33	12
Aprovia	benzovindiflupyr	21 (31.5 fl. oz.)	—	—	—	7	12
Basic copper sulfate	copper sulfate	0	—	0	0	M	24
Cabrio EG	pyraclostrobin	—	0 (56 oz.)	0 (56 oz.)	0 (56 oz.)	11	24
Captan 80WDG (formulations and times may vary)	captan	0 (15 lb.)	0 (43.75 lb.)	3(12.5 lb)	1(30 lb)	M	48
CaptEvate	captan + fenhexamid	—	0 (21 lb.)	0 (21 lb.)	3(21 lbs)	M + 17	24 strawberry 48 blueberry and raspberry[5]
Dithane, others	mancozeb	66*	—	—	—	M	24
Elevate	fenhexamid	0*(3lb.)	0 (6lb.)	0(6 lb.)	0*(6 lb.)	17	12
Endura	boscalid	14(24 oz.)	—	—	—	7	12
Evito	fluoxystrobin	—	—	—	1	11	12
Flint	trifloxystrobin	14(24 oz.)	—	—	1(19.2 oz.)	11	12
Fontelis	penthiopyrad	—	0(72 fl. oz.)	—	0(72 fl. oz.)	7	12
Forum	dimethomorph	28(30 fl. oz.)	—	—	—	40	12
Indar	fenbuconazole	—	30(24 fl. oz.)	—	—	3	12
Inspire Super	difenoconazole + cyprodinil	14*(80 fl. oz.)	7 (80 fl. oz.)	—	0(80 fl. oz.)	3 + 9	12
JMS Stylet Oil	oil	0	0	0	0	—	4
Kenja	isofetamid	14 (66 fl. oz.)	—	—	0 (54 fl. oz.)	7	12
Luna Experience	fluopyram + tebuconazole	14 (34 fl. oz.)	—	—	—	7 + 3	12
Luna Sensation	fluopyram + trifloxystrobin	—	0(27.1 fl. oz.)	—	0 (27.1 oz.)	7 + 11	12
Luna Tranquility	fluopyram + pyrimethanil	—	1 (54.7 fl. oz.)	0 (54.7 fl. oz.)	1 (54.7 oz.)	7 + 9	12
Merivon	fluxapyroxad + pyraclostrobin	14(33 oz)	—	—	0 (33 fl. oz.)	7 + 11	12
Mettle	tetraconazole	14	—	—	0	3	12
Omega	fluazinam	—	30 (7.5 pt.)	—	—	29	12
OSO	polyoxin D	0 (4.2 oz. a.i.)	0 (4.2 oz. a.i.)	0 (4.2 oz. a.i.)	0 (4.2 oz. a.i.)	19	4
Pristine	pyraclostrobin + boscalid	14*(23 oz)	0*(23 oz)	0*(92 oz)	0*(23 oz)	11 + 7	12[6]
Procure, Trionic	triflumizole	7 (32 oz.)	—	—	1	3	12
ProPhyt, Phostrol, Agri-Fos, Legion, Rampart	phosphorous acid	0	0	0*	0	33	4

(continued)

Fungicide Pre-harvest Intervals and Restricted Entry Intervals for Small Fruit[1] *(continued)*

Trade Name	Common Name	Pre-harvest Intervals (days) (Maximum amount/acre/season)[2]				FRAC[3] Code	REI[4] (hours)
		Grape	Blueberry	Brambles	Strawberry		
Proline	prothioconazole	—	—	7 (11.4 fl. oz.)	—	3	12
Protocol	thiophanate-methyl + propiconazole	—	—	—	1 (5.3 pt.)	1 + 3	24
Quadris Top	difenoconazole + azoxystrobin	14(56 fl. oz.)*	7(56 fl. oz.)	—	1(56 fl. oz.)	3 + 11	12
Quash	metconazole	—	—	7 (7.5 oz.)	—	3	12
Quilt Xcel	azoxystrobin + propiconazole	--	30 (82 fl. oz.)	30 (105 fl. oz.)	0 (56 fl. oz.)	11+ 3	12
Quintec	quinoxyfen	14*(33 fl. oz.)	—	—	1*(24 fl. oz.)	13	12
Rally	myclobutanil	14 (1.5 lb.)	—	1 (10 oz.)	1 (10 oz.)	3	24
Ranman	cyazofamid	30*(16.5 fl. oz.)	—	—	—	21	12
Reason	fenamidone	30 (8.1 fl. oz.)	—	—	—	11	12
Revus	mandipropamid	14(32 fl. oz.)	—	—		40	12
Revus Top	difenoconazole + mandipropamid	14*(28 fl. oz.)	—	—	—	3 + 40	12
Ridomil Gold SL	mefenoxam	—	*	45(0.9 gal.)	0(1.5 qt.)	4	48
Ridomil Gold MZ	mefenoxam + mancozeb	66(10 lb)*	—	—	—	4 + M	48
Rovral	iprodione	7**(8 pt.)	0*(8 pt.)	0*(8 pt.)	0*(2 pt.)	2	24 (fruit)/48 (grape)[7]
Scala	pyrimethanil	7(36 fl. oz.)	—	—	1(54 fl. oz.)	9	12[8]
Sovran	kresoxim-methyl	14*(25.6 oz.)	—	—	—	11	12
Sulforix	calcium polysulfide	0	0	0	—	M	48
Sulfur	sulfur	0	0	0	0	M	24
Switch	cyprodinil + fludioxonil	7	0 (56 oz.)	0 (56 oz.)	0 (56 oz.)	9 + 12	12
Tanos	famoxadone + cymoxanil	30(72 oz.)	—	0(72 oz.)	—	11 + 27	12
Tebuzol	tebuconazole	14(2 lb.)	—	—	—	3	12
Thiram	thiram	—	—	—	3	M	24
Tilt, Bumper,	propiconazole	—	30(30 fl. oz.)	30(30 fl. o.z)	0(16 fl. oz.)	3	12
Topsin M	thiophanate-methyl	14 (4 lb.)	—	—	1(4 lb.)	1	See label
Torino	cyflufenamid	3*(6.8 fl. oz.)	—	—	0(6.8 fl. oz.)	U6	4
Vangard	cyprodinil	7*(30 oz.)	—	—	—	9	12
Vivando	metrafenone	14 (42.6 fl. oz.)	—	—	—	U8	12
Zampro	ametoctradin + dimethomorph	14 (56 fl. oz.)	—	—	—	45 + 40	12
Ziram	ziram	21*(28 oz)	*	—	—	M	48

[1] — = not registered or not recommended. * = refer to label directions.

[2] Numbers in parentheses are the maximum amounts of the fungicide permitted per season.

[3] FRAC Code represents the fungicide mode of action. For fungicide resistance management, do not tank mix or alternate fungicides with the same FRAC number in the spray program. M = multi-site inhibitors.

[4] All fungicides have an REI, which is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REIs. REI; restrictions in REI may prohibit the use of certain pesticides during harvest.

[5] Captan has various formulations; refer to label. CaptEvate has different REIs for each crop. Refer to label.

[6] REI for Pristine is 12 hr EXCEPT for grapes when conducting cane tying, cane turning, or cane girdling, which is then 5 days.

[7] REI for Rovral is 48 hours on grapes ,24 hours on other fruit crops.

[8] REI for Scala is 24 hours on grapes, 12 hours on strawberries.

[9] REI for Topsin M WSB is 24 hours on strawberries, 48 hours on grapes.

Note on Fungicide Resistance Management

Plant pathogenic fungi have been known to evolve resistance to fungicides after repeated exposure. To manage fungicide resistance, avoid successive applications of fungicides in the same group or type of chemistry.

Several tables in this guide list Fungicide Resistance Action Committee (FRAC) codes. The FRAC codes identify the various fungicide mode of action groups. Rotating to fungicides with a different FRAC code should help avoid development of fungicide resistance in pathogenic fungi.

Strobilurin Fungicides (FRAC code 11) include: azoxystrobin (Abound, Quadris Top, Quilt Xcel), pyraclostrobin (Cabrio, Pristine, Merivon), trifloxystrobin (Flint, Gem, Adament, Luna Sensation), kresoxim-methyl (Sovran), fenamidone (Reason), and famoxadone (Tanos).

Sterol Inhibiting Fungicides (FRAC code 3) include: triadimefon (Bayleton), tebuconazole (Tebuzol, Adament, Luna Experience), myclobutanil (Rally), triflumizole (Procure), fenarimol (Vintage), tetraconazole (Mettle), fenbuconazole (Indar), difenoconazole (Inspire Super, Quadris Top, Revus Top), and propiconazole (Aframe Plus, Bumper, Quilt Xcel, Tilt).

These fungicides are also at-risk for resistance development: thiophanate-methyl (Topsin M, T-methyl), fenhexamide (Elevate), SDHI [Aprovia, Endura, Kenja, and pre-mix partners boscalid (Pristine), fluopyram (Luna series), and fluxopyroxad (Merivon)], metalaxyl (Ridomil), iprodione (Rovral), cyprodinil (Vangard, Switch), and pyrimethanil (Scala).

These broad-spectrum protectant fungicides (FRAC Code M) and are not considered at risk for resistance development: captan (Captan), mancozeb (Dithane, Manzate, Penncozeb), carbamate (Ferbam), thiram (Thiram), ziram (Ziram), fixed copper (several trade names), and sulfur.

Several pre-mix products contain fungicides with different FRAC codes and are an alternative to rotations and tank mixes. Pre-mixes include Adament, Aframe Plus, CaptEvate, Inspire Super, Luna Experience, Luna Sensation, Luna Tranquility, Merivon, Pristine, Protocol, Quadris Top, Revus Top, Ridomil Gold MZ, Ridomil Gold Copper, Switch, Tanos, and Zampro.

Insecticide and Miticide Pre-harvest Intervals and Restricted Entry Intervals on Small Fruit[1]

See Generic Insecticides, pages 219-220. *Consult product labels for complete restrictions and limitations.*

Trade Name	Common Name	Pre-harvest Intervals (days)				IRAC[2] Code	REI[3] (hours)	Respirator required
		Grape	Blueberry	Brambles	Strawberry			
Acramite	bifenazate	14	—	1	1	20	12 hr/5days	
Actara	thiamethoxam	5	3	3	3	4A	12	
Admire Pro	imidacloprid	0/30*	3/7*	3/7*	7/14*	4A	12	
Agri-Mek (RUP)	abamectin	28	—	7	3	6	12	
Altacor	chlorantraniliprole	14	1	3	—	28	4	
Apollo	clofentezine	21	—	—	—	10A	12	
Asana (RUP)	esfenvalerate	—	14	7	—	3	12	
Assail	acetamiprid	7	1	1	1	4A	12	Yes
Avaunt	indoxacarb	7	7	—	—	22	12	
Baythroid (RUP)	cyfluthrin	3	—	—	—	3	12	Yes
BeetleGONE!	Bacillus thuringiensis	0	0	0	0	11A	4	
Belay	clothianidin	0/30*	—	—	—	4A	12	
Beleaf	flonicamid	—	—	—	0	29	12	
Brigade (RUP)	bifenthrin	30	1	3	0	3	12	
Closer	sulfoxaflor	7	—	—	—	4C	12	
Confirm	tebufenozide	—	14	14	—	18	4	
Coragen	chlorantraniliprole	—	—	—	1	28	4	
Courier	buprofezin	—	—	—	3	16	12	
Danitol (RUP)	fenpropathrin	21	3	3	2	3	24	
Deadline	metaldehyde	0	0	0	0	—	12	

(continued)

Insecticide and Miticide Pre-harvest Intervals and Restricted Entry Intervals on Small Fruit[1] *(continued)*

Trade Name	Common Name	Pre-harvest Intervals (days)				IRAC[2] Code	REI[3] (hours)	Respirator required
		Grape	Blueberry	Brambles	Strawberry			
Delegate	spinetoram	7	3	1	—	5	12	
Diazinon (RUP)	diazinon	—	5	—	5*	1B	120	Yes
Dibrom (RUP)	naled	10	—	—	1	1B	48/72	Yes
Dicofol	dicofol	7	—	—	2/3	UN	31/39 days	Yes
DiPel[4] (OMRI)	B. thuringiensis	0	0	0	0	11A	4	Yes
Entrust (OMRI)	spinosad	7	1	1	1	5	4	Yes
Envidor	spirodiclofen	14	—	—	—	23	12	
Esteem	pyriproxyfen	—	7	—	—	7C	12	
Exirel	cyantraniliprole	—	3	—	1	28	12	
Imidan	phosmet	7/14	3	—	—	1B	24 hr/14 days	Yes
Intrepid	methoxyfenozide	21/30	7	3	3	18	4	
Kanemite	acequinocyl	7	—	1	1	20B	12	
Knack	pyriproxyfen	21	7	7	—	7C	12	
Lannate* (RUP)	methomyl	—	3	—	—	1A	48 hr/7 days*	Yes
Lorsban (some RUP)	chlorpyrifos	35*	—	—	21*	1B	24	Yes
Malathion	malathion	3*	1*	1	3	1B	12/24	
Movento	spirotetramat	7	—	—	—	23	24	
Mustang Maxx (RUP)	zeta-cypermethrin	1	1	1	—	3A	12	
Mycotrol	Beauveria	0	0	0	0	—	4	Yes
Nealta	cyflumetofen	14	—	—	1	25	12	
Neemix, Aza-Direct (OMRI)	azadirachtin	0	0	0	0	UN	4/12	
Nexter	pyridaben	7/10	—	—	1/10	21A	12	
Oberon	spiromesifen	—	—	—	3	23	12	
Onager	hexythiazox	7	—	—	—	10A	12	
Platinum	thiamethoxam	60	75	—	50	4A	12	
Portal	fenpyroximate	14	—	—	1	21	12	
Pyganic (OMRI)	pyrethrins	0	0	0	0	3A	12	Yes
Radiant	spinetoram	—	—	—	1	5	4	
Rimon	novaluron	—	8	—	1	15	12	
Savey	hexythiazox	—	—	3	3	10A	12	
Sevin	carbaryl	7	7	7	7	1A	12	Yes
Sivanto Prime	flupyradifurone	0/30*	3	0	0	4D	4/48*	
Sluggo (OMRI)	iron phosphate	0	0	0	0	—	0	
Surround	kaolin	0	0	0	0	—	4	Yes
Vendex (RUP)	fenbutatin-oxide (hexakis)	28*	—	—	1*	12B	48	Yes
Venom, Scorpion	dinotefuran	1/28	—	—	—	4A	12	
Zeal	etoxazole	14	—	0	1	10B	12	

[1] — = not registered or not recommended. * = specific pre-harvest intervals or restricted entry intervals vary for different formulation, application rates, crops, or geographical location — refer to label directions. RUP = restricted use pesticide. OMRI = Organic Materials Review Institute — approved for use in organic production.

[2] IRAC code represents the mode of action of the insecticide.

[3] All insecticides have a restricted entry interval (REI). The restricted-entry interval is the time immediately after a pesticide application when entry into the treated area is limited. Check labels for REI and personal protection equipment (PPE) required for early re-entry. Restrictions in REI may prohibit the use of certain pesticides during harvest.

[4] Products that contain Bacillus thuringiensis for caterpillar control include Agree, Biobit, CryMax, DiPel, Javelin, Lepinox, and XenTari.

Growth Regulator PHIs and REIs

Edited by John Strang, Shawn Wright and Elizabeth Wahle

Growth Regulator Pre-harvest Intervals and Restricted Entry Intervals

Trade Name	Common Name	Pre-harvest Interval (days)						REI (hours)
		Apple	Pear	Peach	Sweet Cherry	Tart Cherry	Plum	
Apogee, Kudos	Prohexadione-calcium	45	—[1]	—	20	—	—	12
Amid Thin-W	NAD	2	2	—	—	—	—	48
Blush		7	—	—	—	—	—	4
Cytokin	kinetin	0	0	0	0	0	0	4
Ethrel, Motivate, Ethephon	ethephon	7	—	—	7	7	—	48
Fruitone N	NAA	2	2	—	—	—	—	48
K-Salt Fruit Fix 200	NAA	2	2	—	—	—	—	24
K-Salt Fruit Fix 800	NAA	2	2	—	—	—	—	48
MaxCel, Exilis	6-benzladenine	86	86	—	—	—	—	12
ProGibb	gibberellic acid (GA3)	—	—	—	0	0	0	4
ProVide	GA4 + 7	—	—	—	—	—	—	4
Promalin, Typy, Cytoplex HMS, Perlan	6BA + GA4 + 7	0	[3]	0	[3]	—	—	4/24
ReTain	AVG	7	7	7	—	—	7	12

[1] — = not registered or not recommended

[2] Check label for state registration

[3] Non-bearing trees only.

Chemical Weed Control in Fruit Crops

Edited by Shawn Wright, Elizabeth Wahle, John Strang, Stephen Meyer, Daniel Becker and Chris Smigell

Controlling weeds in fruit plantings is increasingly important, especially as tree fruit production more closely resembles grape and berry crop production. Managing weeds along the crop hedgerows greatly improves plant establishment and growth. Herbicides can provide good weed control with little labor and frequently at a low cost compared to manual weed control. Herbicides, when used properly, improve plant or tree growth and control insects, diseases, and mice and voles.

Proper Application

For herbicides to be effective, you must properly select them for the weeds they are intended to control. You must apply them at the proper time, at the proper rate, and with the proper equipment. The degree of weed control depends largely on the operator's skill.

In most cases, the given herbicide rates are for overall coverage (broadcast rates). For **band treatment** common in fruit plantings, reduce the amounts according to the portion of area treated. For example, to control weeds in a 4-foot-wide band beneath a crop planted in rows 10 feet apart, the rate of herbicide needed per acre of crop is 4/10 of the broadcast rate per acre.

Herbicides can injure fruit plants if used improperly. Make sprayer adjustments and calibrations as precise as possible to assure accurate and uniform applications. Use nozzles appropriate for herbicide application at low pressures (20-40 psi) on a fixed boom-type applicator, unless the label has specific recommendations. This type of sprayer is calibrated easily and, when designed properly, deposits herbicide uniformly.

Consider using one of the recently introduced low-drift nozzles such as the Turbo TeeJet Nozzle or TurboDrop Nozzle. They have been designed to provide similar performance to traditional flat fan nozzles while reducing the number of very small droplets that are highly subject to drift.

While backpack or hand sprayers may be suitable for spot treatment with post-emergence herbicides, do not use them to apply pre-emergent herbicides around fruit plants. The application rate is critical with pre-emergent herbicides, and hand sprayers cannot be calibrated well enough for accurate application. Slight application rate errors can cause severe damage to fruit plants.

Calibrate each sprayer carefully and apply herbicides according to the suggested rates. Note that when applying many pre-emergence herbicides to the soil, you should adjust rates according to soil characteristics. Generally, use lower rates on sandy soils with low organic matter, and use higher rates on heavier textured soils and those high in organic matter. With some herbicides, no rate changes are suggested. If you are unsure about an herbicide's effectiveness or possible crop damage, test it on a small portion of the planting before using it extensively.

Herbicide Resistance Management

Continued use of the same herbicide can lead to the development of herbicide-resistant weeds or the establishment of tolerant weeds. Avoid using the same product or chemically related products for several consecutive years to avoid building up herbicide-resistant weed biotypes. We recommend that you rotate herbicides and include non-chemical controls whenever possible to avoid these problems and improve weed control.

