Midwest Fruit Pest Management Guide

2023-2024

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AG1304

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ICSG-18

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ID-465

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ID-232

Ohio
Ohio State University Extension
Bulletin 506

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About This Guide

The ***Midwest Fruit Pest Management Guide*** 2023-2024 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, peach, grapes, blueberry, brambles, strawberry) 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/department/hla/extension/_docs/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.

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), and proceeds from the sale of the spray guide. 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; Ric Bessin managed the insecticide efficacy data. 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 publication 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. It can be found at http://www2.ca.uky.edu/agcomm/pubs/id/id93/id93.htm.

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.

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 site: https://www.cdms.net/LabelsSDS/home; 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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Citation

Beckerman, J., Bessin, R., Welty, C., Athey, K., Wahle, E., Lewis, D., Long, E., Joshi, N., Guedot, C., Meyer, S., Strang, J., Gaulthier, N. 2022. Midwest Fruit Pest Management Guide 2023-2024. Available online at: https://ag.purdue.edu/department/hla/extension/_docs/id-465.pdf

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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. A sample record sheet is on page 285. 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.

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

= 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, https://kb.osu.edu/handle/1811/90762).

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 lb	15 tbsp	9 t tbsp	3 tbsp
	4 lb	13 tbsp	8 tbsp	8 tsp
	3 lb	10 tbsp	6 tbsp	2 tbsp
	2 lb	8 tbsp	4 tbsp	4 tsp
	1 lb	3 tbsp	6 tsp	2 tsp
	1/2 lb (8 oz)	5 tsp	1 tbsp	1 tsp
Emulsifiable Concentrate, Liquid	5 gal	1 quart	1 1/4 pt	13 tbsp
	4 gal	1 1/2 pt	1 pt	10 tbsp
	3 gal	1 1/4 pt	3/4 pt	8 tbsp
	2 gal	3/4 pt	1/2 pt	5 tbsp
	1 gal	1/2 pt	8 tbsp	3 tbsp
	1 qt	3 tbsp	2 tbsp	2 tsp
	1 pt	5 tsp	1 tbsp	1 tsp

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, https://www.uky.edu/Ag/Horticulture/masabni/Publications/HO-83.pdf).

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

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

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 are confusing 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 182 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.

1. 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. **MD signifies timing to set Mating Disruption traps.**

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					European red mite			
									Japanese beetle
		rosy apple aphid				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, R. Bessin and C. Welty
Pathology Lead: J. Beckerman
Horticulture Lead: J. Strang and E. Wahle

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 as early as petal fall, 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.

Table 1-1. Effectiveness of fungicides for control of apple diseases – dormant through silver tip[1]

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

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 two 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 two to three 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 (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 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.

Table 1-2. Effectiveness of fungicides for control of apple diseases – green tip through half-inch green[1]

Product and formulation Active ingredient	FRAC code[2]	powdery mildew	scab	REI[3] PHI[4]	Max amt[5] Max app[6]
Captan 80 WDG	M	x	2.5-5 lb	24h	40 lb
captan		x	G	0d	NA
Cuprofix Ultra 40 disperss	M	x	1-2.5 lb	12h	NA
copper sulfate		x	G-F	NA	NA
Ferbam Granulfo (76WDG)	M	x	3.5 lb	24h	NA
ferbam		x	F	NA	3
Kocide 3000	M	x	0.75-7 lb	48h	53.3 lb
copper hydroxide		x	G-F	0d	NA
Microthiol Disperss	M	10-20 lb	10-20 lb	24h	NA
sulfur		G	i-F	0d	NA
Roper DF Rainshield	M	x	3 or 6 lb	24h	21 lb
mancozeb		x	G	77d	6
Scala SC	9	x	7-10 fl oz	12h	40 fl oz
pyrimethanil		x	E-G	72d	NA
Vangard WG	9	x	5 oz	12h	30 oz
cyprodinil		x	G	0d	2
Ziram 76DF	M3	x	3 or 6 lb	48h	42.4 lb
ziram		x	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 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. For European red mite, oil should be used at higher rates (1-2%) at this pre-bloom stage, but reduced to 0.5% for summer sprays.
- 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 Diazinon is 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.
- 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.
- **Oriental fruit moth:** Pheromone traps for oriental fruit moth should be deployed by half-inch green, with the first catch of moths expected at the pink stage.

Table 1-3. Insecticides for control of apple insects – green tip through half-inch green[1]

Product and Formulation Active ingredient	IRAC code[2]	European red mite	rosy apple aphid	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	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
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	4.8-14.5 fl oz	4.8-14.5 fl oz	12h	101.5 fl oz
esfenvalerate		x	G	i	21d	NA
Assail 30SG	4A	x	2.5-4 oz	8 oz	12h	32 oz
acetamiprid		x	E	s	7d	4
Azera 0.21EC	3A	x	32 fl oz	x	12h	NA
azadirachtin + pyrethrins		x	u	x	0d	10
Baythroid XL (1EC) **(RUP)**	3A	x	x	2.4-2.8 fl oz	12h	2.8 fl oz
beta-cyfluthrin		x	x	G	7d	NA
Belay (2.13SC)	4A	x	4-6 fl oz	6 fl oz	12h	12 fl oz
clothianidin		x	E	G	7d	NA
Beleaf 50SG	29	x	2-2.8 oz	x	12h	8.4 oz
flonicamid		x	G	x	21d	3
Centaur WDG (70WDG)	16	x	x	34.5 oz	12h	34.5 oz
buprofezin		x	x	E	14d	1
Closer SC (2SC)	4C	x	1.5-2.75 fl oz	5.75 fl oz	12h	17 fl oz
sulfoxaflor		x	E	s	7d	4

(Continued)

Table 1-3. Insecticides for control of apple insects – green tip through half-inch green[1] *(continued)*

Product and Formulation Active ingredient	IRAC code[2]	European red mite	rosy apple aphid	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
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
Delta Gold (1.5EC) **(RUP)**	3A	x	x	0.9-1.9 fl oz	12h	3.6 fl oz
deltamethrin		x	x	u	21d	NA
Diazinon AG600 **(RUP)**	1B	x	x	12.75 fl oz/100 gal	4d	25.5 fl oz
diazinon		x	x	x	21d	2
Esteem 35WP	7C	x	3-5 oz	4-5 oz	12h	10 oz
pyriproxyfen		x	E	E	45d	2
Exirel (0.83SE)	28	x	13.5-20.5 fl oz	x	12h	61.5 fl oz
cyantraniliprole		x	E	x	3d	3
Imidan 70W	1B	x	x	2.125-5.75 lb	4 or 7d	15.5 lb
phosmet		x	x	F	7d	NA
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
Mustang Maxx (0.83EC) **(RUP)**	3A	x	1.2-4 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	7-16 fl oz	12h	NA
azadirachtin		x	F	u	0d	NA
Nexter (SC)	21A	11-17 fl oz	x	x	12h	NA
pyridaben		G	x	x	25d	1
Oil (superior)	UN	0.5-2%	0.5-2%	0.5-2%	NA	NA
mineral oil		x	x	G	NA	NA
Onager Optek (1EC)	10	12-24 oz	x	x	12h	24 oz
hexythiazox		E	x	x	28d	1
Permethrin 25W **(RUP)**	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	2.5-5.1 fl oz	2.5-5.1 fl oz	24h	1.6 pt
gamma-cyhalothrin		x	G	i	21d	NA

(Continued)

Table 1-3. Insecticides for control of apple insects – green tip through half-inch green[1] *(continued)*

Product and Formulation Active ingredient	IRAC code[2]	European red mite	rosy apple aphid	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Savey 50DF	10A	3-6 oz	x	x	12h	6 oz
hexythiazox		E	x	x	28d	1
Sevin XLR Plus	1A	x	1.5-3 qt	1.5-3 qt	12h	15 qt
carbaryl		x	F	F	3d	8
Sivanto Prime (1.67SC)	4D	x	7-14 fl oz	10.5-14 fl oz	4h	28 fl oz
flupyradifurone		x	G	G	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	1.2-2.5 fl oz	1.2-2.5 fl oz	24h	12.8 fl oz
lambda-cyhalothrin		x	G	i	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 (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 one- to four-week intervals at the first sign of regrowth, to control shoot growth and reduce the risk of fire blight. See page 47 for more information regarding application of Apogee or Kudos for control of plant vigor and improved resistance to 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.

Table 1-4. Fungicides for management of apple diseases – tight cluster through pink[1]