Tank Mixes

Certain herbicides may be combined in suitable tank mixes. Consult product labels for approved combinations and recommended rates. Do not use tank mixes that are not listed on the label.

By using tank mixes, you can apply a pre-emergence herbicide together with a post-emergence herbicide to provide improved weed control, or you can apply two pre-emergence herbicides at reduced rates, each to gain better weed control and reduce the risks of crop damage. **Always follow label recommendations.**

Timing of Applications

Weed management may require multiple applications each year. Timing is important for best results.

Growers often apply a post-emergence herbicide in early spring to control winter annuals and perennials before they flower. The timing of this application may be too early for maximum pre-emergence herbicide effectiveness. It is often wise to follow the first application with a second application of a tank mix of post- and pre-emergence herbicides about three weeks after the first. This controls any weeds that have emerged since the first application and puts the pre-emergence in place at the right time, so it lasts through the main period of weed emergence.

Spot treatments with suitable post-emergence herbicides keeps the planting weed-free for most of the season. Always observe pre-harvest intervals. Many pre-emergence herbicides can be applied in spring or

fall, and some labels suggest a split application. Fall applications can be very effective at managing weeds.

Site Preparation Before Planting

Most perennial weeds cannot be controlled effectively in the spring before planting or once the crop is planted. Growers should strive to eradicate established perennial weeds during site preparation in the season prior to establishing the crop.

You should apply glyphosate (a nonselective systemic herbicide) products such as Roundup, Touchdown, and many other formulations in the summer prior to planting when weeds are actively growing. Applying glyphosate just before harvesting winter wheat or rye — this is known as a pre-harvest treatment — is an excellent way to control creeping perennials such as Canada thistle and goldenrod.

Treatments applied to stubble can also be highly effective. Fields that are in hay or pasture should be allowed to grow in the spring or fall until the grass is at least 8 inches tall. Ideally, perennial broadleaf weeds should be approximately at the bud to early flowering stage at the time of treatment. Summer and early fall applications of glyphosate may be more effective against perennial broadleaf weeds than spring applications.

Allow five to seven days for glyphosate to translocate throughout the root system before plowing under. This should be followed by repeated shallow cultivations as green "flushes" of weed seedlings appear. An alternative is to apply paraquat (Gramoxone) or glufosinate (Rely or generics) for contact nonselective weed control as flushes of weed seedlings appear.

Trade Name and Active Ingredient (a.i.)

Herbicide labels list the chemical names of the active ingredients and the percentage or amount of the active ingredients as "a.i." Herbicides come in various formulations and under various trade names. For the sake of brevity, only the original trade name is listed in this guide. See the table on pages 218-223 for other trade names registered for use on fruit crops.

Always read each label carefully, as rates and labeled crops may differ between labels with similar active ingredients. Follow the recommended rates as they are listed on the label of the product you plan to use.

Use Restrictions

Federal regulations control herbicide use and prescribe the crops the herbicides can be used on, as well as the timing and rates for which these materials are registered. Use only registered materials at the recommended rates for the crops listed. Herbicides are covered by Worker Protection Standards where they apply. Labels include restricted-entry intervals (REI) and personal protective equipment (PPE) information. Product labels are the final authority — follow them carefully.

Good Rules to Remember

1. The rates recommended in this guide are mid-range rates applicable for medium to fine soils. Always refer to labels for full details about rates depending on soil type, organic matter content, age of plants, etc.
2. Applying post-emergence herbicides under stress conditions to weeds (such as high temperatures in midsummer, drought, cool temperatures in the spring, etc.) may result in poor weed control.
3. Use a fixed-spray boom, appropriate nozzles, and low pressure for even application without drift.
4. Spray only in little or no wind (less than 5 mph).
5. Adjust rates according to bandwidth.
6. Follow herbicide restrictions on new plantings. Allow plants to become well established and the soil well settled around plants before application.
7. Use herbicide sprayers for herbicides only.
8. Clean sprayers thoroughly when changing herbicides, especially when you have used 2,4-D, Chateau, or Prowl.
9. Store pesticides in locked storage. Do not allow liquid pesticides to freeze.
10. Protect the environment — avoid surface or ground water contamination. Dispose of excess spray material carefully and according to label directions. Do not allow grazing in treated areas.
11. **Read the label. Understand it thoroughly. Follow its directions.**

Herbicide Recommendations for Apple and Pear

For generic herbicides, see page 221.

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual grasses and broadleaves	Alion (Indaziflam 1.67 lb. a.i./gal) at 5.0-6.5 fl. oz. in minimum of 10 gal. of water	Trees must be established at least 3 years after transplanting. Avoid direct or indirect spray contact with crop foliage, green bark, roots, or fruit, as it may cause localized crop injury and death. Allow at least 30 days between applications. Do not exceed 10.3 fl. oz. per acre in a 12-month period. Do not apply to frozen ground. Do not apply within 25 feet of ponds, rivers, streams, or wetlands. Spot spraying is not recommended. Shake container well before use. 14-day PHI.
annual and perennial grasses and broadleaves	Casoron CS (dichlobenil 1.4 lb a.i./gal.) at 1.4-2.8 gal. in 7-100 gal. of water	Apply from late fall to early spring prior to weed emergence or when weeds are less than 2 inches tall. Apply when temperatures are below 70°F. Do not use on light sandy soils. Do not use until 1 year after transplanting. Do not use in nurseries.
annual broadleaves and suppression of grasses	Chateau SW (flumioxazin 51% a.i.) at 6-12 oz. in 15-75 gal. of water	Do not apply to trees established less than 1 year unless protected from spray contact by nonporous wraps. Do not apply after bud break on apples unless using a hooded or shielded sprayer. Do not apply to fine textured soils. Do not exceed 2 applications in a growing season or make a sequential application within 30 days of the first application. Do not apply when plants are under stress. Do not apply within 300 yards of nondormant pears. Do not incorporate. Do not allow drift to contact foliage or green bark. Do not exceed 24 oz. per season. Minimum 30 days between applications. 60-day PHI.
annual broadleaves and suppression of grasses	Goal 2XL (oxyfluorfen 2 lb. a.i./gal.) at 2-8 pt. in minimum of 20 gal. of water	**Dormant Application Only:** Effective both pre-emergence (5-8 pt.) and post-emergence (2-8 pt.) as directed spray on weeds larger than 4 inches. Do not apply from bud swell until harvest completion. Can be mixed with other pre-emergence herbicides or with Roundup or Gramoxone. Do not exceed 8 pt. per year.
annual broadleaves and suppression of grasses	GoalTender (oxyfluorfen 4 lb. a.i./gal.) at 2.5-4 pt. in minimum of 20 gal. of water	**Dormant Application Only:** Effective both pre-emergence banded application (2.5-4 pt.) and post-emergence (1-4 pt.) as directed spray on weeds larger than 4 inches. Do not apply from bud swell until harvest completion. Can be mixed with other pre-emergence herbicides or with Roundup or Gramoxone. Do not exceed 3 pt. per year on a broadcast basis.
annual grasses and broadleaves	Karmex DF (diuron 80% a.i.) at 4 lb. in 25-40 gal. of water	Effective both pre-emergence and post-emergence (min. 70°F with high humidity). Apply under trees established at least 1 year. Do not treat trees grafted on full-dwarf rootstocks. Do not exceed 1 application per year. **Apple Only:** May be tank mixed with Sinbar (1.5-2 lb. each) in orchards established at least 2 years. Karmex/Sinbar can be applied in the spring before weeds emerge or after harvest in the fall.
annual and perennial grasses and certain broadleaves	Kerb SC (pronamide 35.6% a.i.) at 2.5-9.5 pt. in 40-50 gal. of water. Rate depends on weed pressure and soil type. See table on label.	Apply as a directed spray in the fall after harvest prior to soil freeze-up. Rainfall or irrigation are required to activate. Do not apply more than 9.5 pt./A/year or make more than 1 application per year. Age restriction: Kerb SC may not be applied to (1) trees less than 1 year old, (2) fall-transplanted stock transplanted less than 1 year old, or (3) spring-transplanted stock transplanted less than 6 months. **Restricted use pesticide.**
annual grasses and broadleaves	Matrix FNV (rimsulfuron 25% a.i.) at 4 oz. in minimum of 10 gal. of water	Apply only to crops that have been established for 1 full growing season and are in good health and vigor. Weeds are controlled for 60-90 days after application. Matrix burns down small, actively growing weeds less than 1 inch tall. When weeds are present at application, a labeled burndown herbicide such as glyphosate, paraquat, or glufosinate with an appropriate adjuvant improves control. Avoid direct or indirect contact with crop foliage or fruit, except undesirable suckers. Do not use Matrix FNV in a spray solution with a pH below 4.0 or above 8.0. Best results are obtained when the soil is moist at the time of application and 0.5 inch of rainfall or sprinkler irrigation occurs within 2 weeks of application. 7-day PHI.
annual grasses and broadleaves	Princep 4L (simazine 4 lb. a.i./gal.) at 2-4 qt. in minimum of 40 gal. of water	Apply under trees established at least 1 year. Apply in spring before weeds emerge, avoiding contact with fruit, foliage, or stems. Do not apply more than 4 qt. per acre per calendar year. 150-day PHI for apples.
broadleaves	Sandea (halosulfuron-methyl 75% a.i.) 0.5-1 oz. in minimum of 15 gal. of water	**Apple Only:** Apply a single or sequential application based on weed pressure. Apply to bare ground for best results. If small weeds are present, mix with a post-emergence broad-spectrum herbicide.

(continued)

Herbicide Recommendations for Apple and Pear *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annual grasses and broadleaves	Sinbar WDG (terbacil 80% a.i.) at 0.5-4 lb. in minimum of 20 gal. of water	**Apple Only:** Apply either in the spring before weeds emerge or during early stages of seedling growth, or after harvest in the fall. Trees must be established at least 3 years. Do not contact foliage or fruit with spray or mist. 60-day PHI. **Non-bearing: (young, newly planted) Apple:** Apply at 0.5-1 lb. Make the first application after a significant rainfall or irrigation event that allows the ground to settle around the base of the trees. Make 1-2 applications per season. Do not exceed 1 lb. per year. Do not use on soils with <1% organic matter.
annual grasses and broadleaves and suppression of yellow nutsedge	Solicam DF (norflurazon 78.6% a.i.) at 5 lb. in minimum of 20 gal. of water	Apply a directed spray to settled and firm soil from fall to early spring before weeds emerge. Soil should be settled and firm. Rainfall or irrigation of 0.5 inch is needed within 4 weeks. Do not contact fruit or foliage. Do not apply after bud break on sandy loam soils. Check label for maximum amount allowed per year depending on soil type. **Apple:** Can be applied immediately after planting. **Pear:** Minimum 12 months after planting east of the Mississippi River before first application; minimum 18 months after planting west of the Mississippi before first planting. 60-day PHI.
annual grasses and certain broadleaves	Surflan 4AS (oryzalin 4 lb. a.i./gal.) at 2-6 qt. in 20-40 gal. of water	Make a single band or broadcast application to the ground beneath trees before weeds emerge. Apply alone to weed-free soil or post-emergence mixed with Roundup or Gramoxone. Rainfall or irrigation (0.5 inch) is required for activation. Minimum 2.5 months between applications. Do not exceed 12 qt. per year.
Post-emergence		
annual broadleaves	Aim EC (carfentrazone 2 lb. a.i./gal.) at 2 fl. oz. in 20 gal. of water	Apply any time during the season. Always add NIS 0.25% v/v or crop oil 1% v/v. Mix with Roundup or Gramoxone for broader weed control. Do not exceed 7.9 fl. oz. per year. Minimum 14 days between applications. 3-day PHI. **Sucker Control:** Apply when suckers are green. Do not allow spray to contact fruit, foliage, or green bark.
annual and some perennial broadleaves	Amine 4 (2,4-D) at 1-4 pt. in 5-25 gal. of water	Apply as directed spray to annuals 1-2 inches high and to perennials up to early bud stage. Do not allow spray to contact leaves, fruit, limbs or exposed roots of tree. Use coarse spray and low pressure to avoid drift. Do not apply during windy periods, when there is a temperature inversion or at extremely high temperatures. Non-bearing trees must be established at least 1 year. On bearing trees, do not apply during bloom and only after irrigation. Do not apply to bare ground. Use higher rate on perennial weeds. Do not exceed 2 applications per year. Maximum 75 days between applications. 14-day PHI.
annual broadleaves and suppression of grasses	Chateau WDG (flumioxazin 51% a.i.) at 6-12 oz. in 15-75 gal. of water	Do not apply to trees established less than 1 year unless protected from spray contact by nonporous wraps. Do not apply after bud break on apples unless using a hooded or shielded sprayer. Do not apply to fine textured soils. Do not exceed 2 applications in a growing season or a sequential application within 30 days of the first application. Do not apply when plants are under stress. All applications to pears or within 100 meters of pears must be made when they are dormant and 2 months before spring bud break. Apply alone pre-emergence or tank mix with Roundup or Gramoxone post-emergence with a crop oil 1% v/v or NIS 0.25% v/v. Do not incorporate. Do not allow drift to contact foliage or green bark. Do not exceed 24 oz. per season. Minimum 30 days between applications. 60-day PHI.
annual broadleaves	Goal 2XL (oxyfluorfen 2 lb. a.i./gal.) at 2-8 pt. in minimum 40 gal. of water	See Pre-emergence section (page 197) for details.
annual broadleaves	GoalTender (oxyfluorfen 4 lb. a.i./gal.) at 2.5-4 pt. in minimum 40 gal. of water	See Pre-emergence section (page 197) for details.

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Herbicide Recommendations for Apple and Pear *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
most annual grasses and broadleaf weeds and top kill of perennial weeds	Gramoxone (paraquat 3 lb. a.i./gal.) at 1.7-2.7 pt. in minimum of 10 gal. of water	Apply as directed spray to actively growing weeds. Repeat applications are necessary to give sustained control. Apply as a coarse spray. Always add NIS 0.25% v/v (2 pt./100 gal.) or crop oil 1% v/v (1 gal./100 gal.). Do not allow spray to contact leaves, fruit, or green stems. May be used for root sucker control. Do not exceed 5 applications per year. If application made during harvest, pick all fruit off of the ground prior to application. **Restricted use pesticide. Only certified applicators can mix, load and apply. Not to be used by uncertified persons working under the supervision of a certified applicator. Applicators must complete an EPA-approved paraquat training every 3 years https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators Containers under 120 gallons will have "closed-system" packaging to be used with a closed-transfer system.** Harvest crop at normal maturity.
annual grasses and broadleaves	Karmex DF (diuron 80% a.i.) at 4 lb. in 25-40 gal. of water	See Pre-emergence section (page 197) for details
annual and perennial grasses	Poast 1.5EC (sethoxydim 1.5 lb. a.i./gal.) at 1.5-2.5 pt. in 25 gal. of water	Apply as a directed spray to actively growing grass before they exceed maximum recommended heights. Always add crop oil 1.25% v/v. Do not exceed 2.5 pt. per application or 7.5 pt. per season. 14-day PHI.
annual and perennial grasses and broadleaves	Rely 280 (glufosinate 2.34 lb. a.i./gal.) at 48-82 fl. oz. in minimum of 20 gal. of water	Apply as a directed spray to actively growing weeds. Avoid spray drift or mist contact with green bark, stems, or foliage, as injury may occur. Only trunks with callused, mature brown bark should be sprayed unless protected by nonporous wraps, grow tubes, or waxed containers. Maximum rate is 246 fl. oz. per acre in a 12-month period. Add AMS to the spray tank if spray water is hard. Do not make spot or directed spray applications to tree trunks or to apple suckers, as tree injury may occur. Do not apply more than 246 fl. oz. of product per acre per calendar year or make more than 3 applications at a maximum rate of 82 fl. oz. per acre per year. Applications must be a minimum of 14 days apart. 14-day PHI.
annuals and some perennial grasses and broadleaves	Roundup WeatherMax, Roundup PowerMax 5.5EC (glyphosate 5.5 lb. a.i./gal.) at 11 fl. oz.-3.3 qt. in 10-40 gal. of water	Rate depends on weed species and stage of growth. See label for details. Do not exceed 7 qt. per acre per year. Apply as preplant broadcast application or in fall for control of roots and rhizomes of perennial weeds or as a directed spray or wiper application (33-100% solution) to actively growing weeds in established plantings. Always add AMS 8.5-17 lb./100 gal. in hard water or drought conditions. Do not allow spray to contact any part other than mature bark. Avoid application to suckers and recent pruning wounds. Does not provide residual control. Can be mixed with labeled pre-emergence herbicides. 1-day PHI.
broadleaves and nutsedge	Sandea (halosulfuron-methyl 75% a.i.) 0.5-1 oz. in minimum of 15 gal. of water	**Apple Only:** For best results, use a NIS with post-emergence applications. Avoid spray drift on tree foliage and fruit, and do not apply when temperatures exceed 85°F. Do not apply to trees established less than 1 year. Do not exceed 2 oz. per 12-month period. May not control ALS-resistant weeds. Make a single application using a minimum of 0.75 oz. per acre of Sandea when nutsedge is fully emerged at the 3- to 5-leaf stage. A second application may be made later in the season for secondary nutsedge emergence.
annuals and perennial grasses and broadleaves	Scythe 4.2E (pelargonic acid 4.2 lb. a.i./gal.) at 3-10% spray mix	For contact nonselective control or burndown of a broad spectrum of actively growing weeds. Use low rate for annual weed control and high rates for maximum vegetative burndown. Use as a directed or shielded spray. Can be mixed with Roundup.
most annual and perennial grasses	Select Max (clethodim 0.97 lb. a.i./gal) at 12-16 fl. oz.	Apply post-emergence as a directed spray to young, actively growing grasses. Do not exceed 16 fl. oz./A in a single application or per season. A minimum 14-day interval is required for repeat applications. Add NIS at 0.25% v/v or COC/MSO at 1 qt/A or 1% v/v. 14-day PHI.
most annual and perennial broadleaves	Stinger (clopyralid 3 lb. a.i./gal.) at 1/3-2/3 pt. in 10 gal. or more of total spray volume per acre	**Apple only:** Make one or two applications per crop year. Apply only to trees 1 year or older. Avoid direct contact with foliage, fruit, or tree trunks. Do not apply during bloom east of the Rocky Mountains. Do not exceed a total of 2/3 pt. per acre per crop year. 30-day PHI.