Product and formulation Active ingredient	FRAC code[2]	powdery mildew	rust	scab	REI[3] PHI[4]	Max amt[5] Max app[6]
Aprovia (EC)	7	5.5-7 fl oz	5.5-7 fl oz	5.5-7 fl oz	12h	27.6 fl oz
benzovindiflupyr		F	u	E-G	30d	NA
Captan 80 WDG	M	2.5-5 lb	x	5 lb	24h	40 lb
captan		i	x	G	0d	NA
Cevya	3	3-5 fl oz	3-5 fl oz	3-5 fl oz	12h	NA
mefentrifluconazole		G-E	E	E	0d	NA
Cuprofix Ultra 40D	M	x	x	1-2.5 lb	12hr	NA
copper sulfate		x	x	F-G	NA	NA
Excalia (2.84 SC)	7	3-4 fl oz	3-4 fl oz	3-4 fl oz	12h	8 fl oz
inpyrfluxam		E-G	u	E	PF	2
Ferbam Granuflo (76 WDG)	M3	x	3.5 lb	3.5 lb	24h	NA
ferbam		x	G	F	NA	3
Flint Extra	11	2.5-2.9 fl oz	2.5-2.9 fl oz	2.5-2.9 fl oz	12h	10.5 fl oz
trifloxystrobin		G [r]	F	E [r]	14d	NA
Fontelis (1.67 SC)	7	16-20 fl oz	16-20 fl oz	16-20 fl oz	12h	61 fl oz
penthiopyrad		G	E	E	28d	NA
Indar 2F	3	6-8 fl oz	6-8 fl oz	6-8 fl oz	12h	32 fl oz
fenbuconazole		E [r]	E	E [r]	14d	4
Inspire Super (EW)	3+9	12 fl oz	12 fl oz	12 fl oz	12h	60 fl oz
difenoconazole + cyprodinil		F	E	E	28d	NA
Kenja 400SC	7	12.5 fl oz	x	12.5 fl oz	12h	NA
isofetamid		s	x	F	20d	NA
Luna Privilege (SC)	7	2.4-6.8 fl oz	x	4-6.8 fl oz	NA	NA
fluopyram		G	x	G-E	NA	NA
Luna Sensation (SC)	7+11	5-5.8 fl oz	4-5.8 fl oz	4-5.8 fl oz	12h	21 fl oz
fluopyram + trifloxystrobin		G [r]	F	E [r]	14d	4
Luna Tranquility (SC)	7+9	11.2-16 fl oz	x	11.2-16 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		G	x	E	72d	NA
Merivon (2.09SC)	7+11	4-5.5 fl oz	4-5.5 fl oz	4-5.5 fl oz	12h	22 fl oz
fluxapyroxad + pyraclostrobin		G	s	E	0d	4
Microthiol Disperss	M	10-20 lb	x	10-20 lb	24h	NA
sulfur		G	x	i-F	0d	NA
Miravis (1.67 SC)	7	3.4 fl oz	3.4 fl oz	3.4 fl oz	4h	13.6 fl oz
pydiflumetofen		G	G	E	30d	4
Omega 500F	29	x	13.8 fl oz	10-13.8 fl oz	12h	138 fl oz
fluazinam		x	s-G	G	28d	10
OSO 5%	19	3.75-13 fl oz	x	3.75-13 fl oz	4h	78 oz
polyoxin D		F	x	F	0d	6
Pristine	11+7	14.5-18.5 oz	14.5-18.5 oz	14.5-18.5 oz	12h	74 oz
pyraclostrobin + boscalid		E [r]	E	E [r]	0d	4

(Continued)

Table 1-4. Fungicides for management of apple diseases – tight cluster through pink[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	powdery mildew	rust	scab	REI[3] PHI[4]	Max amt[5] Max app[6]
Procure 480 SC	3	8-16 fl oz	8-16 fl oz	8-16 fl oz	12h	64 fl oz
triflumizole		E [r]	E [r]	G [r]	14d	NA
Rally 40WSP	3	5-10 oz	5-8 oz	5-8 oz	24h	5 lb
myclobutanil		E [r]	F	E-G[r]	14d	NA
Roper DF Rainshield	M	6 lb	6 lb	6 lb	24h	21 lb
mancozeb		i	G	G	77d	6
Scala (SC)	9	x	x	7-10 fl oz	12h	40 fl oz
pyrimethanil		x	x	G-E	72d	NA
Sercadis	7	3.5-4.5 fl oz	4.5 fl oz	3.5-4.5 fl oz	12h	18 fl oz
fluxapyroxad		G	s	G-E	0d	4
Sovran (50WG)	11	4-6.4 oz	3.2-6.4 oz	3.2-6.4 oz	12h	25.6 oz
kresoxim-methyl		G [r]	E	E [r]	30d	4
Syllit FL	U12	x	x	1.5 pt	48h	3 pt
dodine		x	x	E [r]	pink	2
Topguard Specialty Crops (SC)	3	8-12 fl oz	8-12 fl oz	13 fl oz	12h	52 fl oz
flutriafol		E	E	G	14d	4
Topsin-M WSB	1	0.75-1 lb	x	0.75-1 lb	24h	4 lb
thiophanate methyl		G [r]	x	i	1d	NA
Torino (SC)	U6	6.8 oz	x	x	4h	6.8 oz
cyflufenamid		E	x	x	14d	1
Vangard WG (75WG)	9	x	x	5 oz	12h	30 oz
cyprodinil		x	x	G	0d	2
Ziram 76DF	M3	x	6 lb	6 lb	48h	42.4 lb
ziram		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 scales; expect crawlers four to six weeks after adults emerge.
- **Pyrethroids** (Asana, Baythroid, Danitol, Mustang Maxx, Permethrin, Proaxis, and Warrior) kill predatory 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.
- **Oriental fruit moth:** If this pest is to be managed by pheromone mating disruption, then dispensers should be deployed at pink. See details on page 26-27.

Table 1-5. Insecticides for control of apple insects – tight cluster through pink[1]

Product and formulation Active ingredient	IRAC code[2]	rosy apple aphid	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	4.5 oz	12h	16.5 oz
thiamethoxam		E	21d	NA
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	12h	101.5 fl oz
esfenvalerate		G	21d	NA
Assail 30SG	4A	2.5- 4 oz	12h	32 oz
acetamiprid		E	7d	4
Azera 0.21EC	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
Mustang Maxx (0.83EC) **(RUP)**	3A	1.2-4 fl oz	12h	24 fl oz
zeta-cypermethrin		u	14d	NA
Neemix 4.5 (0.39L)	UN	5-7 fl oz	12h	NA
azadirachtin		F	0d	NA
Permethrin 25W **(RUP)**	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	2.5-5.1 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

(Continued)

Table 1-5. Insecticides for control of apple insects – tight cluster through pink[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	rosy apple aphid	REI[3] PHI[4]	Max amt[5] Max app[6]
Vydate L (2L) **(RUP)**	1A	4-8 pt	48h	8 pt
oxamyl		G	14d	4
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 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 two weeks after application for plants to be less susceptible to disease. See comments on page 49. Excessive nitrogen fertilization will make trees more susceptible to fire blight.
- **Bitter rot and summer rots:** Rot control begins now for best results. Applying mancozeb at this time using the label's extended program for control of scab provides collateral control of bitter and summer rot, and saves on applications of captan.

Table 1-6. Fungicides labeled for control of apple diseases – bloom[1]

Product and formulation Active ingredient	FRAC code[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	M	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	x	x	3-5 fl oz	3-5 fl oz	3-5 fl oz	3-5 fl oz	12h	NA
mefentrifluconazole		x	x	G-E	E	E	F-G	0d	NA
Cuprofix Ultra 40D	M	x	5.5-7.5 lb	x	x	1-2.5 lb	x	12hr	NA
copper sulfate		x	F-G	x	x	F-G	x	NA	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	x	x	12 fl oz	12 fl oz	12 fl oz	x	12h	60 fl oz
difenoconazole + cyprodinil		x	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	x	x	11.2-16 fl oz	x	11.2-16 fl oz	x	12h	54.7 fl oz
fluopyram + pyrimethanil		x	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	x	x	10-20 lb	x	10-20 lb	x	24h	NA
sulfur		x	x	G	x	i-F	x	0d	NA

(Continued)

Table 1-6. Fungicides labeled for control of apple diseases – bloom[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bitter rot	fire blight	powdery mildew	rust	scab	summer rot	REI[4] PHI[3]	Max amt[5] Max app[6]
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-F	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 oz
polyoxin D		x	x	F	x	F	x	0d	6
Polyram 80 DF	M3	x	x	x	3 lb	3 lb	x	24h	21 lb
metiran		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	3 lb	x	6 lb	6 lb	6 lb	3 lb	24h	21 lb
mancozeb		see note above	x	i	G	G	see note above	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
Syllit FL	U12	x	x	x	x	1.5 pt	x	48h	3 pt
dodine		x	x	x	x	E [r]	x	pink	2
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	M3	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.
- **Codling moth** (monitoring): Put out pheromone traps now to monitor adult codling moth activity. 2 per 5 acres, minimum of 2 per block. See page 34 for information about how to use traps to determine optimal insecticide timing.
- **Codling moth** (management with mating disruption): Deploy pheromone dispensers at bloom. See details below.

Mating disruption for codling moth control and oriental fruit moth

Several products are registered in some states 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 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 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.

Table 1-7. 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	

Table 1-7. Products for pheromone mating disruption of codling moth and oriental fruit moth *(continued)*

Target	Type	Product name	Rate	Duration
Oriental fruit moth (OFM) only *continued*	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

- **Bitter rot and summer rots:** Rot control begins now for best results. Applying mancozeb at this time using the label's extended program for control of scab provides collateral control of bitter and summer rot, and saves on applications of captan.
- 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.