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Herbicide Recommendations for Apple and Pear (continued)

Weed Problem	Material and Rate per Acre	Notes and Comments
annual and perennial broadleaves	Treevix (saflufenacil 0.7 lb. a.i.) at 1 oz. in 20-40 gal. of water	Trees must be established for 12 months prior to application. May be applied as a single application or up to 3 times per season with a separation of 21 days between sprays. Do not exceed 3.0 oz. per acre per cropping season. Trunk shields should be used until trees have been established for 2-3 years. For optimum burndown, use with methylated seed oil (MSO), ammonium sulfate (AMS), or urea ammonium nitrate (UAN) adjuvant. Do not use an NIS as a substitute for MSO. Apply only when wind is 10 mph or less and blowing away from nontarget areas. Rainfast in 1 hour. Do not use in tree nurseries. 0-day PHI.
annual and perennial broadleaves	Venue (Pyrafluven ethyl 2% a.i.) at 0.7-4.0 fl. oz. plus other labeled herbicides in minimum of 20 gal. of water	Apply as a directed spray during dormant period and prior to bloom. Avoid contact with foliage and green bark. More effective on weeds less than 4 inches tall and 3 inches in diameter. Use higher rate and spray volume for larger weeds. Do not exceed 3 applications or 6.8 fl. oz. per acre per season. Allow a minimum of 30 days between applications. Adding COC or NIS is recommended. May be used for sucker growth control on the basil portion of trunks and root sprouts when tissue is young, immature and not hardened off. Avoid contact with green uncallused bark of young trees less than one year old unless protected by nonporous wraps or grow tubes. Do not allow spray to drift onto desirable fruit or foliage as damage will occur. May be mixed with 2, 4-D, glyphosate, or grass herbicides for enhanced control. Not registered in all states. Spray water pH needs to be less than 7.5. 0-day PHI.

Herbicide Recommendations for Peach, Nectarine, Plum, and Cherry

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual grasses and broadleaves	Alion (Indaziflam 1.67 lb. a.i./gal.) at 5.0-6.5 fl. oz. in minimum of 10 gal. of water	Trees must be established at least 3 years after transplanting. Avoid direct or indirect spray contact with crop foliage, green bark, roots, or fruit, as it may cause localized crop injury and death. Allow at least 30 days between applications. Do not exceed 10.3 fl. oz. per acre in a 12-month period. Do not apply to frozen ground. Do not apply within 25 feet of ponds, rivers, streams, or wetlands. Spot spraying is not recommended. Shake container well before use. 14-day PHI.
annual and perennial grasses and broadleaves	Casoron CS (dichlobenil 1.4 lb. a.i./gal.) at 1.4-2.8 gal. in 7-100 gal. of water	**Cherry Only:** Apply from late fall to early spring prior to weed emergence, or when weeds are less than 2 inches tall. Apply when temperatures are below 70°F. Do not use on light sandy soils or until 1 year after transplanting. Do not use in nurseries.
annual broadleaves and suppression of grasses	Chateau WDG (flumioxazin 51% a.i.) at 6-12 oz. in 15-75 gal. of water	Do not apply to trees established less than 2 years unless protected from spray contact by nonporous wraps. Do not apply during the period after flowering through leaf drop unless shielded application equipment ensures that spray drift will not contact crop foliage. Do not apply to fine-textured soils. Do not apply within 100 meters of nondormant pears. Apply alone pre-emergence or tank mix with Gramoxone post-emergence with a crop oil 1% v/v or NIS 0.25% v/v. Do not incorporate. Do not allow drift to contact foliage or green bark. Do not exceed 24 oz. per season or exceed 2 applications per growing season. Minimum 30 days between applications. 60-day PHI.
annual broadleaves and suppression of grasses	Goal 2XL (oxyfluorfen 2 lb. a.i./gal.) at 5-8 pt. in minimum of 20 gal. of water	**Dormant Application Only:** Effective both pre-emergence (5-8 pt.) and post-emergence (2-8 pt.) as a directed spray on weeds larger than 4 inches. Do not apply from bud swell until harvest completion. Can be mixed with other pre-emergence herbicides or with Roundup or Gramoxone. Do not exceed 8 pt. per year.
annual broadleaves and suppression of grasses	GoalTender (oxyfluorfen 4 lb. a.i./gal.) at 2.5-4 pt. in minimum of 20 gal. of water	**Dormant Application Only:** Effective both pre-emergence banded application (2.5-4 pt.) and post-emergence (1-4 pt.) as directed spray on weeds larger than 4 inches. Do not apply from bud swell until harvest completion. Can be mixed with other pre-emergence herbicides or with Roundup or Gramoxone. Do not exceed 3 pt. per year on a broadcast basis.
annual grasses and broadleaves	Karmex DF diuron (80% a.i.) at 2-5 lb. in 25-40 gal. of water	**Peach Only:** Effective both pre-emergence and post-emergence (minimum 70°F with high humidity). Apply under trees established at least 3 years. May be tank mixed with Sinbar (2 lb. each) in orchards established at least 2 years. Karmex/Sinbar can be applied in the spring before weeds emerge or after harvest in the fall. Do not exceed 1 application per year. 20-day PHI for IL and MO. 3-month PHI for other states.

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Herbicide Recommendations for Peach, Nectarine, Plum, and Cherry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annual and perennial grasses and certain broadleaves	Kerb SC (pronamide 35.6% a.i.) at 2.5-9.5 pt. in 40-50 gal. of water. Rate depends on weed pressure and soil type. See table on label.	Apply as a directed spray in the fall after harvest prior to soil freeze-up. Rainfall or irrigation are required to activate. Do not apply more than 9.5 pt./A/year or make more than 1 application per year. **Age restriction:** Kerb SC may not be applied to (1) trees less than 1 year old, (2) fall-transplanted stock transplanted less than 1 year old, or (3) spring-transplanted stock transplanted less than 6 months. **Restricted use pesticide.**
annual grasses and broadleaves	Matrix FNV (rimsulfuron 25% a.i.) at 4 oz. in minimum of 10 gal. of water	Apply only to crops that have been established for 1 full growing season and are in good health and vigor. Weeds are controlled for 60-90 days after application. Matrix burns down small actively growing weeds less than 1 inch tall. When weeds are present at application, a labeled burndown herbicide such as paraquat with an appropriate adjuvant improves control. Avoid direct or indirect contact with crop foliage or fruit, except undesirable suckers. Do not use Matrix FNV in a spray solution with a pH below 4.0 or above 8.0. Best results are obtained when the soil is moist at the time of application and 0.5 inch of rainfall or sprinkler irrigation occurs within 2 weeks of application. 14-day PHI.
annual grasses and broadleaves	Princep 4L (simazine 4 lb. a.i./gal.) at 1.6-4 qt. in minimum of 40 gal. of water	Apply under trees established at least 1 year. Apply in spring before weeds emerge avoiding contact with fruit, foliage, or stems. **Peach Only:** Use only in AR, MO, and states east of the Mississippi River. **Plum, Sweet Cherry Only:** Use only in MO and states east of the Mississippi River.
annual grasses and broadleaves	Sinbar WDG (terbacil 80% a.i.) at 0.5-4 lb. in minimum of 20 gal. of water	**Peach Only:** Apply either in the spring before weeds emerge or during early stages of seedling growth or after harvest in the fall. Trees must be established at least 3 years. Do not contact foliage or fruit with spray or mist. 60-day PHI. **Non-bearing (young, newly planted) Stone Fruits:** Apply at 0.5-1 lb. Make the first application after a significant rainfall or irrigation event that allows the ground to settle around the base of the trees. Make 1-2 applications per season. Do not exceed 1 lb. per year. Do not use on soils with <1% OM.
annual grasses and broadleaves and suppression of yellow nutsedge	Solicam DF (noraflurazon 78.6% a.i.) at 3.75-5 lb. in minimum of 20 gal. of water	Apply a directed spray from fall to early spring before weeds emerge. Soil should be settled and firm. Rainfall or irrigation of 0.5 inch is needed within 4 weeks. Do not contact fruit or foliage. Do not apply after bud break on sandy loam soils. Check label for maximum amount allowed per year depending on soil type. **Peach, Nectarine:** minimum 6 months after planting before first application. **Plum:** minimum 12 months after planting before first application. **Cherry:** minimum 18 months after planting before first application. 60-day PHI.
annual grasses and certain broadleaves	Surflan 4AS (oryzalin 4 lb. a.i./gal.) at 2-6 qt. in 20-40 gal. of water	Make a single band of broadcast application to the ground beneath trees before weeds emerge. Apply alone to weed-free soil or post-emergence mixed with Roundup or Gramoxone. Minimum 0.5 inch rainfall or irrigation required for activation. Minimum 2.5 months between applications. Do not exceed 12 qt. per year.
annual grasses and broadleaves	Treflan HFP 4EC (trifluralin 4 lb. a.i./gal.) at 1.5-4 pt. in 5-40 gal. of water	**Peach, Plum Only:** Incorporate within 24 hours to reduce loss of activity. **New Plantings:** Apply 1.25-2 pt. and incorporate before transplanting. **Established Plantings:** Apply 2-4 pt. and incorporate prior to period of weed germination or after removal of weeds with tillage of herbicides.
Post-emergence		
annual broadleaves	Aim EC (carfentrazone 2 lb. a.i./gal.) at 2 fl. oz. in 20 gal. of water	Apply any time during the season. Add NIS (2 pt./100 gal.) or COC (1 gal./100 gal.). Mix with Roundup or Gramoxone for broader weed control. Do not exceed 7.9 fl. oz. per year. Minimum 14 days between applications. 3-day PHI. **Sucker Management:** Apply when suckers are green. Do not allow spray to contact fruit, foliage, or green bark.
annual and some perennial broadleaves	Amine 4 (2,4-D) at 1-4 pt. in 5-25 gal. of water	Apply as directed spray to annuals 1-2 inches high and to perennials up to early bud stage. Do not allow spray to contact leaves, fruit, limbs or exposed roots of tree. Use coarse spray and low pressure to avoid drift. Do not apply during windy periods, when there is a temperature inversion or at extremely high temperatures. Non-bearing trees must be established at least 1 year. On bearing trees, do not apply during bloom and only after irrigation. Do not apply to bare ground. Use higher rate on perennial weeds. Do not exceed 2 applications per year. Maximum 75 days between applications. 40-day PHI.

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Herbicide Recommendations for Peach, Nectarine, Plum, and Cherry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
most annual and perennial grassess	Fusilade DX (Fluazifop-P-butyl 2 lb. a.i./gal.) at 16-24 fl. oz. in 20-40 gal. of water	Apply post-emergence as a directed spray avoiding contact with tree foliage to young actively growing grasses. Add a COC at 1% v/v (1 gal./100 gal.) or NIS at 0.25-0.5% v/v (1-2 qt./100 gal.) in the finished spray volume. Do not exceed 72 fl. oz. per acre per year. Maintain a minimum of 21 days between applications. Do not exceed a maximum of 3 applications per year. 14-day PHI.
annual broadleaves	Goal 2XL (oxyfluorfen 2 lb. a.i./gal.) at 5-8 pt. in minimum of 40 gal. of water	See Pre-emergence section (page 200) for details.
annual broadleaves	GoalTender (oxyfluorfen 4 lb. a.i./gal.) at 2.5-4 pt. in minimum of 40 gal. of water	See Pre-emergence section (page 194) for details.
most annual grasses and broadleaf weeds and top kill of perennial weeds	Gramoxone (paraquat 3 lb. a.i./gal.) at 1.7-2.7 pt. in minimum of 10 gal. of water	Apply as directed spray to actively growing weeds. Repeat applications are necessary to give sustained control. Apply as a coarse spray. Always add NIS 0.25% v/v or crop oil 1% v/v. Do not allow spray to contact leaves, fruit, or green stems. Do not exceed 3 applications per year. **Restricted use pesticide. Only certified applicators can mix, load and apply. Not to be used by uncertified persons working under the supervision of a certified applicator. Applicators must complete an EPA-approved paraquat training every 3 years https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators Containers under 120 gallons will have "closed-system" packaging to be used with a closed-transfer system.** 14-day PHI peach; 28-day PHI nectarine, plum, cherry.
annual grasses and broadleaves	Karmex DF diuron (80% a.i.) at 2-5 lb. in 25-40 gal. of water	See Pre-emergence section (page 200) for details.
annual and perennial grasses	Poast 1.5E (sethoxydim 1.5 lb. a.i./gal.) at 1.5-2.5 pt. in 25 gal. of water	Apply as a directed spray to actively growing grasses before they exceed maximum recommended heights. Always add crop oil 1.25% v/v. Do not exceed 2.5 pt. per application or 5 pt. per season. Peach, plum, and nectarine are very tolerant to Poast and may be applied over the top of small non-bearing trees. 25-day PHI.
annual and perennial grasses and broadleaves	Rely 280 (glufosinate 2.34 lb. a.i./gal.) at 48-82 fl. oz. in minimum of 20 gal. of water	Apply as a directed spray to actively growing weeds. Avoid spray drift or mist contact with green bark, stems, or foliage, as injury may occur. Only trunks with callused, mature brown bark should be sprayed unless protected by nonporous wraps, grow tubes, or waxed containers. Add AMS to the spray tank if spray water is hard. Maximum rate is 164 fl. oz. per acre in a 12-month period. Do not make more than 2 applications at a maximum rate of 82 fl oz per acre per year. Do not make spot or directed spray applications to tree trunks or to suckers as tree injury may occur. Applications must be a minimum of 28 days apart. 14-day PHI.
annuals and some perennial grasses and broadleaves	Roundup 5.5EC (glyphosate 5.5 lb. a.i./gal.) at 11 fl. oz.-3.3 qt. in 10-40 gal. of water (many other formulations)	Rate depends on weed species and growth stage. See label for details. Apply as preplant broadcast application or in fall for control of roots and rhizomes of perennial weeds or as a directed spray or wiper application (33-100% solution) to actively growing weeds in established plantings. Always add AMS 8.5-17 lb./100 gal. in hard water or drought conditions. Do not allow spray to contact any part other than mature bark. Avoid application to suckers and recent pruning wounds. Use extreme care to ensure that no part of peach tree is contacted with spray. Apply only near trees that have been planted in the orchard for 2 or more years. Does not provide residual control; can be mixed with labeled pre-emergence herbicides. 17-day PHI.
annual and perennial grasses and broadleaves	Scythe 4.2E (pelargonic acid 4.2 lb. a.i./gal.) at 3-10% spray mix	For contact nonselective control or burndown of a broad spectrum of actively growing weeds. Use low rate for annual weed control and high rates for maximum vegetative burndown. Use as a directed or shielded spray. Can be mixed with Roundup.
most annual and perennial broadleaves	Select Max (clethodim 0.97 lb. a.i./gal.) at 12-16 fl. oz.	Apply post-emergence as a directed spray to young, actively growing grasses. Do not exceed 16 fl. oz./A in a single application or per season. A minimum 14-day interval is required for repeat applications. Add NIS at 0.25% v/v or COC/MSO at 1 qt/A or 1% v/v. 14-day PHI.
most annual and perennial grasses	Stinger (clopyralid 3 lb. a.i./gal.) at 1/3-2/3 pt. in 10 gal. or more of total spray volume per acre	Make one or two applications per crop year. Apply only to trees 1 year or older. Avoid direct contact with foliage, fruit, or tree trunks. Do not apply during bloom east of the Rocky Mountains. Do not exceed 2/3 pt. per acre per crop year. 30-day PHI.

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Herbicide Recommendations for Peach, Nectarine, Plum, and Cherry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annual and perennial broadleaves	Venue (Pyrafluven ethyl 2% a.i.) at 0.7-4.0 fl. oz. plus other labeled herbicides in minimum of 20 gal. of water	Apply as a directed spray during dormant period and prior to bloom. Avoid contact with foliage and green bark. More effective on weeds less than 4 inches tall and 3 inches in diameter. Use higher rate and spray volume for larger weeds. Do not exceed 3 applications or 6.8 fl. oz. per acre per season. Allow a minimum of 30 days between applications. Adding COC or NIS is recommended. May be used for sucker growth control on the basil portion of trunks and root sprouts when tissue is young, immature and not hardened off. Avoid contact with green uncallused bark of young trees less than one year old unless protected by nonporous wraps or grow tubes. Do not allow spray to drift onto desirable fruit or foliage as damage will occur. May be mixed with 2, 4-D, glyphosate, or grass herbicides for enhanced control. Spray water pH needs to be less than 7.5. 0-day PHI.

Herbicide Recommendations for Non-bearing Fruit Trees Only

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre- and Post-emergence		
annual broadleaves and yellow nutsedge	Broadloom (bentazon 4 lb. a.i./gal.) at 1.5-2 pt. in minimum of 20 gal. of water	Apply as a directed post-emergence spray. Always add COC 1% v/v. Avoid spraying stems, bark, or foliage. Do not exceed 2 pt. per application or exceed 4 pt. per season. 1-year PHI.
most annual and perennial grasses	Fusilade DX (Fluazifop-P-butyl 2 lb. a.i./gal.) at 16-24 fl. oz. in 20-40 gal. of water	For non-bearing apple and pear that will not be harvested within 1 year after application. Apply post-emergence as a directed spray, avoiding contact with tree foliage to young actively growing grasses. Add COC at 1% v/v (1 gal./100 gal.) or NIS at 0.25-0.5% v/v (1-2 qt./100 gal.) in the finished spray volume. Do not exceed 72 fl. oz. per acre or 3 applications per year. Maintain a minimum of 14 days between applications.
most broadleaves	Gallery 75DF (isoxaben 75% a.i.) at 0.66-1.33 lb in minimum of 10 gal. of water	Apply in late summer to early fall; or pre-emergence in early spring prior to seed germination or immediately after cultivation. Do not apply to new transplants until soil has settled with no cracks present. Rainfall or irrigation (1/2 inch) is needed within 21 days of application. Not effective on germinated weeds. Minimum 60 days between applications. Maximum rate is 4 lb. per acre.
annual grasses and certain broadleaves	Prowl 3.3EC (pendimethalin 3.3 lb. a.i./gal.) **Short-term weed control:** at 2.4 qt. in minimum of 20 gal. of water **Long-term weed control:** 4.8 qt. in minimum of 20 gal. of water	Do not apply if buds have started to swell. May be applied preplant incorporated, preplant surface, or pre-emergence. For best results, rain or irrigation is needed within 21 days of application. Not effective on germinated weeds. Do not allow spray to contact leaves, shoots, or buds. For new plantings, do not apply until soil has settled and no cracks are present.
annual grasses and broadleaves	Reglone (diquat 2 lb. a.i./gal.) at 1.5-2 pt. in minimum of 15 gal. of water	Apply post-emergence as a directed spray using a shield for contact burn of weeds. Always use NIS at 0.5% v/v. Complete coverage is essential for good control. Can be used during site preparations and up to within 1 year of harvest. Do not allow contact with green stems, foliage, or fruits. Do not use for food or feed for 1 year after application. 1-year PHI.
annual grasses and broadleaves	Showcase 1.25G (granular) (triflualin + isoxaben + oxyfluorfen 1.25 lb. a.i./50-lb. bag) at 100-200 lb.	For use on stone fruits only; not labeled for apple or pear. Use as a dormant application for stone fruits only. Apply prior to weed germination or immediately after cultivation. 1-year PHI.
annual grasses and certain broadleaves	Snapshot 2.5TG (isoxaben + trifluralin 2.5% a.i.) at 100-200 lb.	Apply pre-emergence on weed-free clean soil. For best results 1/2 inch rain or irrigation is needed within 3 days of application. Not effective on germinated seeds. Minimum 60 days between applications. Do not exceed 600 lb. per year.
annual and perennial broadleaves	Venue (Pyrafluven ethyl 2% a.i.) at 0.7-4.0 fl. oz. plus other labeled herbicides in a minimum of 20 gal. of water	Apply as directed spray during dormant period and prior to bloom. Avoid contact with foliage and green bark. More effective on weeds less than 4 inches tall and 3 inches in diameter. Use higher rate and spray volume for larger weeds. Do not exceed 3 applications or exceed 6.8 fl. oz. per acre in one season. Allow a minimum of 30 days between applications. Adding COC or NIS is recommended. May be mixed with 2,4-D, glyphosate, or grass herbicides for enhanced control. Not registered in all states. Spray water pH needs to be less than 7.5. 12-month PHI on non-bearing trees.