Table 1-8. Effectiveness of fungicides for control of apple diseases – petal fall[1]

Product and formulation Active ingredient	FRAC code[2]	bitter rot	fire blight	powdery mildew	rust	scab	summer rot	REI[3] PHI[4]	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 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	M	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	x	x	3-5 fl oz	3-5 fl oz	3-5 fl oz	3-5 fl oz	12h	NA
mefentrifluconazole		x	x	G-E	E	E	F-G	0d	NA
Cuprofix Ultra 40D	M	x	5.5-7.5 lb	x	x	1-2.5 lb	x	12hr	NA
copper sulfate		x	F-G	x	x	F-G	x	NA	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

(Continued)

Table 1-8. Effectiveness of fungicides for control of apple diseases – petal fall[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bitter rot	fire blight	powdery mildew	rust	scab	summer rot	REI[3] PHI[4]	Max amt[5] Max app[6]
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 fl 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 fl 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	x	x	12 fl oz	12 fl oz	12 fl oz	x	12h	60 fl oz
difenoconazole + cyprodinil		x	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	x	x	11.2-16 fl oz	x	11.2-16 fl oz	x	12h	54.7 fl oz
fluopyram + pyrimethanil		x	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	x	x	10-20 lb	x	10-20 lb	x	24h	NA
sulfur		x	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-F	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 oz
polyoxin D		x	x	F	x	F	x	0d	6
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

(Continued)

Table 1-8. Effectiveness of fungicides for control of apple diseases – petal fall[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bitter rot	fire blight	powdery mildew	rust	scab	summer rot	REI[3] PHI[4]	Max amt[5] Max app[6]
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	3 lb	x	6 lb	6 lb	6 lb	3 lb	24h	21 lb
mancozeb		see note above	x	i	G	G	see note above	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	M3	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 predatory 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 to avoid killing bees and other pollinators.
- **Rosy apple aphid** is best treated at pink, but there is some chance to control it at petal fall if infestations develop.
- **European red mite:** If not managed pre-bloom, it can be managed at petal fall or later; see products listed at green tip (pages 17-19).
- Although Sevin is listed (page 31) for plum curculio control, there is a risk of fruit thinning when used within 30 days of bloom.

Table 1-9. Insecticides for control of apple insects – petal fall[1]

Product and formulation Active ingredient	IRAC code[2]	oriental fruit moth	plum curculio	REI[3] PHI[4]	Max amt [5] Max app[6]
Actara (25WDG)	4A	x	4.5-5.5 oz	12h	16.5 oz
thiamethoxam		x	G	21d	NA
Altacor (35WDG)	28	2.5-4.5 oz	x	4h	9 oz
chlorantraniliprole		E	x	5d	NA
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	4.8-14.5 fl oz	12h	101.5 fl oz
esfenvalerate		E	G	21d	NA
Assail 30SG	4A	5-8 oz	8 oz	12h	32 oz
acetamiprid		E	G	7d	4
Avaunt (30WDG)	22	5-6 oz	5-6 oz	12h	24 oz
indoxacarb		G	G	14d	4
Azera 0.21EC	3A	5-6 oz	x	12h	NA
azadirachtin + pyrethrins		x	x	0d	10
Baythroid XL (1EC) **(RUP)**	3A	2-2.4 fl oz	2.4-2.8 fl oz	12h	2.8 fl oz
beta-cyfluthrin		E	G	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		E	G	14d	NA
Delegate WG (25WG)	5	4.5-7 oz	x	4h	28 oz
spinetoram		E	x	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	6-10 fl oz	x	4h	29 fl oz
spinosad		F	x	7d	4
Exirel (0.83SE)	28	10-17 fl oz	13.5-20.5 fl oz	12h	61.5 fl oz
cyantraniliprole		E	G	3d	3
Imidan 70W	1B	2.1-5.75 lb	2.1-5.7 lb	4 or 7d	15.5 lb
phosmet		E	G	7d	NA
Intrepid 2F	18	12-16 fl oz	x	4h	64 fl oz
methoxyfenozide		G	x	14d	NA
Madex HP	31	0.5-3 fl oz	x	4h	NA
Cydia pomonella granulovirus		G	x	0d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	1.2-4 fl oz	1.2-4 fl oz	12h	24 fl oz
zeta-cypermethrin		E	G	14d	NA
Neemix 4.5 (0.39L)	UN	4-16 fl oz	x	12h	NA
azadirachtin		F	x	0d	NA
Permethrin 25W **(RUP)**	3A	x	6.4-16 oz	12h	32 oz
permethrin		x	G	See label	NA
Permethrin 3.2EC **(RUP)**	3A	x	4-16 fl oz	12h	20 fl oz
permethrin		x	G	See label	NA

(Continued)

Table 1-9. Insecticides for control of apple insects – petal fall[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	oriental fruit moth	plum curculio	REI[3] PHI[4]	Max amt [5] Max app[6]
Proaxis (0.5EC) **(RUP)**	3A	2.5-5.1 fl oz	2.5-5.1 fl oz	24h	1.6 pt
gamma-cyhalothrin		G	G	21d	NA
Proclaim (5SG) **(RUP)**	6	4.8 fl oz	x	12 or 48h	14.4 oz
emamectin benzoate		F	x	14d	NA
Rimon 0.83EC	15	20-40 fl oz	x	12h	150 fl oz
novaluron		G	x	14d	NA
Sevin XLR Plus	1A	x	1.5-3 qt	12h	15 qt
carbaryl		x	G	3d	8
Verdepryn 100SL (0.83SL)	28	5.5-11 fl oz	5.5-11 fl oz	4h	33 fl oz
cyclaniliprole		E	G	7d	3
Virosoft CP4	31	1.6-3.2 fl oz	x	4h	NA
Cydia pomonella granulovirus		F	x	0d	NA
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 fl oz	1.2-2.5 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 four-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 two weeks of an oil spray or spreader-sticker. Can affect fruit finish of Golden Delicious.
- **Bitter rot and summer rots:** Rot control begins now for best results. Applying mancozeb at this time using the label's extended program for control of scab provides collateral control of bitter and summer rot, and saves on applications of captan. Be aware of 77-day PHI for early apples.

Fungicide Resistance Management

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

Table 1-10. Effectiveness of fungicides for control of apple diseases – first and second cover[1]

Product and formulation Active ingredient	FRAC code[2]	bitter rot	powdery mildew	rust	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	5.5-7 fl oz	12h	27.6 fl oz
benzovindiflupyr		G-E	F	u	F	E-G	F	30d	NA
Captan 80 WDG	M	2.5-5 lb	2.5-5 lb	x	2.5-5 lb	2.5-5 lb	2.5-5 lb	24h	40 lb
captan		E	i	x	G	G-E	E	0d	NA
Cevya	3	x	3-5 fl oz	3-5 fl oz	3-5 fl oz	3-5 fl oz	3-5 fl oz	12h	NA
mefentrifluconazole		x	G-E	E	G-E	E	F-G	0d	NA
Excalia (2.84 SC)	7	3-4 fl oz	3-4 fl oz	3-4 fl oz	3-4 fl oz	3-4 fl oz	x	12h	8 fl oz
inpyrfluxam		u	E-G	u	E-G	u	x	PF	2
Ferbam Granuflo (76 WDG)	M3	3.5 lb	x	3.5 lb	3.5 lb	3.5 lb	3.5 lb	24h	NA
ferbam		F	x	G	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	2.5-2.9 fl oz	2.9 fl oz	12h	10.5 fl oz
trifloxystrobin		G	G[r]	F	G[r]	G	G	14d	NA
Fontelis (1.67 SC)	7	x	16-20 fl oz	16-20 fl oz	16-20 fl oz	x	16-20 fl oz	12h	61 fl oz
penthiopyrad		x	G	E	G	x	u	28d	NA
Indar 2F	3	x	6-8 fl oz	6-8 fl oz	6-8 fl oz	6-8 fl oz	x	12h	32 fl oz
fenbuconazole		x	E[r]	E	E[r]	G	x	14d	4
Inspire Super (EW)	3+9	x	12 fl oz	12 fl oz	12 fl oz	12 fl oz	x	12h	60 fl oz
difenoconazole + cyprodinil		x	F	E	F	E	x	28d	NA
Kenja 400SC	7	x	12.5 fl oz	x	12.5 fl oz	x	x	12h	NA
isofetamid		x	s	x	s	x	x	20d	NA
Luna Privilege (SC)	7	x	2.4-6.8 fl oz	x	2.4-6.8 fl oz	6.8 fl oz	x	NA	NA
fluopyram		x	G	x	G	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	5-5.8 fl oz	4-5.8 fl oz	4-5.8 fl oz	12h	21 fl oz
fluopyram + trifloxystrobin		E	G[r]	F	G[r]	G-E	E	14d	4
Luna Tranquility (SC)	7+9	x	11.2-16 fl oz	x	11.2-16 fl oz	x	x	12h	54.7 fl oz
fluopyram + pyrimethanil		x	G	x	G	x	x	72d	NA

(Continued)