Herbicide Recommendations for Grape

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual and perennial grasses and broadleaves	Alion (indaziflam 19.05%) (1.67 lb./gal.) at 5 fl. oz.	Only use in established vineyards at least 5 years after planting and on vines that exhibit normal growth and good vigor. Do not use on sandy soil or soils with 20% or more gravel content. Ensure 12 inches of soil barrier between the surface and the major portion of the root system. **Age Restriction:** Do not apply to vines less than 5 years old.
annual and perennial grasses and broadleaves	Casoron CS (dichlobenil 15.3% a.i.) at 1.4-2.8 gal.	Apply from late fall through early spring. Applications should be made prior to weed emergence, or when emerged weeds are less than 2 inches tall. Use only on well-established plants. **Age Restriction:** Do not apply to vines less than 1 year old.
annual broadleaves and suppression of grasses	Chateau SW (flumioxazin 51% a.i.) at 6-12 oz. in 10-30 gal. of water	Do not apply after bloom unless with a hooded or shielded application. Apply alone pre-emergence or tank mix with Roundup or Gramoxone post-emergence. Do not incorporate. Do not allow drift to contact foliage or green bark. Do not exceed 24 oz. per season. Minimum 30 days between applications. Also has post-emergence activity. 60-day PHI. **Age Restriction:** Do not apply to vines established less than 2 years unless they are trellised at least 3 ft. from the ground or are protected by nonporous wraps, grow tubes, or waxed containers.
annual grasses and broadleaves	Devrinol 2-XT (napropamide 2 lb. a.i./gal.) at 2 gal. per acre	Apply from late fall (prior to soil freezing) to early spring (prior to weed emergence). Apply to a weed-free soil surface or tank mix with a suitable post-emergence herbicide. May be applied to newly planted and established crops. Do not exceed 2 gal. per acre per crop cycle. 70-day PHI.
annual broadleaves and suppression of grasses	Goal 2XL (oxyfluorfen 2 lb. a.i./gal/) at 5-8 pt. in minimum of 10 gal. of water	**Dormant Application Only:** Effective both pre-emergence (5-8 pt.) and post-emergence (2-8 pt.) as a directed spray on weeds less than 4 inches tall. Do not apply from bud swell to harvest. Can be mixed with other pre-emergence herbicides, or with Roundup or Gramoxone. Do not exceed 8 pt. per year. **Age Restriction:** Do not apply to grapes established less than 3 years unless vines are on a trellis wire a minimum of 3 ft. above ground.
annual broadleaves and suppression of grasses	GoalTender (oxyfluorfen 4 lb. a.i./gal.) at 2.5-4 pt. in minimum of 20 gal. of water	**Dormant Application Only:** Effective both pre-emergence as a banded application (2.5-4 pt.) and post-emergence (1-4 pt.) as a directed spray on weeds less than 4 inches tall. Do not apply from bud swell to harvest. Can be mixed with other pre-emergence herbicides, or with Roundup or Gramoxone. Do not exceed 4 pt. per year on a band application basis. **Age Restriction:** Do not apply to grapes established less than 3 years unless vines are on a trellis wire a minimum of 3 ft. above ground.
annual grasses and broadleaves	Karmex DF (diuron 80% a.i.) at 2-6 lb. in 25-40 gal. of water	**Age Restriction:** Use on vineyards established at least 3 years and trunks at least 1.5 inches in diameter. Apply as a directed spray to soil under trellis in early spring prior to weed germination. Do not exceed 1 application per year. On soils low in organic matter (1-2%), severe injury may result if heavy rainfall occurs soon after treatment.
annual and perennial grasses and certain broadleaves	Kerb SC (pronamide 35.6% a.i.) at 2.5-9.5 pt. in 40-50 gal. of water. Rate depends on weed pressure and soil type. See table on label.	Apply as a directed spray in the fall after harvest prior to freeze-up, or in early winter when temperatures are below 55˚F. Rainfall or irrigation are required to activate. Do not exceed 1 application per year or exceed 9.5 pt./A/year. Age restriction: Do not apply to vines less than 1 year old. **Restricted use pesticide.**
annual grasses and broadleaves	Matrix FVN or SG (rimsulfuron 25% a.i.) at 4 oz. in a minimum of 10 gal. of water	Apply as a banded application to the base of the vines. Best results are obtained when the soil is moist at the time of application and 1/2 inch of rainfall or sprinkler irrigation occurs within 2 weeks after application. **Age Restriction:** Do not apply to vines established less than one year. 14-day PHI.
annual and perennial grasses and broadleaves	Mission (flazasulfuron 25% a.i.) at 2.14-2.85 oz. in 15-50 gal. of water	Pre emergence: Apply as a directed spray to soil beneath vines to prevent injury to foliage and bark of young vines. You must use a protective for third year vines to minimize injury potential. Post emergence: Apply to weeds less than 4 inches tall and before tillering of grasses in sufficient volume to get thorough coverage. Always use an adjuvant. Do not exceed 2 applications at the 2.85 oz. rate per acre per year. **Age Restriction:** Apply to grapes established 3 years or more. 75-day PHI.
annual grasses and broadleaves	Princep 4L (simazine 4 lb. a.i./gal) at 2-4 qt. in 25-40 gal. of water	**Age Restriction:** Use on vineyards established at least 3 years. Apply to soil under trellis between harvest and early spring before weeds emerge. Apply alone to weed-free soil or tank mix with Roundup or Gramoxone. Do not exceed 1 application per year.

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Herbicide Recommendations for Grape *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annual grasses and certain broadleaves	Prowl H_2O (pendimethalin 3.8 lb. a.i./gal) at 3.2-6.3 qt. in minimum of 20 gal. of water	Apply only to dormant grapevines. Do not apply if buds have started to swell. In bearing vineyards, this product may be applied any time after fall harvest, during winter dormancy, and in the spring. In non-bearing vineyards this product may be applied preplant incorporated, preplant surface, or pre-emergence. For best results, rain or irrigation is needed within 21 days of application. Not effective on germinated weeds. Do not allow spray to contact leaves, shoots, or buds. For new plantings, do not apply until soil has settled and no cracks are present.
annual grasses and certain broadleaves	Snapshot 2.5TG (isoxaben+trifluralin 2.5% a.i.) at 100-200 lb.	**Non-bearing Only:** May only be used on crops that will not be harvested within 1 year of application. Rainfall or irrigation of 0.5 inch is needed within 3 days of application. Not effective on germinated weeds. Minimum 60 days between applications. Do not exceed 600 lb. per 12-month period. Do not apply to new transplants until soil has settled and with no cracks.
annual grasses and broadleaves and suppression of yellow nutsedge	Solicam DF (norflurazon 78.6% a.i.) at 1.25-5 lb. in minimum of 20 gal. of water	Apply as a directed spray to settled and firm soil from fall to early spring before weeds emerge. Rainfall or irrigation is needed within 4 weeks of application. Do not contact fruit or foliage. Do not apply after bud break on sandy loam or other coarse-textured soils. Check label for maximum amount allowed per year depending on soil type. **Age Restriction:** Allow a minimum of 24 months after planting before first application. 60-day PHI.
annual grasses and certain broadleaves	Surflan 4AS (oryzalin 4 lb. a.i./gal.) at 2-6 qt. in 20-40 gal. of water	Make a single band or broadcast application to the ground beneath vines before weeds emerge. Apply alone to weed-free soil or post-emergence mixed with Roundup or Gramoxone. Minimum 1/2 inch of rainfall or irrigation is required for activation. Minimum of 2.5 months between applications. Do not exceed 12 qt. per year.
annual grasses and broadleaves	Treflan HFP 4EC (trifluralin 4 lb. a.i./gal.) at 1-4 pt. in 5-40 gal. of water	In a new planting, apply 1-4 pt. and incorporate within 24 hours. In an established planting, apply 2-4 pt. prior to weed germination or immediately after removal of weeds with tillage or other herbicides and incorporate within 24 hours. 60-day PHI.
annual and perennial broadleaves	Trellis (isoxaben 75% a.i.) at 0.67-1.33 lb. in minimum of 10 gal. of water	**Non-bearing:** Apply any time before target weeds germinate or immediately after cultivation. 1-year PHI. **Bearing:** Apply before target weeds germinate or immediately after cultivation. Do not exceed 2 applications per crop year or exceed 1.33 lb. (1.0 lb. isoxaben) per acre per crop year. 165-day PHI.
annual and perennial grasses and broadleaves	Zeus Prime|XC (carfentrazone-ethyl 3.5% and sulfentrazone 31.8% a.i.) at 7.7-15.2 fl. oz. per acre in minimum of 10 gal. of water	Apply as a broadcast or banded soil application directed to the base of the trunks of vines. If weeds are present, tank mix with a post-emergence herbicide to eliminate emerged weeds. Apply a single broadcast application at 15.2 fl. oz. per acre (0.41 lb. a.i./acre). May be applied as a banded treatment twice per year. Do not exceed 15.2 fl. oz. (0.41 lb. a.i)/acre/year. Minimum of 60 days between applications. Do not apply after bud break except with hooded or shielded sprayer. 3-day PHI. **Age Restriction:** Apply to crops that have been growing for at least 2 years and are in good condition.
annual and perennial grasses and broadleaves	Zeus XC (sulfentrazone 39.6% a.i.) at 8-12 fl. oz. per acre in a minimum of 10 gal. of water	Apply as a broadcast or banded soil application directed to the base of the trunk of vines. If weeds are present, tank mix with a post emergence herbicide to eliminate emerged weeds. Apply a single broadcast application at 8-12 fl. oz./acre (0.25-0.375 lb. a.i./acre). May be applied as a banded treatment twice per year. Minimum 60 days between applications. Do not exceed 12 fl. oz. (0.375 lb a.i)/acre/ year. Do not apply after bud break except with hooded or shielded sprayer. 3-day PHI. **Age Restriction:** Apply to crops that have been growing for at least 3 years and are in good condition.
Post-emergence		
annual broadleaves	Aim EC (carfentrazone 2 lb. a.i./gal.) at 1-2 fl. oz. in 20 gal. of water	Apply any time during the season as a post-emergence directed spray or as a hooded spray treatment. Always add NIS at 0.5% v/v or COC at 1% v/v. Mix with Roundup or Gramoxone or labeled pre-emergence herbicides for broader weed control. Do not exceed 7.9 fl. oz. per year. Minimum 14 days between applications. 3-day PHI. **Sucker Management:** Apply when suckers are green. Do not allow spray to contact desirable fruit, foliage, or green bark.

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Herbicide Recommendations for Grape *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
most annual and perennial grasses	Fusilade DX 2EC (fluazifop-p 2 lb. a.i./gal.) at 16-24 fl. oz. in 25 gal. of water	Apply as a directed spray to actively growing grasses before tillering. Always add COC at 0.5-1% v/v or NIS at 0.25-0.5% v/v. Avoid contact with grape foliage. Rainfast in 1 hour. Do not exceed 24 fl. oz. per application per acre or exceed 72 fl. oz. per acre per year. Minimum 14 days between applications and a maximum of 3 applications per year. 50-day PHI.
annual broadleaves	Goal 2XL (oxyfluorfen 2 lb. a.i./gal/) at 5-8 pt. in minimum of 20 gal. of water	See Pre-emergence section (page 204) for details.
annual broadleaves	GoalTender (oxyfluorfen 4 lb. a.i./gal.) at 2.5-4 pt. in minimum of 40 gal. of water	See Pre-emergence section (page 204) for details.
most annual grasses and broadleaves and top kill of perennial weeds	Gramoxone (paraquat 3 lb. a.i ./gal.) at 1.7-2.7 pt. in minimum of 10 gal. of water	Apply as directed spray to actively growing weeds. Repeat applications are necessary to give sustained control. Avoid contact with desired new shoots, fruit, or foliage. Apply as a coarse spray. Always add NIS at 0.25% v/v or COC at 1% v/v. Best results with flat fan nozzles. Do not exceed 5 applications per year. **Sucker Management:** Apply when suckers are less than 8 inches tall. Do not allow spray to contact desirable fruit, foliage, or green bark. **Restricted use pesticide. Only certified applicators can mix, load and apply. Not to be used by uncertified persons working under the supervision of a certified applicator. Applicators must complete an EPA-approved paraquat training every 3 years https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators Containers under 120 gallons will have "closed-system" packaging to be used with a closed-transfer system.** Harvest at normal crop maturity.
annual and perennial grasses and broadleaves	Mission (flazasulfuron 25% a.i.) at 2.14-2.85 oz. in 15-50 gal. of water	See Pre-emergence section (page 204) for details.
annual and perennial grasses	Poast 1.5EC (sethoxydim 1.5 lb. a.i./gal) at 1.5-2.5 pt. in minimum of 5 gal. of water	Apply as a directed spray to actively growing grasses before tillering. Always add COC at 1% v/v. Do not exceed 2.5 pt. per application or exceed 5 pt. per season. 50-day PHI.
annual grasses and broadleaves	Reglone (diquat 2 lb. a.i./gal.) at 1.5-2 pt. in minimum 15 gals of water	**Non-bearing Only:** May only be used on crops that will not be harvested within 1 year of application. Apply as a directed spray using a shield for contact burn of weeds. Apply when wind speed is 3-10 miles per hour. Complete coverage is essential for good control. Always use NIS at 0.5% v/v. Can be used during site preparation and up to 1 year of harvest. Do not allow contact with green stems, foliage or fruits. 1-year PHI.
annual and perennial grasses and broadleaves	Rely 280 (glufosinate 24.5% a.i. (2.34 lb./gal.)) at 48-82 fl. oz. in minimum of 15 gal. of water	Spray only trunks with callused, mature, brown bark unless protected from spray contact by nonporous wraps, grow tubes, or waxed containers. Apply as a directed spray to actively growing weeds. Add AMS to the spray tank if spray water is hard. Do not exceed 246 fl. oz. per acre per year. Do not make more than 3 applications at a maximum rate of 82 fl. oz. per acre per year. For spot application, mix 1.7 fl. oz./gal. 14-day PHI.
annuals and some perennial grasses and broadleaves	Roundup WeatherMax 5.5EC (glyphosate 5.5 lb. a.i./gal.) at 11 fl. oz. to 3.3 qt. in 10-40 gal. of water	Apply as a directed spray or wiper application to actively growing weeds in established plantings. Rate depends on equipment used, weed species, and stage of growth. See label for details. Always add ammonium sulfate at 8.5-17 lb./100 gal. in hard water or drought conditions (see label). Do not allow spray to contact any part other than mature bark. Does not provide residual control; can be mixed with labeled pre-emergence herbicides. 14-day PHI.
annual and perennial grasses and broadleaves	Scythe 4.2E (pelargonic acid 4.2 lb. a.i./gal.) at 3-10% spray solution	For contact nonselective control or burndown of a broad spectrum of actively growing weeds. Use low rate for annual weed control and high rate for maximum vegetative burndown. Use as a directed spray or shielded spray. Can be mixed with Roundup.
most annual and perennial grasses	Select Max (clethodim 0.97 lb. a.i./gal.) at 9-16 fl. oz.	**Non-bearing Only:** May only be used on crops that will not be harvested within 1 year of application. Apply as a directed spray to actively growing grasses before tillering. Do not use if rain is expected within 1 hour. Always add NIS at 0.25% v/v. Do not use COC. May be applied as a spot treatment at 0.32-0.64 fl. oz. per gal. Do not exceed 32 fl. oz. per year.
annual broadleaves	Venue (pyraflufen ethyl 0.17 lb. a.i./gal.) at 3.0-4.0 fl. oz. in minimum of 20 gal. water	Use as a directed spray from dormancy, prior to bloom and postharvest. Repeat if needed. Keep off green stems and foliage. The addition of COC at 1-2% is recommended. Not registered in all states. Do not exceed 6.8 fl. oz. per acre per year or 3 applications per growing season.

Herbicide Recommendations for Blueberry

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual grasses and broadleaves	Callisto (mesotrione 4 lb. a.i./gal.) at 3.0-6.0 fl. oz.	Apply pre-emergence or early post-emergence. For improved post- emergence control, apply split applications at 3.0 .fl. oz. at least 14 days apart. Do not exceed 2 applications per year or exceed 6 fl. oz. per year. Do not apply after the onset of bloom. Include a COC tolerated by blueberries if applied post- emergence to weeds.
annual and perennial grasses and broadleaves	Casoron CS (dichlobenil 15.3% a.i.) at 1.4-2.8 gal.	Apply from late fall through early spring. Applications should be made prior to weed emergence, or when emerged weeds are less than 2 inches tall. Use only on well-established plants. Do not apply during new shoot emergence. **Age Restriction:** Do not apply to plants less than 1 year old.
annual broadleaves and suppression of grasses	Chateau SW (flumioxazin 51% a.i.) at 6-12 oz.	Apply as a uniform band directed at the base of the bush. Avoid direct spray contact to foliage or green bark. Preferred application timing is in the fall. Do not exceed 6 oz. per acre per application. Do not make a sequential application within 30 days of the first application. Do not exceed 12 oz. per acre per 12-month period. **Age Restriction:** Do not apply to plants less than 2 years old unless they are protected by nonporous wrap, grow tubes or waxed containers. 7-day PHI.
annual grasses and broadleaves	Devrinol 2-XT (napropamide 2 lb. a.i./gal.) at 2 gal./acre (see Generic Herbicides, page 221)	Apply to a weed-free soil surface or tank mix with a suitable post-emergence herbicide. May be applied to newly planted and newly established crops. Do not exceed 2 gal. per acre per crop cycle.
most broadleaves	Gallery 75DF (isoxaben 75% a.i.) at 0.66-1.33 lb. in minimum of 10 gal. of water	**Non-bearing Only:** May only be used on crops that will not be harvested within 1 year of application. Apply in late summer to early fall; or in early spring prior to weed germination or anytime immediately after cultivation. Do not apply to new transplants until soil has settled with no cracks present. Rainfall or irrigation of 1/2 inch is needed within 21 days of application. Not effective on germinated weeds. Minimum of 60 days between applications. Do not exceed 4 lb. per acre per 12-month period.
annual grasses and broadleaves	Karmex DF (diuron 80% a.i.) at 1.5-4 lb. in 25-40 gal. of water Selected states only	**Age Restriction:** Use only in fields established at least 1 year. Apply as a band treatment at the base of bushes. Do not apply to exposed roots. **For AR and MO Only:** Apply 1.5-2 lb. in spring and repeat after harvest in the fall. Always add NIS at 0.25% v/v. **For IN and OH Only:** Apply 2-4 lb. in late spring. Alternatively, apply 2 lb. in fall and repeat in spring.
annual and perennial grasses and certain broadleaves	Kerb SC (pronamide 35.6% a.i.) at 2.5-5.0 pt. in 20-50 gal. of water. Rate depends on weed pressure. See table on label.	Apply as a directed spray in the fall after harvest prior to freeze-up, or in early winter when temperatures are below 55˚F. Rainfall or irrigation are required to activate. Do not exceed 1 application per year or 5.0 pt./A/year. **Age restriction:** Do not apply to newly transplanted blueberries until roots are well established. **Restricted use pesticide.**
annual and perennial grasses and broadleaves	Princep 4L (simazine 4 lb. a.i./gal.) at 2-4 qt. in minimum of 40 gal. of water	Apply in spring before weeds emerge and before canes leaf out, or make a split application of 2 qt. in spring plus 2 qt. in fall. Do not apply when fruit is present, or illegal residues may result. For plants established less than 6 months, apply half the above rate.
annual broadleaf weeds and nutsedge	Sandea (halosulfuron 75%) at 0.5-1 oz. in minimum of 15 gal. of water	Apply with ground equipment as a broadcast application to the ground on either side of the row. Apply as a single or sequential application depending on weed pressure. If small weeds are present, mix with a post-emergence broad-spectrum-type herbicide to maximize and enhance the spectrum of control. For post-emergence nutsedge control, make a single application when nustedge is fully emerged. Or, make 2 sequential applications. Apply the first to the initial nutsedge flush when it has reached the 3-5-leaf stage. If a second application is needed, it can be applied later in the season. Avoid contact with blueberry bushes. Minimum of 45 days between applications. Do not exceed 2 oz. per acre per year. 14-day PHI. **Age Restriction:** Do not apply to plants established less than 1 year.
annual grasses and broadleaves	Sinbar WDG (terbacil 80% a.i.) at 2-3 lb. in minimum of 25 gal. of water	**Age Restriction:** Use only on plantings established at least 1 year. Best results when applied shortly before or after weed emergence. Avoid contact of foliage or fruit with spray or mist. Apply either in the spring or after harvest in the fall before weeds emerge or during early stage of seedling regrowth. Do not use on soils where roots are exposed. Do not use on sand or loamy sand with 1-3% organic matter. Use rate varies by soil type.