Table 1-10. Effectiveness of fungicides for control of apple diseases – first and second cover[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bitter rot	powdery mildew	rust	scab	sooty blotch/ fly speck	summer rot	REI[4] PHI[3]	Max amt[5] Max app[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	4-5.5 fl oz	12h	22 fl oz
fluxapyroxad + pyraclostrobin		E	G	s	G	E	E	0d	4
Microthiol Disperss	M	x	10-20 lb	x	10-20 lb	x	x	24h	NA
sulfur		x	G	x	F-i	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	3.4 fl oz	4h	13.6 fl oz
pydiflumetofen		s-F	G	G	G	G	s	30d	4
Omega 500F	29	13.8 fl oz	x	13.8 fl oz	13.8 fl oz	10-13.8 fl oz	13.8 fl oz	12h	138 fl oz
fluazinam		F	x	s[G]	s[G]	F	s-G	28d	10
OSO 5%	19	x	3.75-13 fl oz	x	3.75-13 fl oz	x	x	4h	4.2 oz
polyoxin D		x	F	x	F	x	x	0d	6
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	14.5-18.5 oz	12h	74 oz
pyraclostrobin + boscalid		F-E	E[r]	E	E[r]	E	E	0d	4
Procure 480 SC	3	x	8-16 fl oz	8-16 fl oz	8-16 fl oz	x	x	12h	64 fl oz
triflumizole		x	E[r]	E[r]	E[r]	x	x	14d	NA
Rally 40WSP	3	x	5-10 oz	5-8 oz	5-10 oz	x	x	24h	5 lb
myclobutanil		x	E[r]	F	E[r]	x	x	14d	NA
Roper DF rainshield	M	3 lb	6 lb	6 lb	6 lb	x	3 lb	24h	21 lb
mancozeb		see note above	i	G	G	x	see note above	77d	6
Sercadis	7	x	3.5-4.5 fl oz	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	s	F	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	4-6.4 oz	12h	25.6 oz
kresoxim-methyl		x	G[r]	E	G[r]	G	G	30d	4
Topguard Specialty Crops (SC)	3	13 fl oz	8-12 fl oz	8-12 fl oz	8-12 fl oz	x	13 fl oz	12h	52 fl oz
flutriafol		u	E	E	E[r]	x	u	14d	4
Topsin-M WSB	1	x	0.75-1 lb	x	0.75-1 lb	0.75-1 lb	0.75-1 lb	24h	4 lb
thiophanate methyl		x	G[r]	x	G[r]	G-E	G	1d	NA
Torino (SC)	U6	x	6.8 oz	x	x	x	x	4h	6.8 oz
cyflufenamid		x	E	x	x	x	x	14d	1
Ziram 76DF	M3	6 lb	x	6 lb	6 lb	6 lb	6 lb	48h	42.4 lb
ziram		G	x	G	G	G	i	14d	7

Apple First and Second Cover – Insects

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

- Although Sevin is listed for control of several pests, be aware of a risk of fruit thinning when Sevin is used within 30 days of bloom.

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 as shown in table below.
- See Mating Disruption for Codling Moth Control, pages 26-27.
- 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 Maxx, 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 third cover. The minimum rate of Esteem is effective when used pre-bloom, but use the maximum rate if application is delayed until the crawler stage in early summer. One application is sufficient for Esteem, but for other products, use two applications, 10 days apart

Potato leafhopper

- Effectiveness of products for leafhopper control are shown in the table for minor pests on pages 55-58.

Table 1-11. Insecticides for control of apple insects – first and second cover[1]

Product and formulation Active ingredient	IRAC code[2]	codling moth	oriental fruit moth	plum curculio	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	x	4.5-5.5 oz	x	12h	16.5 oz
thiamethoxam		x	x	G	x	21d	NA
Altacor (35WDG)	28	2.5-4.5 oz	2.5-4.5 oz	x	x	4h	9 oz
chlorantraniliprole		E	E	x	x	5d	NA
Asana XL (0.66EC) **(RUP)**	3A	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	101.5 fl oz
esfenvalerate		E	E	G	i	21d	NA
Assail 30SG	4A	4-8 oz	5-8 oz	8 oz	8 oz	12h	32 oz
acetamiprid		E	E	G	s	7d	4
Avaunt (30WDG)	22	5-6 oz	5-6 oz	5-6 oz	x	12h	24 oz
indoxacarb		F	G	G	x	14d	4
Azera 0.21EC	3A	x	5-6 oz	x	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	2-2.4 fl oz	2.4-2.8 fl oz	2.4-2.8 fl oz	12h	2.8 fl oz
beta-cyfluthrin		E	E	G	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	E	G	x	14d	NA
Delegate WG (25WG)	5	4.5-7 oz	4.5-7 oz	s	x	4h	28 oz
spinetoram		E	E	s	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	6-10 fl oz	x	x	4h	29 fl oz
spinosad		G	F	x	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	10-17 fl oz	13.5-20.5 fl oz	x	12h	61.5 fl oz
cyantraniliprole		E	E	G	x	3d	3
Imidan 70W	1B	2.1-5.75 lb	2.1-5.75 lb	2.1-5.7 lb	2.1-5.75 lb	4 or 7d	15.5 lb
phosmet		G	E	G	F	7d	NA

(Continued)