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Herbicide Recommendations for Blueberry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annual grasses and certain broadleaves	Snapshot 2.5TG (isoxaben+trifluralin 2.5% a.i.) at 100-200 lb.	**Non-bearing Only:** May only be used on crops that will not be harvested within 1 year of application. Do not apply to new transplants until soil has settled. For best results, 1/2 inch of rain or irrigation is needed within 3 days of application. Not effective on germinated weeds. Minimum 60 days between applications. Do not exceed 600 lb. per 12-month period.
annual grasses and broadleaves and suppression of yellow nutsedge	Solicam DF (norflurazon 78.6% a.i.) at 2.5-5 lb. in minimum of 20 gal. of water	Apply as a directed spray to settled and firm soil from fall to early spring before weeds emerge. Rainfall or irrigation of 1/2 inch is needed within 4 weeks. Do not contact fruit or foliage. Do not apply after bud break on sandy loam soils. Check label for maximum amount allowed per year depending on soil type. Minimum 6 months after planting before first application. 60-day PHI.
annual grasses and certain broadleaves	Surflan 4AS (oryzalin 4 lb. a.i./gal.) at 2-6 qt. in 20-40 gal. of water	Make a single band or broadcast application to the ground beneath plants before weeds emerge. Apply alone to weed-free soil or post-emergence mixed with Roundup or Gramoxone. Minimum 1/2 inch of rainfall or irrigation is required for activation. Minimum 2.5 months between applications. Do not exceed 12 qt. per year.
annual grasses and broadleaves	Velpar 2L (hexazinone 2 lb. a.i./gal.) at 0.5-1 gal. in 20 gal. of water	Apply to pruned blueberries in the spring before leaf emergence as a directed soil application. Some clones are susceptible to injury. 90-day PHI. **Age Restriction:** Use on plantings established at least 3 years.
annual and perennial grasses and broadleaves	Zeus Prime|XC (carfentrazone-ethyl 3.5% and sulfentrazone 31.8% a.i.) at 7.7-15.2 fl. oz. per acre in minimum of 10 gal. of water	Apply as a broadcast or banded soil application directed to the base of the trunks of bushes or vines. If weeds are present, tank mix with a post-emergence herbicide to eliminate emerged weeds. Apply a single broadcast application at 15.2 fl. oz. per acre (0.41 lb. a.i./acre). May be applied as a banded treatment twice per year. Do not exceed 15.2 fl. oz. (0.41 lb. a.i.)/acre/year. Minimum of 60 days between applications. Do not apply after bud break except with hooded or shielded sprayer. 3-day PHI. **Age Restriction:** Apply to crops that have been growing for at least 2 years and are in good condition.
annual and perennial grasses and broadleaves	Zeus XC (sulfentrazone 39.6% a.i.) at 8-12 fl. oz. per acre in a minimum of 10 gal. of water	Apply as a broadcast or banded soil application directed to the base of the trunk of bushes or vines. If weeds are present, tank mix with a post-emergence herbicide to eliminate emerged weeds. Apply a single broadcast application at 8-12 fl. oz. per acre (0.25-0.375 lb. a.i./acre). May be applied as a banded treatment twice per year. Minimum of 60 days between applications. Do not exceed 12 fl. oz. (0.375 lb. a.i.)/acre/year. Do not apply after bud break except with hooded or shielded sprayer. 3-day PHI . **Age Restriction:** Apply to crops that have been growing for at least 3 years and are in good condition.
Post-emergence		
annual broadleaves	Aim EC (carfentrazone 2 lb. a.i./gal.) at 1-2 fl. oz. in 20 gal. of water	Apply broadcast at base of canes during dormant stage or with hooded shields between rows during growing season. Always add NIS at 0.25% v/v or COC at 1% v/v. Do not exceed 2 fl. oz. during dormant season or exceed 6.1 fl. oz. during growing season. Minimum 14 days between applications. 1-day PHI.
annual broadleaves and suppression of grasses	Chateau SW (flumioxazin 51% a.i.) at 6-12 oz.	Apply 6 to 12 oz. (0.188 to 0.38 lb. ai/A) of Chateau Herbicide SW per broadcast acre plus an adjuvant (0.25% v/v non-ionic surfactant or 1 qt./A crop oil concentrate)
most annual and perennial grasses	Fusilade DX 2EC (fluazifop-p 2 lb a.i./gal.) at 16-24 fl. oz. in 25 gal. of water	Apply as a directed spray to actively growing grasses before tillering. Always add COC at 1% v/v or NIS at 0.25% v/v. Avoid contact with foliage. Rainfast in 1 hour. Do not exceed 48 fl. oz. in a maximum of two 24 oz. applications per year. Minimum 14 days between applications. 1-day PHI.
most annual grasses and broadleaves and top kill of perennial weeds	Gramoxone (paraquat 3 lb. a.i ./gal.) at 1.3-2.7 pt. in minimum of 50 gal. of water	Apply as directed spray to actively growing weeds before emergence of new canes or shoots. Repeat applications are necessary to give sustained control. Apply as a coarse spray to avoid drift injury. Avoid contact with desired new shoots, fruit, or foliage. Always add NIS at 0.25% v/v or COC at 1% v/v. Do not exceed 2 applications per year. **Restricted use pesticide. Only certified applicators can mix, load and apply. Not to be used by uncertified persons working under the supervision of a certified applicator. Applicators must complete an EPA-approved paraquat training every 3 years https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators Containers under 120 gallons will have "closed-system" packaging to be used with a closed-transfer system.** Harvest fruit at normal maturity.

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Herbicide Recommendations for Blueberry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annual and perennial grasses	Poast 1.5EC (sethoxydim 1.5 lb. a.i./gal.) at 1.5-2.5 pt. in minimum of 5 gal. of water	Apply as a directed spray to actively growing grasses before tillering. Always add COC at 1% v/v. Do not exceed 2.5 pt. per application or exceed 5 pt. per season. 30-day PHI.
annual grasses and broadleaves	Reglone (diquat 2 lb. a.i./gal.) at 1.5-2 pt. in minimum of 15 gal. of water	**Non-bearing Only:** May only be used on crops that will not be harvested within 1 year of application. Apply as a directed spray using a shield for contact burn of weeds. Apply when wind speed is 3-10 miles per hour. Complete coverage is essential for good control. Always add NIS at 0.06-0.5% v/v. Can be used during site preparation and up to 1 year of harvest. Do not allow contact with green stems, foliage, or fruits. 1-year PHI.
annual and perennial grasses and broadleaves	Rely 280 (glufosinate 24.5% a.i. (2.34 lb./gal.) at 48-82 fl. oz. in minimum of 15 gal. of water	Apply as a directed spray to actively growing weeds. Do not apply on desirable foliage or drift on foliage, green, or uncallused bark. Coverage of all foliage is necessary for optimum control. Do not exceed 164 fl. oz. per acre per year. Do not make more than 2 applications at a maximum rate of 82 fl. oz. per acre per year. Add AMS to the spray tank if spray water is hard. 14-day PHI.
annuals and some perennial grasses and broadleaves	Roundup WeatherMax 5.5EC (glyphosate 5.5 lb. a.i./gal.) at 0.5-5.3 qt. in 10-40 gal. of water	Apply as a directed spray or wiper application to actively growing weeds in established plantings. Always add ammonium sulfate at 8.5-17 lb./100 gal. in hard water or drought conditions. Do not allow spray to contact any part other than mature bark. For applications within rows of berries, use only selective equipment (directed spray, hooded sprayer, shielded sprayer, or wiper application) to minimize the potential for overspray or drift onto the crop. For berry crops, hooded or shielded sprayers must be fully enclosed (including top, sides, front, and back). Only wiper applications or shielded sprayers capable of preventing all contact with the crop may be used. Rate depends on weed species and stage of growth. Does not provide residual control. Can be mixed with labeled pre-emergence herbicides. 14-day PHI.
annual and perennial grasses and broadleaves	Scythe 4.2E (pelargonic acid 4.2 lb. a.i./gal.) at 3-10% spray solution	For contact nonselective control or burndown of a broad spectrum of actively growing weeds. Use low rate for annual weed control and high rate for maximum vegetative burndown. Use as a directed spray or shielded spray. Can be mixed with Roundup.
most annual and perennial grasses	Select Max (clethodim 0.97 lb. a.i./gal.) at 9-16 fl. oz.	Apply as a directed spray to actively growing grasses before tillering. Do not use COC. Minimum 14 days between applications. Always add NIS at 0.25% v/v. May be applied as a spot treatment at 0.32-0.64 fl. oz./gal. Rainfast in 1 hour. Do not exceed 64 fl. oz. per year. 14-day PHI.

Herbicide Recommendations for Brambles

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual and perennial grasses and broadleaves	Casoron CS (dichlobenil 15.3% a.i.) at 1.4-2.8 gal.	Apply from late fall through early spring. Applications should be made prior to weed emergence, or when emerged weeds are less than 2 inches tall. Use only on well-established plants. Do not apply during new shoot emergence. **Age Restriction:** Do not apply to plants less than 1 year old.
annual broadleaves and suppression of grasses	Chateau SW (flumioxazin 51% a.i.) at 6 oz./acre in a minimum of 15 gal. of spray solution per acre	Apply as a uniform band directed at the base of the canes. Preferred application timing is in the fall. Do not exceed 6 oz. per acre per application. Do not apply over the top of the crop or allow spray to come in contact with the crop as a result of application or drift. Do not apply within 300 yards of non-dormant pome or stone fruit. 7-day PHI.
annual grasses and broadleaves	Devrinol 2-XT (napropamide 2 lb. a.i./gal.) at 2 gal./acre	Apply to a weed-free soil surface or tank mix with a suitable postemergent herbicide. May be applied to newly planted and newly established crops. Do not apply more than 2 gal. per acre per crop cycle.
most broadleaves	Gallery 75DF (isoxaben 75% a.i.) at 0.66-1.33 lb. in minimum of 10 gal. of water	**Non-bearing Only:** May only be used on crops that will not be harvested within 1 year of application. Apply in late summer to early fall, or in early spring prior to weed germination, or anytime immediately after cultivation. Do not apply to new transplants until soil has settled with no cracks present. Rainfall or irrigation of 1/2 inch is needed within 21 days of application. Not effective on germinated weeds. Minimum 60 days between applications. Do not exceed 4 lb. per acre per 12-month period.
annual grasses and broadleaves	Karmex DF (diuron 80% a.i.) at 3 lb. in 25-40 gal. of water Selected states only	**Age Restriction:** Apply in fields established at least 1 year. Do not exceed 1 application per year. Do not spray exposed roots to avoid injury. **IN and OH only:** Apply 3 lb. in late spring for raspberries. If used post-emergence, avoid contact with foliage. Best results if temperature is at least 70°F with high humidity.

(continued)

Herbicide Recommendations for Brambles *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annual grasses and broadleaves	Princep 4L (simazine 4 lb. a.i./gal.) at 2-4 qt. in minimum of 40 gal. of water	Apply in spring before weeds emerge and before canes leaf out. Or, make a split application of 2 qt. in spring plus 2 qt. in fall. Do not apply when fruit is present, or illegal residues may result. On plants established less than 6 months, apply at half the rate.
annual grasses and broadleaves	Sinbar WDG (terbacil 80% a.i.) at 1-2 lb. in minimum of 20 gal. of water	Make a single band or broadcast application as a directed spray to soil beneath the canes in the fall or early spring before fruit set and shortly before or after weed emergence. Avoid contact of foliage or fruit with spray or mist. Do not use on soils where roots are exposed. **Age Restriction:** Use only on plantings established at least 1 year. 70-day PHI.
annual grasses and certain broadleaves	Snapshot 2.5TG (isoxaben+trifluralin 2.5% a.i.) at 100-200 lb.	Non-bearing Only: May only be used on crops that will not be harvested within 1 year of application. For best results, 1/2 inch of rain or irrigation is needed within 3 days of application. Not effective on germinated weeds Do not apply to new transplants until soil has settled. Minimum 60 days between applications. Do not exceed 600 lb. per 12-month period.
annual grasses and broadleaves and suppression of yellow nutsedge	Solicam DF (norflurazon 78.6% a.i.) at 2.5-5 lb. in minimum of 20 gal. of water	Apply as a directed spray to settled and firm soil from fall to early spring before weeds emerge. Rainfall or irrigation of 1/2 inch within 4 weeks to activate. Do not contact fruit or foliage. Do not apply after bud break on sandy loam soils. Check label for maximum amount allowed per year depending on soil type. **Age Restriction:** Minimum 12 months after planting before first application. 60-day PHI.
annual grasses and certain broadleaves	Surflan 4AS (oryzalin 4 lb. a.i./gal.) at 2-6 qt. in 20-40 gal. of water	Make a single band or broadcast application to the ground beneath vines before weeds emerge. Apply alone to weed-free soil or post-emergence mixed with Roundup or Gramoxone. Rainfall or irrigation of 1/2 inch is required for activation. Minimum 2.5 months between applications. Do not exceed 12 qt. per year.
annual and perennial grasses and broadleaves	Zeus Prime|XC (carfentrazone-ethyl 3.5% and sulfentrazone 31.8% a.i.) at 7.7-15.2 fl. oz./acre in minimum of 10 gal. of water	Apply as a broadcast or banded soil application directed to the base of the trunks of bushes or vines. If weeds are present, tank mix with a post-emergence herbicide to eliminate emerged weeds. Apply a single broadcast application at 15.2 fl. oz. (0.41 lb. a.i) per acre. May be applied as a banded treatment twice per year. Do not exceed 15.2 fl. oz. (0.41 lb. a.i.) /acre/year. Minimum 60 days between applications. Do not apply after bud break except with hooded or shielded sprayer. 3-day PHI. **Age Restriction:** Apply to crops that have been growing for at least 2 years and are in good condition.
annual and perennial grasses and broadleaves	Zeus XC (sulfentrazone 39.6% a.i.) at 8-12 fl. oz./acre in a minimum of 10 gal. of water	Apply as a broadcast or banded soil application directed to the base of the trunk of bushes or vines. If weeds are present, tank mix with a post-emergence herbicide to eliminate emerged weeds. Make a single broadcast application at 8-12 fl. oz. (0.25-0.375 lb. a.i) per acre. May be applied as a banded treatment twice per year. Minimum of 60 days between applications. Do not exceed 12 fl. oz. (0.375 lb. a.i.)/acre/year. Do not apply after bud break except with hooded or shielded sprayer. 3-day PHI. Age Restriction: Apply to crops that have been growing for at least 3 years and are in good condition.
Post-emergence		
annual broadleaves	Aim EC (carfentrazone 2 lb. a.i./gal.) at 1-2 fl. oz. in 20 gal. of water	Apply with hooded shields between rows during growing season. Always add NIS at 0.25% v/v or COC at 1% v/v. Do not exceed 25.6 fl. oz. per year. Minimum 14 days between applications. 15-day PHI. **Primocane Control:** Apply when primocanes are 6 inches at 6.4 fl. oz. in minimum of 20 gal. of water at intervals of 14-21 days. Direct sprays to bottom 18 inches of canes.
most annual and perennial grasses	Fusilade DX 2EC (fluazifop-p 2 lb. a.i./gal.) at 16-24 fl. oz. in 25 gal. of water	Apply as a directed spray to actively growing grasses before tillering. Always add COC at 1% v/v or NIS at 0.25% v/v. Avoid contact with foliage. Rainfast in 1 hour. Do not exceed 48 fl. oz. in a maximum of two 24 fl. oz. applications per year. Minimum 14 days between applications. 1-day PHI.
most annual grasses and broadleaves and top kill of perennial weeds	Gramoxone (paraquat 3 lb. a.i./gal.) at 1.3-2.7 pt. in minimum of 50 gal. of water	Apply as directed spray to actively growing weeds before emergence of new canes or shoots. Repeat applications are necessary to give sustained control. Apply as a coarse spray to avoid drift injury. Avoid contact with desired new shoots, fruit, or foliage. Always add NIS at 0.25% v/v or COC at 1% v/v. Do not exceed 2 applications per year. **Restricted use pesticide. Only certified applicators can mix, load and apply. Not to be used by uncertified persons working under the supervision of a certified applicator. Applicators must complete an EPA-approved paraquat training every 3 years https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators Containers under 120 gallons will have "closed-system" packaging to be used with a closed-transfer system.** Harvest crop at normal harvest maturity.
annual grasses and broadleaves	Karmex DF (diuron 20% a.i.) at 3 lb. in 25-40 gal. of water.	Selected states only. See Pre-emergence on page 209 for details.

(continued)

Herbicide Recommendations for Brambles *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annual and perennial grasses	Poast 1.5EC (sethoxydim 1.5 lb. a.i./gal.) at 1.5-2.5 pt. in minimum of 5 gal. of water	Apply as a directed spray to actively growing grasses before tillering. Always add COC at 1% v/v. Do not exceed 5 pt. per season. May be used as a spot treatment at 1-1.5% solution. 45-day PHI.
annual grasses and broadleaves	Reglone (diquat 2 lb. a.i./gal.) at 1.5-2 pt. in minimum of 15 gal. of water	**Non-bearing Only:** May only be used on crops that will not be harvested within 1 year of application. Apply as a directed spray using a shield for contact burn of weeds. Apply when wind speed is 3-10 miles per hour. Complete coverage is essential for good control. Always use NIS at 0.06-0.5% v/v. Can be used during site preparation and up to 1 year of harvest. Do not allow contact with green stems, foliage or fruits. 1-year PHI.
annuals and some perennial grasses and broadleaves	Roundup WeatherMax 5.5EC (glyphosate 5.5 lb. a.i./gal.) at 0.5-5.3 qt. in 10-40 gal. of water	Apply as a directed spray or wiper application to actively growing weeds in established plantings. Always add ammonium sulfate at 8.5-17 lb./100 gal. in hard water or drought conditions. Do not allow spray to contact any part other than mature bark. For applications within rows of berries, use only selective equipment (directed spray, hooded sprayer, shielded sprayer, or wiper application) to minimize the potential for overspray or drift onto the crop. For berry crops, hooded or shielded sprayers must be fully enclosed (including top, sides, front, and back). Only wiper applications or shielded sprayers capable of preventing all contact with the crop may be used. Use with extreme care around raspberries as serious damage may occur if any part of the plant comes in contact with the product. Rate depends on weed species and stage of growth. Does not provide residual control. Can be mixed with labeled pre-emergence herbicides. 14-day PHI.
annual and perennial grasses and broadleaves	Scythe 4.2E (pelargonic acid 4.2 lb. a.i./gal.) at 3-10% spray solution	For contact nonselective control or burndown of a broad spectrum of actively growing weeds. Use low rate for annual weed control and high rate for maximum vegetative burndown. Use as a directed spray or shielded spray. Can be mixed with Roundup.
most annual and perennial grasses	Select Max (clethodim 0.97 lb. a.i./gal.) at 9-16 fl. oz.	Apply post-emergence as a directed spray to young actively growing grasses. Do not exceed 16 fl. oz./A in a single application or 64 fl. oz./A per season. A minimum 14-day interval is required for repeat applications. Always add NIS at 0.25% v/v. Do not use COC. Rainfast in 1 hour. 7-day PHI.

Herbicide Recommendations for Strawberry

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual broadleaves and suppression of grasses	Chateau SW (flumioxazin 51% a.i.) at 3 oz.	**Pre-transplanting:** Apply a minimum of 30 days before transplanting and before laying plastic. Can be mixed with Gramoxone or Roundup. **Pre-emergence on Dormant Plants:** Can be applied over the top of established or newly planted dormant strawberries. Add COC at 1% v/v or NIS at 0.25% v/v to help control emerged broadleaf weeds. Do not apply to frozen ground. **Shielded or Hooded Application in Row Middles:** Do not apply after fruit set and not over strawberry plants. Apply prior to weed emergence.
annual grasses and some broadleaves	Dacthal 6F (DCPA 6 lb. a.i./gal.) at 8-12 pt. in minimum of 20 gal. of water	**At Planting:** Apply 12 pt. at transplanting. Can be preplant incorporated. Clean cultivator or hoe if necessary before treatment. **Established:** Apply in early fall or in early spring immediately after mulch removal. Clean cultivate or hoe if necessary before treatment. Applications may be made directly over the plants without injury. Do not apply from bloom through harvest.
annual grasses and certain broadleaves	Devrinol 2-XT (napropamide 2 lb. a.i./gal.) at 2 gal./acre	**Established Plantings (spring):** Apply after removing straw mulch. Water into soil to a depth of 2-4 inches (by rainfall or irrigation) within 24-72 hours of application. **Established Plantings (fall):** Apply before putting winter protective mulch over plants. Water into soil to a depth of 2-4 inches (by rainfall or irrigation) within 24-72 hours of application. Do not apply to frozen ground. Do not exceed 2 gal. per acre per crop cycle. **Strawberries Not Grown with Plastic:** Apply to a weed-free soil surface. May be applied to newly transplanted crops. Delay application until the desired number of daughter plants has become established. Do not exceed 2 gal. per acre per crop cycle. Do not apply from bloom through harvest. **Strawberries Grown with Plastic Mulch on Plant Beds:** Apply to a weed-free soil before laying plastic mulch. Incorporate to a depth of 2 inches within 24-72 hours of application and before laying plastic. May also be applied to soil between beds. Do not exceed 2 gal. per acre per crop cycle. Do not apply from bloom through harvest.

(continued)

Herbicide Recommendations for Strawberry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annual broadleaves, especially winter annuals	Goal 2XL (oxyfluorfen 2 lb. a.i./gal.) at 1-2 pt. in minimum of 40 gal. of water	**Fallow Bed Preparation Only:** Apply with Roundup for control of winter annual broadleaves a minimum of 30 days before transplanting. Fallow bed should be worked thoroughly to a depth of 2.5 inches prior to planting.
annual grasses and certain broadleaves	Prowl H_2O 3.8E (pendimethalin 3.8 lb. a.i./gal.) at 1-2 pt. in minimum of 20 gal. of water. Rate depends on soil type. See label for details.	Apply as a broadcast spray before transplanting or after transplanting but before growth starts. May not be used on beds that will be covered in plastic. A second application may be used in a band between rows up to 35 days before harvest. Do not allow the spray to contact strawberry foliage. May be applied to strawberries in fall or winter dormancy prior to the onset of new growth. May be applied to perennial strawberries during renovation after foliage has been mowed, but prior to the onset of new growth. Adequate rainfall or irrigation after application prior to weed emergence provides the most benefit. Do not exceed 3 pt. per application or exceed 6 pt. per season. 35-day PHI.
annual grasses and broadleaves	Sinbar WDG (terbacil 80% a.i.) at 2-8 oz. in minimum of 20 gal. of water	**Planting Year:** Apply 2-3 oz. immediately after transplanting but before runners start to root. Application of 2-6 oz. can also be made to dormant plants in late summer or early fall for control of winter annual weeds. If transplants have started to develop new foliage in the spring, or are not dormant in late summer or early fall at time of application, 1/2 to 1 inch of rain or irrigation is necessary to wash Sinbar off. Do not use on soils with less than 0.5% organic material, as plant injury can occur. **Harvest Years:** Apply 4-8 oz. after post-harvest renovation and before new growth begins in midsummer. An additional 4-8 oz. prior to mulching in late fall is recommended to extend weed control through harvest of the following year. Do not exceed 8 oz. per season. 110-day PHI. **Note:** Strawberry varieties differ in sensitivity to Sinbar, and significant plant injury is possible. Conduct a field test before adoption as a normal practice, particularly for new varieties.
annual broadleaf weeds, grasses and nutsedge	Spartan 4F (sulfentrazone 39.6%) at 4-8 oz. in 20-40 gal. of water	Apply prior to planting, post-transplant before new leaves emerge from dormant crowns. Do not exceed 8 fl. oz. per acre per application or exceed 12 oz. (0.375 lb. a.i.)/acre/year. Rate depends on soil texture. Some cultivars may be sensitive. See label. Some states may have supplemental or Special Local Need labels. 70-day PHI.
Post-emergence		
annual broadleaves	Aim EC (carfentrazone 2 lb. a.i./gal.) at 0.5-2 fl. oz. in minimum of 10 gal. of water	Apply with hooded shields between rows during growing season to actively growing weeds. Best results when weeds are <4 inches and rosettes <3 inches across. Always add NIS at 0.25% v/v or COC at 1% v/v. Do not exceed 6.1 fl. oz./year. Minimum 14 days between applications. 0-day PHI.
annual and some perennial broadleaves	2,4-D amine (4 lb. a.i./gal.) at 2-3 pt. in 25-50 gal. of water	**For Established Plantings Only:** Apply in early spring when strawberries are dormant or immediately after last picking. Do not apply unless possible injury to the crop is acceptable. Do not tank mix with Poast. Several 2,4-D amine products are available, but only a few are labeled for strawberry. Check label for specific use directions.
most annual and perennial grasses	Fusilade DX 2EC (fluazifop-p 2 lb. a.i./gal.) at 16 fl. oz. in 25 gal. of water	Apply as a directed spray to actively growing grasses before tillering. Always add COC at 1% v/v or NIS at 0.25% v/v. Rainfast in 1 hour. Do not exceed 16 fl. oz. per year. Do not exceed 1 application per year. 14-day PHI.
annual broadleaves	Goal 2XL (oxyfluorfen 2 lb. a.i./gal.) at 1-2 pt. in minimum of 40 gal. of water	See Pre-emergence section for details.
most annual grasses and broadleaves and top kill of perennial weeds	Gramoxone (paraquat 3 lb. a.i ./gal.) at 1.3 pt. in minimum of 20 gal. of water	Apply as a postemergence directed spray in a minimum of 20 gal. per acre. Apply by directed spray between rows, using shields to prevent contact with crop. Add NIS at 0.25% v/v or COC at 1% v/v. Do not exceed 3 applications per year. 21-day PHI. **Restricted use pesticide. Only certified applicators can mix, load and apply. Not to be used by uncertified persons working under the supervision of a certified applicator. Applicators must complete an EPA-approved paraquat training every 3 years https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators Containers under 120 gallons will have "closed-system" packaging to be used with a closed-transfer system.** 21-day PHI.
most annual and perennial grasses (post-emergence only)	Poast 1.5EC (sethoxydim 1.5 lb. a.i./gal.) at 1-2.5 pt. in 25 gal. of water	Apply to actively growing grasses before tillering. Always add COC at 1% v/v. May be used as a spot treatment at 1-1.5% spray solution. Do not exceed 2.5 pt. per application or exceed 2.5 pt. per season. **Caution:** Application of Poast up to six weeks after Sinbar application can occasionally cause strawberry leaf injury. 7-day PHI.

(continued)

Herbicide Recommendations for Strawberry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
annuals and some perennial grasses and broadleaves	Roundup WeatherMax 5.5EC (glyphosate 5.5 lb. a.i./gal/) at 0.5-5.3 qt. in 10-40 gal. of water	Apply as pre-plant broadcast application or in fall prior to planting for control of roots and rhizomes of perennial weeds or as a hooded, shielded directed spray or wiper application (33-100% solution) to actively growing weeds between rows in established plantings. Always add ammonium sulfate 8.5-17 lb./100 gal. in hard water or drought conditions. Do not allow spray to contact any desired plants. Does not provide residual control; can be mixed with labeled pre-emergence herbicides. Rate depends on weed species and stage of growth. 14-day PHI.
annual and perennial grasses and broadleaves	Scythe 4.2E (pelargonic acid 4.2 lb. a.i./gal.) at 3-10% spray solution	For contact nonselective control or burndown of a broad spectrum of actively growing weeds. Use low rate for annual weed control and high rate for maximum vegetative burndown. Use as a directed spray or shielded spray. Can be mixed with Roundup.
most annual and perennial grasses	Select Max (clethodim 0.97 lb. a.i./gal.) at 9-16 fl. oz.	Apply as a directed spray to actively growing grasses before tillering. Always add COC at 1% v/v. Rainfast in 1 hour. Do not exceed 64 fl. oz./year or exceed 16 fl. oz./application. Minimum 14 days between applications. May be applied as a spot treatment at 0.32-0.64 fl. oz./gal. 4-day PHI.
annual and perennial broadleaves	Spur (clopyralid 3 lb. a.i./gal.) at 2/3 pt. in minimum of 10 gal. of water	**For perennial strawberries only.** Make 1 application after harvest. Make only 1 application per crop year. Do not tank mix with other herbicides. Not registered in all states, but has 24(c) special local needs registration in several states. Check for state registration.
annual grasses and broadleaves	Ultra Blazer 2E (acifluorfen 2 lb. a.i./gal.) at 1.5 pt. in minimum of 20 gal. of water	May be applied up to the maximum application rate of 1.5 pt. per acre per application using ground equipment. Make broadcast applications in 20 -40 gal. water per acre. Reduce rates proportionally for band or strip treatment. Do not apply more than 3 pt. per acre per season. Apply with NIS, COC, AMS or UAN solution additive. **Annual Strawberries Grown on Plastic Mulch:** Make 1 banded application before laying plastic and after final land preparation, and prior to transplanting the crop. For application between rows of plastic mulch, apply as a direct-shielded application between mulched beds. Do not allow contact with strawberry plants. 60-day PHI. **Perennial Strawberry (matted row):** Make 2 applications: the first can be made after the last harvest or following bed renovation. The second can be made when plants are dormant during late fall to early spring. 120-day PHI.

Small Fruit Herbicide REI, PHI and Special Notes

Compiled and edited by John Strang, Elizabeth Wahle and Shawn Wright

Trade Name	Common Name	WSSA	Risk of Resistance	REI	Strawberry	Raspberry	Blackberry	Grape	Blueberry
Aim EC	carfentrazone-ethyl	14	medium	12	0	15	15	3	0
Alion	indaziflam	21	medium	12	--	14	14	14	14
Amine 4	2,4-D amine	4	low	48	N/A	--	--	--	--
Broadloom	bentazon	6	medium	48	--	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Callisto	mesotrione	27	medium	12	--	no bloom to harvest	no bloom to harvest	--	no bloom to harvest
Casoron CS	dichlobenil	20	medium	12	--	N/A	N/A	N/A	N/A
Chateau SW	flumioxazin	14	medium	12	Row middle application - Do not apply after fruit set	7	7	60	7
Dacthal	DCPA	3	low	12	Pre or at transplanting; Established - no bloom to harvest	--	--	--	--
Devrionol DF-XT	napropamide	15	low	24	N/A5	N/A	N/A	70	N/A
Fusilade DX	fluazifop	1	high	12	14	1	1	50	NB/10 mo
Gallery	isoxaben DF or SC	21	medium	12	--	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Trellis	isoxaben 75%	21	medium	12	--	NB/1 yr	NB/1 yr	NB/1 yr|60	NB/1 yr
Trellis SC	isoxaben 45.45%	21	medium	12	--	NB/1 yr	NB/1 yr	NB/1 yr|60	NB/1 yr|60[4]
GoalTender	oxyfluorfen 41%	14	medium	24	Fallow PP	--	--	Fallow PP| Dormant	--
Goal 2XL	oxyfluorfen 22.3%	14	medium	24	Fallow PP	--	--	Fallow PP| Dormant	--
Gramoxone SL 3.0	paraquat	22	medium	24	21	N/A[3]	N/A[3]	N/A[5]	N/A[3]
Karmex DF	diuron	7	medium	12	--	0	0	0	0
Kerb SC	pronamide	3	low	24	--	--	--	N/A[1]	N/A[2]
Matrix FNV	rimsulfuron	2	medium	4	--	--	--	14	--
Mission	flazasulfuron	2	medium	12	--	--	--	75	--
Poast 1.5 EC	sethoxydim	1	high	12	7	45	45	50	1 HB/30 LB
Princep 4L	simazine	5	medium	12	--	N/A6	N/A6	N/A8	N/A6
Prowl	pendimethalin	3	low	12	--	--	--	NB/1 yr	--
Prowl H2O	pendimethalin	3	low	12	35	--	--	21	--
Reglone	diquat	22	medium	24	--	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Rely 280	glufosinate	10	medium	12	--	--	--	14	14
Roundup	glyphosate	9	low	12	14	14	14	14	14
Sandea	halosulfuron	2	low	12	--			--	14

(continued)

Small Fruit Herbicide REI, PHI and Special Notes *(continued)*

Trade Name	Common Name	WSSA	Risk of Resistance	REI	Strawberry	Raspberry	Blackberry	Grape	Blueberry
Scythe	pelargonic acid	26	low	12	N/A	N/A	N/A	N/A	N/A
Select Max	clehtodim	1	high	12	4	7	7		14 HB/45 LB
Showcase	trifluralin+ isoxaben + oxyfluorfen	3, 21, 14	medium	24	--	--	--	--	NB/1 yr
Sinbar WDG	terbacil	5	medium	12	110	70	70	--	N/A
Snapshot	isoxaben+ trifluralin	21+3	medium	12	--	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Solicam DF	norflurazon	12	medium	12	--	Dormant	Dormant	60	60
Spartan	sulfentrazone	14	medium	12	preplant only	--	--	--	--
Spur, Stinger	clopyralid	4	medium	12	N/A1	--	--	--	--
Surflan 4AS	oryzalin	3	low	24	--	N/A	N/A	N/A	HB N/A
Treflan	trifluralin	3	low	12	--	--	--	60	--
Ultra Blazer	acifuorfen	14	medium	48	60/120	--	--	--	--
Velpar L CU	hexazinone	5	medium	48	--	--	--	--	HB 90/LB 450
Venue	pyrafluflen ethyl	14	medium	12	--	--	--	0	--
Zeus Prime XC	carfentrazone-ethyl+ sulfentrazone	14	medium	12	--	3	3	3	3
Zeus XC	sulfentrazone	14	medium	12	--	3	3	3	3

-- = not labelled
DS/NCC = Directed Spray/No Crop Contact
N/A - no PHI specified
[1] = application must be in the fall, after the fruit is harvested, but prior to soil freeze-up
[2] = application in the fall or early winter, but prior to soil freeze-up and snow cover
[3] = apply before emergence of new canes or shoots
[4] = PHI for Highbush Blueberry only, no PHI stated for Lowbush Blueberry
[5] = See label
[6] = do not apply when fruit is present or illegal residues may result
[7] = apply late fall to early spring prior to weed emergence. Do not apply more than once per calendar year
[8] = apply anytime between harvest and early spring. Do not apply more than once per calendar year

Tree Fruit Herbicide REI, PHI and Special Notes

Trade Name	Common Name	WSSA	Risk of Resistance	REI	Apple	Pear	Peach	Nectarine	Plum	Cherry
Aim EC	carfentrazone-ethyl	14	medium	12	3	3	3	3	3	3
Alion	indaziflam	21	medium	12	14	14	14	14	14	14
amine	2,4-D amine	4	low		--	--	40	40	40	40
Amine 4	2,4-D amine	4	low	48	14	14	40	40	40	40
Broadloom	bentazon	6	medium	48	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Casoron CS	dichlobenil	20	medium	12	N/A	N/A	--	--	--	N/A
Chateau SW	flumioxazin	14	medium	12	Not after pink bud/60	Not after pink bud/60	Not after pink bud/60	Not after pink bud/60	Not after pink bud/60	Not after pink bud/60
Fusilade DX	fluazifop	1	high	12	NB/1 yr	NB/1 yr	14	14	14	14
Gallery	isoxaben DF or SC	21	medium	12	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Trellis	isoxaben 75%	21	medium	12	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Trellis SC	isoxaben 45.45%	21	medium	12	NB/1 yr|30	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
GoalTender	oxyfluorfen 41%	14	medium	24	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant
Goal 2XL	oxyfluorfen 22.3%	14	medium	24	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant	Fallow Preplant|N-B|Dormant
Gramoxone SL 3.0	paraquat	22	medium	24	N/A	N/A	14	28	28	28
Karmex DF	diuron	7	medium	12	N/A	N/A	N/A	--	--	--
Kerb SC	pronamide	3	low	24	N/A1	N/A1	N/A1	N/A1	N/A1	N/A1
Matrix FNV	rimsulfuron	2	medium	4	7	7	14	14	14	14
Poast 1.5 EC	sethoxydim	1	high	12	14	14	25	25	NB/1yr	25
Princep 4L	simazine	5	medium	12	150	N/A	N/A7	--	N/A7	N/A7 sweet
Prowl	pendimethalin	3	low	12	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Prowl H2O	pendimethalin	3	low	12	60	60	60	60	60	60
Reglone	diquat	22	medium	24	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Rely 280	glufosinate	10	medium	12	14	14	14	14	14	14
Roundup	glyphosate	9	low	12	14	14	17	17	17	17
Sandea	halosulfuron	2	low	12	14	14	--	--	--	--
Scythe	pelargonic acid	26	low	12	N/A	N/A	N/A	N/A	N/A	N/A
Select Max	clehtodim	1	high	12	14	14	14	14	14	14
Showcase	trifluralin+ isoxaben+ oxyfluorfen	3, 21, 14	medium	24	--	--	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr

(continued)

Tree Fruit Herbicide REI, PHI and Special Notes *(continued)*

Trade Name	Common Name	WSSA	Risk of Resistance	REI	Apple	Pear	Peach	Nectarine	Plum	Cherry
Sinbar WDG	terbacil	5	medium	12	60	--	60	--	--	--
Snapshot	isoxaben+ trifluralin	21+3	medium	12	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Solicam DF	norflurazon	12	medium	12	60	60	60	60	60	60
Surflan 4AS	oryzalin	3	low	24	N/A	N/A	N/A	N/A	N/A	N/A
Treevix	saflufenacil	14	low	12	0	0	--	--	--	--
Treflan	trifluralin	3	low	12	--	--	N/A	N/A	N/A	N/A
Venue	pyrafluflen ethyl	14	medium	12	0	0	0	0	0	0
Zeus Prime XC	carfentra-zone-ethyl +sulfentrazone	14	medium	12	14	--	--	--	--	--

-- = not labelled
DS/NCC = Directed Spray/No Crop Contact
N/A - no PHI specified
[1] = application must be in the fall, after the fruit is harvested, but prior to soil freeze-up
[2] = application in the fall or early winter, but prior to soil freeze-up and snow cover
[3] = apply before emergence of new canes or shoots
[4] = PHI for Highbush Blueberry only, no PHI stated for Lowbush Blueberry
[5] = See label
[6] = do not apply when fruit is present or illegal residues may result
[7] = apply late fall to early spring prior to weed emergence. Do not apply more than once per calendar year
[8] = apply anytime between harvest and early spring. Do not apply more than once per calendar year

Generic Pesticides

A generic agricultural chemical is manufactured and sold by a company other than the original manufacturer and patent holder, usually after the patent has expired. The generic pesticide contains the same active ingredient(s) (AI) and tend to be **similar** in performance to receive an EPA registration.

Generic products are **not always identical**, so be sure to carefully read the label, with special attention to rates and percent active ingredient.

Generic Fungicides

Original Trade Name (Current manufacturer)	**Common Name**	**Other Trade Names** (Manufacturers)
Abound (Syngenta)	azoxystrobin	Azaka (FMC), Azoxystar, Equation, Aframe (Syngenta)
Aliette 80WDG (Bayer)	fosetyl-Al	Legion 80WDG (Makhteshim)
Bravo Weather Stick (Syngenta)	chlorothalonil	Equus DF (Makhteshim), Chlorothalonil 720 (Arysta Life Science)
Captec 4L (Arysta LifeScience North America LLC)	captan	Has several formulations including 50W
Dithane M45 (Dow AgriSciences)	mancozeb	Manzate Max (United Phosphorus, Inc), Penncozeb (several formulations), Roper (Loveland), Koverall (Cheminova)
Elite 45DF	tebuconazole	Orius 3.6F (Makhteshim), Orius 20AQ (Makhteshim), TebuStar 3.6 L (Albaugh), TebuStar 45WSP (Albaugh) Tebuzol 45DF (United Phosphorous, Inc .)
Quilt Xcel (Syngenta)	azoxystrobin+ propiconazole	Aframe Plus (Syngenta), Cover XL (AgriStar)
Rally 40WSP (Dow AgriSciences)	myclobutanil	Sonoma 40WSP (Albaugh)
Ridomil 2E (Syngenta)	metalaxyl	Metastar 2E (Arysta Life Science)
Ridomil Gold SL (Syngenta)	mefenoxam	Ultra Flourish (Nufarm)
Rovral 4F (Bayer)	iprodione	Iprodione 4L AG (Arysta Life Science), Meteor 4L (United Phosphorus Inc .), Nevado 4F (Makhteshim)
Streptomycin 17 (Loveland Products Canada Inc .)	streptomycin	AG Streptomycin (ADAMA), FireWall (AgroSource)
Tilt (Syngenta)	propiconazole	Propimax 41.8L (Dow AgriSciences), Bumper 41.8L (Makhteshim), Orbit 41.8L (Syngenta)
Topsin-M 70WDG (United Phosphorous Inc .)	thiophanate methyl	Thiophanate Methyl 85WSB (Makhteshim), T-Methyl EAG 70WSB (Nufarm), T-Methyl 70WWSB (Arysta Life Science)

Generic Insecticides

Updated by C. Welty

Original Trade Name (Current Manufacturer)	**Common Name**	**Other Trade Names** (Manufacturers)
Acramite (Arysta)	bifenazate	Banter SC; Banter WDG (UPL) Bizate (Loveland) Vigilant 4SC (Arysta)
Admire Pro (Bayer)	imidacloprid	Advise 2F (Winfield) Alias 2F (Adama) Couraze 1.6F, 75WP, 2F (FMC) Imidashot DF (Sulfur Mills) Macho 2FL, 2F (Albaugh) Malice 75WSP (Loveland) Midash 2SC, Forte 4F 4F (Sharda) Montana 2F,4F (Rotam) Nuprid 1.6F, 2F (Nufarm) Pasada 1.6F (Adama) Prey 1.6F (Loveland) Prokoz Zenith 2F (Bayer) Prokoz Zenith 75WSP (Bayer) Sherpa 1.6F (Loveland) Widow 2F (Loveland) Wrangler 4F (Loveland)
Agri-Mek 0 .15EC (Syngenta)	abamectin	Abacus 0.15EC (Rotam) Abamex 0.15ED (Nufarm) Abba 0.15EC (Adama) Abba Ultra 0.30EC (Adama) Borrada 0.15EC (Adama) Nufarm Abamectin 0.15EC (Nufarm) Reaper 0.15EC (Loveland) Temprano 0.15EC (Chemtura) Tide Timectin 0.15EC (Tide Intl .) Willowood Abamectin 0.15EC (Willowood) Zoro 0.15EC (FMC)
Asana XL 0 .66EC (Dupont)	esfenvalerate	S-Fenvalostar 0 .66EC (LG Life Sciences) Zyrate 0 .66EC (Rotam)
Assail 30SG (United Phosphorous)	acetamiprid	Anarchy 30SG (Loveland), 70WP (Loveland) Arvida (Atticus) Intruder Max 70WP (United Phos .)
Baythroid XL 1EC (Bayer)	cyfluthrin	Tombstone 2E (Loveland) Tombstone Helios 2E (Loveland)
Brigade 2EC (FMC) Capture 2EC (FMC)	bifenthrin	BBi-Dash 2EC (Adama) Bifen 2AG Gold (Direct AG Source) Bifenture 2EC (United Phosphorous) Discipline 2EC (Amvac) Fanfare 2EC, EL, ES (Adama) Frenzy Veloz 2EC (Real Farm) Revere 2EC (Adama) Ruckus LFR (Helena) Sniper 2EC (Loveland) Tundra 2EC (Winfield) Xpedient 2FC (Amvac)
Cygon 4EC (FMC)	dimethoate	Dimate 4EC (Winfield) Dimethoate 400, 4EC (Drexel, Loveland, FMC)

(continued)

Generic Insecticides *(continued)*

Original Trade Name (Current Manufacturer)	**Common Name**	**Other Trade Names** (Manufacturers)
Dimilin	diflubenzuron	Diflumax 2L (Helm Agro) Micromite 2L (Arysta)
Dipel (Valent)	*Bacillus thuringienisis*	Agree (Certis) Biobit (Valent) CryMax (Certis) Deliver (Certis) Jackpot WP (Certis) Javelin (Certis) Xentari (Valent)
Esteem 35WP (Valent) Knack 0 .83EC (Valent) Seize (Valent)	pyriproxyfen	Farewell 0.86 EC (Adama) Pitch (0.83EC); Pitch 35WP (Adama)
Intrepid 2F (Corteva AgriSciences)	methoxyfenozide	Invertid 2F (Loveland) Troubador 2F (Helena) Turnstyle 2F (United Phosphorus) Zylo (UPL)
Lorsban 4E, 15G, 75WDG, Advanced 3.76E (Corteva AgriSciences)	chlorpyrifos	Chlorpyrifos 4E (Drexel, Adama) Govern 4E (Tenkoz) Hatchet (Corteva AgriSciences) Nufos 4E (FMC) Saurus 15G (Helena) Vulcan 3.76E (Adama) Warhawk 4E (Loveland) Whirlwind 4E (Helena) Yuma 4E (Winfield)
Mustang Maxx (FMC)	zeta-cypermethrin	Respect 0 .8EC (BASF)
Pounce 3.2EC (FMC)	permethrin	Arctic 3.2EC (Winfield) Permethrin 3.2EC (Loveland, Helena, Direct Ag, Tenkoz) Perm-Up 3.2EC (United Phosphorus) Perm Star AG (LG Int'l)
Proaxis (Loveland)	gamma cyhalothrin	Declare (FMC) Proaxis 0.5EC (FMC)
Savey (Dupont, Gowan) Onager (Gowan) Hexygon (Gowan)	hexythiazox	Hexamite (Albaugh)
Sevin XLR Plus, 4L (Tessenderlo Kerley)	carbaryl	Carbaryl 4L (Drexel, Loveland) Carbaryl 15% Bait (Drexel) Carbaryl Cutworm Bait (Drexel)
Warrior II 2.08CS (Syngenta)	lambda-cyhalothrin	Grizzly Z 1CS (Winfield) Kaiso 24WG (Nufarm) Kendo 1CS (Helm) Lambda-Cy 1EC (United Phosphorus) Lambda T 1EC (Helena) Lamcap (Syngenta) Paradigm 1EC (Adama) Ravage 1EC (Innvictus) Silencer 1EC (Adama)
Zeal (Valent)	etoxazole	Zara WSB; Zara SC (Atticus)

Generic Herbicides[1]

Compiled by Chris Smigell, Joseph Hannan, Elizabeth Wahle and Stephen Meyer

Original Trade Name (Current Manufacturer)	**Common Name**	**Other Trade Names** (Manufacturers)
Amine4 2,4-D (Tenkoz)	2,4-D amine	2,4-D Amine 4 (Winfield) 2,4-D Amine (Alligare) Amine 4 2,4-D Weed Killer (Loveland) Clean Amine (Loveland) Defy Amine 4 (ADAMA) Embed (Corteva Agrisciences) Havoc Amine (Innvictis) Opti-Amine (Helena) Orchard Master (PBI Gordon) Orchard Star (Albaugh/Agristar) Rugged (Winfield) Saber (Loveland) Shredder Amine 4 (Winfield)
Callisto (Syngenta)	mesotrione	Argos (Helm) Bellum (Rotam) Bridle (Winfield) Cavallo 4 SC (Atticus) Explorer (Syngenta) Incinerate (Winfield) Mesotrione 4 SC (Albaugh) Meso Star (Sharda) Motif (United Phosphorus) Sotrion (Growmark) Mesotrione 4SC (Willowood)
Chateau WDG (Valent USA)	flumioxazin	BroadStar (Valent) Flumi 51 (NuFarm) Flumioxazin 51% (Red Eagle) Semera (Atticus) SureGuard (Valent) SureGuard SC (Nufarm) Flumi 51 (Tacoma Ag)T uscany and Tuscany SC (Nufarm) Varsity (Innvictis) Warfox (ADAMA) Zaltus SX (Atticus)
Gallery 75 DF / SC (Corteva Agrisciences)	isoxaben	Trellis and Trellis SC (Corteva AgriSciences)
Goal 2XL (Corteva AgriSciences)	oxyfluorfen	Collide (United Phosphorus) Galigan 2 E , Galigan H2O (ADAMA) GoalTender (Corteva AgriSciences) Oxystar 2 E/4 L (Albaugh/Agri Star) Oxyflo 2 EC/4 SC (Willowood)
Gramoxone /SL 2.0/SL 3.0 (Syngenta)	paraquat All formulations are Restricted Use	Devour (Innvictis) Helmquat 3 SL (Helm) Paraquat Concentrate (Solera) Paraquat 43.2% (Red Eagle) Para-Shot 3.0 (Sharda USA) Parazone 3SL (ADAMA) Purgatory 3 SL (Atticus) Quik-Quat (Drexel) Willowood Paraquat 3 SL (Generic Crop Sci)

(continued)

Generic Herbicides *(continued)*

Original Trade Name (Current Manufacturer)	**Common Name**	**Other Trade Names** (Manufacturers)
Karmex DF (ADAMA)	diuron	Direx 4L (ADAMA) Diuron 4 L/80 DF (Alligare) Diuron 4 L/80 (Drexel) Diuron 4 L (ADAMA) Diuron 4 L (WinField) Diuron 4 L and 80 WDG (Loveland) Parrot 4 L/DF (ADAMA)
Kerb 50 W/SC/SC RUP(Corteva AgriSciences)	pronamide Some formulations are Restricted Use	Pronamide 50 WSP/3.3SC (Willowood USA)
Matrix FNV/SG (Corteva AgriSciences)	rimsulfuron	Grapple (Nufarm) Hinge (Rotam) Pruvin (ADAMA) Solida (FMC) Tetris SG (Atticus)
Poast (BASF)	sethoxydim	Segment (BASF)
Princep 4L/ Caliber 90 (Syngenta)	simazine	Simazine 4 L (several producer/suppliers) Simazine 90 DF (several producer/suppliers) Simazine 90 WDG (Loveland) Sim-Trol 4 L/90 DF (Sipcam)
Prowl 3.3EC/H20 (BASF)	pendimethalin	Acumen (Tenkoz) AquaPen 3.8 (Drexel) Framework 3.3 EC (Winfield) Pendimethalin (Helena) Pendulum 2 G/3.3 EC/AquaCap (BASF) Pin-Dee 3.3 EC (Drexel) Satellite 3.3/HydroCap/Flex (United Phosphorus) Stealth (Loveland) UP-End HydroCap (United Phosphorus)
Reglone (Syngenta)	diquat	Aceto Diquat 2 L AG (Aceto Ag) Dessicash Ag (Sharda-USA) Diquash Ag (Sharda-USA) Nufarm Diquat 2 L (Nufarm) Rowrunner AG (Rotam) Verdure-X-Herbicide (Helm)
Rely 280 (Bayer CropScience)	glufosinate-ammonium	Cheetah (Nufarm) Forfeit 280 (Loveland) Glufosinate 280 SL (Red Eagle) Lifeline and Interline (United Phosphorous) Inflame 280 SL (Atticus) Reckon 280 SL (Solera) Refer 280 SL (Summit) Scout (Valent) Surmise (Albaugh/Agri Star) Tide Glufosinate 280 (Tide Int'l) Total /2.3/TNV/ SL (WinField) Willowood Glufosinate 280SL (Generic Crop Sci)
Roundup WeatherMAX/PowerMAX (Monsanto)	glyphosate	Numerous products

(continued)

Generic Herbicides *(continued)*

Original Trade Name (Current Manufacturer)	**Common Name**	**Other Trade Names** (Manufacturers)
Select 2 EC/Max (Valent USA)	clethodim	Arrow 2 EC (ADAMA) Avatar/S2 (Innvictis) Clethodim (Crop Smart) Clethodim 2 E (Albaugh/Agri Star) Clethodim 2 EC (Agromarketing) Cleanse /2 EC (Winfield) Ceridian 2 EC (Atticus) Envoy Plus (Valent) Intensity and Intensity One (Loveland) Omni Clethodim 2 EC (Helena) Section 2 EC/Three(Winfield) Shadow (Arysta) Vaquero (Wilbur Ellis) Volunteer (Tenkoz)
Stinger (Corteva AgriSciences)	clopyralid	Bite (Sharda) Clean Slate(Nufarm) Clopyr AG (United Phosphorus) Garrison (Nufarm) Savant (Innvictis) Spur (Albaugh) Stigmata (Atticus)
Surflan AS (United Phosphorus)	oryzalin	Fugitive (ADAMA) Oryzalin 4 AS (ADAMA)
Treflan HFP/TR 10 G (Gowan)	trifluralin	Cornbelt Trifluralin EC (Van Diest) Dintec Treflan 4 D (Gowan) Trifluralin 4 EC (several producers/suppliers) Treflan 4 EC (Helena) Treflan 4L (Loveland) Trifluralin HFP (Helena) Trifluralin 10G (Allbaugh) Triflurex HFP (ADAMA) Trust (Winfield)
Ultra Blazer (United Phosphorus)	acifluorfen	Acifin 2 L (Summit) Acifluorfen 2 (Red Eagle) Acifluorfen 2 E (Tacoma Ag) Avalanche Ultra (WinField) Derecho (Atticus) Levity (Innvictis) Acifluorfen (Sharda) Uproar (Winfield)
Velpar DF VU/L VU (Bayer)	hexazinone	Tide Hexazinone 2 SL/75 WDG (Tide Int'l) Velossa (Helena) Velpar L CU/DF CU (Tessenderlo)
Zeus /XC (FMC)	sulfentrazone	Aquesta 4 F (Atticus) Intensa (Sharda) Shutdown (United Phosphorus) Spartan 4 F/FL 4 F (FMC) Sulfen 4 SC (Willowood) Sulfin 4 SC (Summit) Sulfentrazone 4 F (Helm) Sulfentrazone 4 SC (Willowood) Vandal 4 SC (Innvictis) Zone 4 F (Helm)

[1] Check label to make sure product is labeled for the crop that it is to be used on.

Suggested recordkeeping form for restricted-use pesticides.

Farm name and address: _____

Date and State of Growth	Crop	Chemical Applied (trade name, formulation and EPA registration number)	Rate per Acre	Total Applied	Location and Size of Block	Target Pest(s)	Name of Applicator and Certification Number	Wind, Weather, Notes

Suggested recordkeeping form for restricted-use pesticides.

Farm name and address: _____

Date and State of Growth	Crop	Chemical Applied (trade name, formulation and EPA registration number)	Rate per Acre	Total Applied	Location and Size of Block	Target Pest(s)	Name of Applicator and Certification Number	Wind, Weather, Notes

Fruit Grower Newsletters

Arkansas

University of Arkansas Division of Agriculture Cooperative Extension Service offers *Arkansas Fruit and Nut News* (comp.uark.edu/~dtjohnso/Arkansas_Fruit_Newsletter.html). It is published monthly or as needed to Arkansas growers at no cost. It provides timely information about fruit and nut production practices, disease and insect/mite activity, and upcoming meetings. Contact Donn Johnson, AGRI 320 Department of Entomology, Division of Agriculture, University of Arkansas System, Fayetteville, AR 72701; 479-575-2501; email: dtjohnso@uark.edu.

Illinois

University of Illinois Extension publishes *Illinois Fruit & Vegetable News* (ipm.illinois.edu/ifvn). This newsletter covers production practices and insect and disease management. For more information, contact Local Food Systems and Small Farms Educators: Bronwyn Aly (1715 College Ave., Carmi, IL 62821, 618-382-2662, baly@illinois.edu); or Nathan Johanning (402 Ava Road, Murphysboro, IL 62966, 618-687-1727. For disease and insect diagnostics and management recommendations, contact the University of Illinois Plant Clinic at S-417 Turner Hall 1102 S. Goodwin Ave., Urbana IL 61801, 217-333-0519; plantclinic@illinois.edu.

Indiana

Purdue Extension offers *Facts for Fancy Fruit* free of charge at fff.hort.purdue.edu. This fruit grower newsletter is issued to Indiana growers at frequent intervals during the fruit season. You can subscribe to the online version for free, or receive a printout by first class mail for $15 a year. This service supplies timely information on disease and insect activity throughout the state, cultural information, and announcements of upcoming meetings.

For a hard copy, send your name, address, and current fruit interests along with a check for $15, made out to Purdue University to: Facts For Fancy Fruit, Department of Horticulture and Landscape Architecture, 625 Agricultural Mall Drive, Purdue University, West Lafayette, IN 47907-2010.

Iowa

You can find general horticulture information and Iowa State University Plant and Insect Diagnostic Clinic updates at https://hortnews.extension.iastate.edu/. Subscribe to Horticulture & Home Pest News to receive email alerts when we post new information. Go to the News tab. Small Farm Sustainability website, https://www.extension.iastate.edu/smallfarms.

Kentucky

Cooperative Extension issues a monthy newsletter, *Kentucky Fruit Facts* (www.uky.edu/hort/documents-list-fruit-facts), to all Kentucky growers at no cost. This service supplies timely information on disease and insect activity throughout the state, as well as cultural information. To obtain this service, send your name, address and present fruit interests to: Kentucky Fruit Facts, c/o John Strang, Department of Horticulture, N-318 Ag. Sci. Bldg. North, University of Kentucky, Lexington, KY 40546-0091; 859-257-5685; fax: 859-257-2859; jstrang@uky.edu.

Minnesota

The U of M Fruit Blog and Minnesota Enology Blog keep growers informed of the latest developments in fruit and wine research and outreach. They are available at fruit.cfans.umn.edu.

Missouri

The Grape and Wine Institute (GWI) at the University of Missouri publishes an electronic newsletter, The Midwest Winegrower (gwi.missouri.edu/publications). The newsletter includes educational articles about grape growing and winemaking; insect, disease, and weed management; industry news; and notices of events in the region. Contact Tammy Jones (jonestammy@missouri.edu) or Dean Volenberg (volenbergd@missouri.edu): GWI, 214 Walters Hall, Columbia, MO 65211; 573-882-0476.

Ohio

The *Ohio Grape-Wine Electronic Newsletter* (OGEN) is available at www.oardc.ohio-state.edu/grapeweb. To subscribe, email Maria Smith at smith.127203@osu.edu.

The Ohio Fruit News is available through Department of Plant Pathology, Entomology, Horticulture and Crop Science, and South Centers, The Ohio State University. To subscribe, email Rachel Medina at medina.72@osu.edu.

Pesticide Drift Communication Tools

Several states involved in this spray guide have web-based mapping tools that enable producers of pesticide sensitive crops avoid drift injury by communicating with agricultural chemical applicators.

DriftWatch.org serves Colorado, Delaware, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, New Mexico, North Carolina, Wisconsin, and Saskatchewan.

Oklahoma's Pesticidce Drift Risk Advisor can be accessed through the Agweather website at agweather.mesonet.org.

The Ohio Sensitive Crop Registry is available at www.agri.ohio.gov/scr.

Check with the state department of agriculture in your state about similar tools.

Using a Plant Diagnostic Lab

The best way to identify insects, plants, and plant diseases, or to diagnose plant and pest problems, is to send a sample to a diagnostic laboratory along with information and observations about the problem. The National Plant Diagnostic Network website (www.npdn.org) lists diagnostic laboratories by state and region. Contact individual laboratories for specific submission and fee information (see pages 228-229).

To ensure an accurate diagnosis, it's important to collect and ship your specimens properly. Here are a few guidelines for collecting and shipping specimens to a diagnostic lab. *Your state has specific instructions for collecting and shipping samples; check your local clinic's website for details.*

1. Collect fresh specimens. Send a generous amount of material, if available.
2. Ship specimens in a crush-proof container immediately after collecting. If holdover periods are encountered, keep specimen cool. Ship packages early in the week so they to arrive on weekdays.
3. Incomplete information or poorly selected specimens may result in an inaccurate diagnosis or inappropriate control recommendations. Badly damaged specimens are often unidentifiable, and additional sample requests can cause delays.

Submitting Plant Specimens for Disease/Injury Diagnosis

Herbaceous Plants. For generally declining, wilting, or dying plants, send several whole plants showing a range of symptoms — early through more advanced — with roots and adjacent soil intact, if possible. Dig the plants carefully so the root system remains intact. Place roots and surrounding soil in a plastic bag, and fasten it to the base of the stem with a twist tie or string. Wrap the plants in dry newspaper and place in a crush-proof container for shipment. Do not add water or moist paper towels.

Leaves/fruit/woody tissues. When localized infections (such as leaf spots, fruit rots, or cankers) are suspected, send specimens representing early and moderate stages of disease. Press leaves flat between heavy paper or cardboard — do not tape leaves to paper — and wrap fruits and woody tissue in dry paper. For large fruit, wrap each individually in newspaper. Do not place fruit in a plastic bags. Pack firmly in a crush-proof container so that fruit is not bruised during shipping.

Submitting Insect Specimens

Package insects carefully so they aren't crushed when they arrive at the lab. Do not tape insects to paper or package them loosely in envelopes. Separate and label the specimens if you send more than one type in the same package. Provide the appropriate information for each specimen.

Tiny or Soft-bodied Specimens. Submit such specimens (aphids, mites, thrips, caterpillars, grubs, spiders) in a small, leak-proof bottle or vial that is 1 ounce or less filled with with 70 percent rubbing (Isopropyl) alcohol or hand sanitizer. In Kansas, submit in vinegar. Do not submit insects in water, formaldehyde, or without alcohol; they will ferment and decompose.

Hard-bodied Specimens. Submit such specimens (flies, grasshoppers, cockroaches, wasps, butterflies, beetles) dry in a crush-proof container. As noted above, do not tape insects to paper or place them loose in envelopes.

Submitting Samples for Nematode Analysis

If you suspect a nematode problem, contact your clinic for state-specific submission information (see pages 228-229).

In general nematode identification requires collection of at least one quart of soil from the root zone of affected plants. Include roots if the plants are actively growing.

Place the entire sample in a plastic bag. Do not add water or allow it to dry out. Protect the sample from extreme heat (for example, don't leave samples inside a parked vehicle in direct sunlight). It is often helpful to collect a second, similar sample from a nearby area where plant growth appears normal.

Attach a label, note, or tag identifying the sample to the outside of each bag or package.

Selected University Diagnostic Labs

Arkansas

Plant Health Clinic
University of Arkansas
2601 N. Young Ave.
Fayetteville, AR 72704
479-575-7601
clinic https://www.uaex.edu/yard-garden/plant-health-clinic/
plant-health-clinic

Contact:
Sherrie Smith, ssmith@uaex.edu

Illinois

University of Illinois Plant Clinic
S-417 Turner Hall
1102 S. Goodwin Ave.
University of Illinois
Urbana, IL 61801
217-333-0519
web.extension.illinois.edu/plantclinic
plantclinic@illinois.edu
www.facebook.com/UofIPlantClinic

Contacts:
Diane Plewa, dplewa@illinois.edu, (217) 300-3441
Suzanne Bissonnette, sbissonn@illinois.edu, (217) 333-2478

Indiana

Plant and Pest Diagnostic Laboratory
Purdue University
LSPS 101
915 W. State Street
West Lafayette, IN 47907-2054
765-494-7071
Fax: 765-494-3958
ppdl.purdue.edu
www.facebook.com/PurduePPDL

Contacts:
Tom Creswell, creswell@purdue.edu
Gail Ruhl, ruhlg@purdue.edu

Iowa

Iowa State University Plant and Insect Diagnostic Clinic
327 Bessey Hall – The clinic is moving in spring 2018. Contact us or visit our website for up-to-date information.
Iowa State University
Ames, IA 50011
515-294-0581
Fax: 515-294-9420
clinic.ipm.iastate.edu
pidc@iastate.edu
www.facebook.com/ISUPIDC

Kansas

Plant Disease Diagnostic Lab
1712 Claflin Road
4032 Throckmorton PSC
Manhattan, KS 66506
785-532-5810
Fax: 785-532 5692
www.plantpath.k-state.edu/extension/diagnostic-lab
clinic@ksu.edu

Contact:
Judith O'Mara, jomara@ksu.edu

Kentucky

Serving central and eastern Kentucky:
Plant Disease Diagnostic Laboratory
Agricultural Science Building-North
University of Kentucky
Lexington, KY 40546-0091
859-257-8949
Fax: 859-323-1961
plantpathology.ca.uky.edu/extension/diagnostic-laboratories

Contact:
Julie Beale, jbeale@uky.edu
Serving western Kentucky:
Plant Disease Diagnostic Laboratory
Department of Plant Pathology
UK Research and Education Center
P.O. Box 469
1205 Hopkinsville Street
Princeton, KY 42445
270-365-7541 Ext. 228
Fax: 270-365-2667
plantpathology.ca.uky.edu/extension/diagnostic-laboratories
extension/pdd_lab.html

Contact:
Brenda Kennedy, bkennedy@uky.edu

Minnesota
Plant Disease Clinic
Univeristy of Minnesota
495 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108
612-625-1275
pdc.umn.edu
pdc@umn.edu

Missouri
University of Missouri — Plant Diagnostic Clinic
28 Mumford Hall
Columbia, MO 65201
573-882-3019
plantclinic@missouri.edu
plantclinic.missouri.edu

Nebraska
Plant & Pest Diagnostic Clinic
448 Plant Sciences
P.O. Box 830722
University of Nebraska-Lincoln
Lincoln, NE 68583-0722
cropwatch.unl.edu/plantdisease/unl-diagnostic-clinic-lincoln
402-472-2559
Fax: 402-472-2853

Contact:
Kyle Broderick, kbroderick2@unl.edu

Ohio
C. Wayne Ellett Plant and Pest Diagnostic Clinic
Ohio State University
8995 E. Main St., Bldg. 23
Reynoldsburg, OH 43068
614-292-5006
Fax: 614-466-9754
ppdc.osu.edu

Contact:
Joy Pierzynski, pierzynski.4@osu.edu or
ppdc@cfaes.osu.edu
Fruit and Vegetable Pathology Laboratories
The Ohio State University-Wooster Campus
1680 Madison Ave.
Wooster, OH 44691
330-263-3838

Contact:
Fruit Samples: Melanie Lewis Ivey, ivey.14@osu.edu

Oklahoma
Plant Disease and Insect Diagnostic Lab
Department of Entomology & Plant Pathology
127 Noble Research Center
Oklahoma State University
Stillwater, OK 74078
entoplp.okstate.edu/pddl
405-744-9961
Fax: 405-744-7373

Contacts:
Jennifer Olson, jen.olson@okstate.edu
Jana Slaughter, gotbugs@okstate.edu

West Virginia
Plant Diagnostic Clinic
West Virginia University
G102 South Agriculture Sciences Bldg.
Morgantown, WV 26506-6108
anr.ext.wvu.edu/pests/plant-diagnostic-clinic
304-293-8838
Fax: 304-293-6954

Contact:
MM (Mafuz) Rahman, mm.rahman@mail.wvu.edu

Wisconsin
Plant Disease Diagnostics Clinic
Department of Plant Pathology
1630 Linden Drive
University of Wisconsin-Madison
Madison, WI 53706-1598
pddc.wisc.edu
608-262-2863
Fax: 608-263-2626

Contact:
Brian Hudelson, bdh@plantpath.wisc.edu

Pesticide Applicator Safety Education Programs

Below are the state pesticide education programs that provide training and educational materials for becoming a certified pesticide applicator. Find other state pesticide safety education programs at www.ipmcenters.org/contacts/PSEPDirectory.cfm.

University of Arkansas

www.uaex.edu/farm-ranch/pest-management/education-licensing.aspx

University of Illinois

web.extension.illinois.edu/psep

Iowa State University

www.extension.iastate.edu/psep

Kansas State University

www.k-state.edu/pesticides-ipm

University of Kentucky

pest.ca.uky.edu/PSEP/welcome.html

University of Missouri

pat.missouri.edu

Missouri State University

www. https://extension2.missouri.edu/find-your-interest/agriculture-and-environment/natural-resources-and-environment/integrated-pest-management/pesticide-safety

University of Nebraska - Lincoln

pested.unl.edu

Ohio State University

pested.osu.edu

Oklahoma State University

pested.okstate.edu

Purdue University

ppp.purdue.edu

West Virginia Department of Agriculture

agriculture.wv.gov/divisions/regulatoryandenvironmental/pesticides/Pages/Certification-and-Licensing.aspx

University of Wisconsin

ipcm.wisc.edu/pat

Pesticide Emergency and Poison Control Centers

Nationwide phone numbers

Pesticide Poisoning: Call the **Poison Center**, 800-222-1222

This number automatically connects you to the poison center nearest you.

National Pesticide Information Retrieval System (NPIRS): 765-494-6616

National Pesticide Information Center: 800-858-7378

CHEMTREC (800) 424-9300

Arkansas

Arkansas Poison Center: 800-222-1222
Arkansas State Plant Board: 501-225-1595.
Pesticide training, licensing, and education for applying restricted use pesticides.

Illinois

Illinois Poison Control Centers Emergency Nationwide: 800-222-1222
Emergency TTY/TDD: 312-906-6185

Indiana

Indiana Poison Center: 800-222-1222.
Pesticide Poisoning

Indiana Department of Environmental Management: 765-233-7745. *Pesticide Spill Reporting*
Purdue Pesticide Programs: 765-494-4566.
General Information
Office of Indiana State Chemist: 765-494-1492.
Pesticide Certification and Training
Environmental Protection Agency Region 5: 312-886-5220

Iowa

Iowa Statewide Poison Control Center Emergency Phone Number: 800-222-1222
Administrative Phone Number: 712-279-3710
www.iowapoison.org
poisonpal@iowapoison.org
A joint effort by St. Luke's Regional Medical Center, Iowa Health System and University of Iowa Hospitals and Clinics: 2720 Stone Park Blvd., Sioux City, Iowa 51104

Kansas

Poison Control Center, University of Kansas Hospital:
800-222-1222
Kansas City residents may phone: 913-588-6633
Emergency TDD: 913-588-6639
www.kumed.com/poison
poisoncenter@kumc.edu

Kentucky

Kentucky Regional Poison Control Center:
800-222-1222
Metro Louisville residents may phone 502-589-8222
KY Environmental Response: 800-928-2380 or 502-564-2380

Minnesota

Minnesota Poison Control System
Emergency or Urgent Question: 800-222-1222
Local Number: 612-873-3141
www.mnpoison.org
Hennepin County Medical Center
701 Park Avenue,
Mail Code RL, Minneapolis, MN 55415

Missouri

Missouri Poison Center: 800-222-1222
St. Louis residents may phone 314-772-5200
www.cardinalglennon.com/Pages/Poison Center.aspx

Nebraska

Nebraska Regional Poison Center: 800-222-1222
Anyone with a poisoning emergency can call the toll-free telephone number for help. Personnel at the Resource Center will give you first-aid information and direct you to local treatment centers if necessary.

Ohio

Ohio Poison Exposure Centers: 800-222-1222
TDD number: 800-253-7955
All calls are automatically routed to the regional Ohio Poison Exposure Center closest to you. This number should be called to receive medical assistance if you are involved in a pesticide exposure poisoning.

Oklahoma

The Oklahoma Poison Control Center: 800-222-1222
www.oklahomapoison.org

West Virginia

West Virginia Poison Control Center: 800-222-1222
Charleston, WV residents may call 304-388-4211
Pollution, Toxic Chemical and Oil Spills, National: 800-424-8802
West Virginia Department of Natural Resources: 800-642-3074

Wisconsin

800-222-1222 – statewide, emergency
Madison 608-262-3702 – non-emergency
Milwaukee 414-266-2222 – non-emergency

Conversion Factors for Weights and Measures: Equivalents

	Metric	U.S.
Length	1 Millimeter	0.039 inch
	1 Centimeter (10 mm)	0.39 inch
	1 Meter (100 cm)	39.4 inch
	1 Kilometer (1,000 m)	0.62 mile
Area	1 Square Centimeter	0.155 square inch
	1 Square Meter	1.2 square yards
	1 Hectare (10,000 sq m)	2.47 acres
	1 Square Kilometer (100 ha)	247 acres
Weight	1 Gram	0.035 ounces
	1 Kilogram (1,000 g)	2.2 pounds
	1 Ton (metric) — 1,000 kg	1.1 tons (U.S.)
Volume	1 Milliliter	0.034 fluid ounces
	1 Liter (1,000 ml)	1.056 quarts
	1 Cubic Meter (1,000 l)	264.17 gallons (U.S.)
	U.S.	**Metric**
Length	1 Inch	2.54 centimeters
	1 Foot (12 in)	30.5 centimeters
	1 Yard (3 ft)	0.91 meters
	1 Mile (5,280 ft)	1.6 kilometers
Area	1 Square Inch	6.5 square centimeters
	1 Square Foot (144 sq in)	930 square centimeters
	1 Square Yard (9 sq ft)	0.84 square meters
	1 Acre (43,560 sq ft)	0.405 hectares
	1 Square Mile (640 acres)	259 hectares
Weight	1 Ounce	28.3 grams
	1 Pound (16 oz.)	0.454 kilograms
	1 Ton (U.S.) — 2,000 lb	0.907 tons (metric)
Volume	1 Tablespoon (3 teaspoons)	14.79 milliliters
	1 Fluid ounce (2 tablespoons)	29.6 milliliters
	1 Cup (8 fl oz)	0.237 liters
	1 Pint (2 cups)	0.473 liters
	1 Quart (4 cups)	0.946 liters
	1 Gallon (U.S.) — 4 qts	3.8 liters
	1 Cubic Foot	28.3 liters

Metric Abbreviations: mm=millimeter; cm=centimeter; m=meter; km=kilometer; ha=hectare; mg=milligram; g=gram; kg=kilogram; ml=milliliter; l=liter.

Notes

Midwest Fruit Pest Management Guide 2021-2022

The *Midwest Fruit Pest Management Guide* 2021-2022 was developed by the Midwest Fruit Workers Group.

This publication combines two longtime guides that have become familiar to countless growers: the annual *Midwest Small Fruit and Grape Spray Guide* and the annual *Midwest Tree Fruit Spray Guide*.

Printed copies of this publication are available from the Purdue Extension Education Store, https://mdc.itap.purdue.edu. A free PDF download also is available from the Education Store or from your state's cooperative extension service.

Citation

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