Table 1-11. Insecticides for control of apple insects – first and second cover[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	codling moth	oriental fruit moth	plum curculio	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Intrepid 2F	18	16 fl oz	12-16 fl oz	x	x	4h	64 fl oz
methoxyfenozide		s	G	x	x	14d	NA
Lannate LV (2.4WSL) **(RUP)**	1A	3 pt	x	x	x	3d	15 pt
methomyl		G	x	x	x	14d	5
Madex HP	31	0.5-3 fl oz	0.5-3 fl oz	x	x	4h	NA
Cydia pomonella granulovirus		G	G	x	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	E	G	x	14d	NA
Neemix 4.5 (0.39L)	UN	4-16 fl oz	4-16 fl oz	x	7-16 fl oz	12h	NA
azadirachtin		F	F	i	u	0d	NA
Oil (superior)	UN	x	x	x	see label	NA	NA
mineral oil		x	x	x	G	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	24h	1.6 pt
gamma-cyhalothrin		E	G	G	i	21d	NA
Proclaim (5SG) **(RUP)**	6	4.8 oz	4.8 oz	x	x	12 or 48h	1.6 pt
emamectin benzoate		F	F	x	x	14d	NA
Rimon 0.83EC	15	20-40 fl oz	20-40 fl oz	x	x	12h	150 fl oz
novaluron		E	G	x	x	14d	NA
Sevin XLR Plus	1A	1-3 qt	x	1.5-3 qt	1.5-3 qt	12h	15 qt
carbaryl		G	x	G	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	E	G	x	7d	3
Virosoft CP4	31	1.6-3.2 fl oz	1.6-3.2 fl oz	x	x	4h	NA
Cydia pomonella granulovirus		F	F	x	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.

- Roper (mancozeb) has a 77-day PHI and should not be used on early apples or after third cover.
- 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.

Table 1-12. Effectiveness of fungicides for control of apple diseases – third and summer cover[1]

Product and formulation Active ingredient	FRAC code[2]	bitter rot	powdery mildew	scab	sooty blotch/fly speck	summer rot	REI[3] PHI[4]	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	M	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	x	3-5 fl oz	3-5 fl oz	3-5 fl oz	3-5 fl oz	12h	NA
mefentrifluconazole		x	G-E	E	E	F-G	0d	NA
Cuprofix Ultra 40D	M	x	x	1-2.5 lb	x	x	12hr	NA
copper sulfate		x	x	F-G	x	x	NA	NA
Excalia (2.84 SC)	7	3-4 fl oz	3-4 fl oz	3-4 fl oz	3-4 fl oz	x	12h	8 fl oz
inpyrfluxam		u	E-G	E	u	x	PF	2
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 fl 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 fl 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	x	12 fl oz	12 fl oz	12 fl oz	x	12h	60 fl oz
difenoconazole + cyprodinil		x	F	E	E	x	28d	NA
Kenja 400SC	7	x	12.5 fl oz	12.5 fl 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
Luna Tranquility (SC)	7+9	x	11.2-16 fl oz	11.2-16 fl oz	x	x	12h	54.7 fl oz
fluopyram + pyrimethanil		x	G	E	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	E	E	E	0d	4
Microthiol Disperss	M	x	10-20 lb	10-20 lb	x	x	24h	NA
sulfur		x	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-F	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 oz
polyoxin D		x	F	F	x	x	0d	6

(Continued)

Table 1-12. Effectiveness of fungicides for control of apple diseases – third and summer cover[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bitter rot	powdery mildew	scab	sooty blotch/fly speck	summer rot	REI[3] PHI[4]	Max amt[5] Max app[6]
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 [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
Roper DF Rainshield	M	3 lb	6 lb	6 lb	x	3 lb	24h	21 lb
mancozeb		see note above	i	G	x	see note above	77d	6
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	0.75-1 lb	0.75-1 lb	0.75-1 lb	0.75-1 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	M3	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 (if rainy) to 14 days (if dry).

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

- Timing for sprays depends on which insecticides will be used. See table on page 51 for target timing for each product.

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.
- 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, not specifically for brown marmorated stink bug.

San Jose scale crawlers

- Crawlers may be present by second or third cover. The minimum rate of Esteem 35W is effective when used pre-bloom, but use the maximum rate if application is delayed until the crawler stage in early summer. One application is sufficient for Esteem, but for other products, use two applications, 10 days apart.

Table 1-13. Insecticides for control of apple insects – third and summer cover[1]

Product and formulation Active ingredient	IRAC code[2]	apple maggot	brown marm'd stink bug	codling moth	Japanese beetle	oriental fruit moth	San Jose scale	woolly apple aphid	REI[3] PHI[4]	Max amt[5] Max app[6]
Admire Pro (4.6F)	4A	2.8 fl oz	x	x	x	x	2.8-8 fl oz	7-10.5 fl oz	12h	10.5 fl oz
imidacloprid		G	x	x	x	x	F	G	21d	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	4.8-14.5 fl oz	4.8-14.5 fl oz	4.8-14.5 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	8 oz	x	4-8 oz	5-8 oz	5-8 oz	8 oz	2.5-4 oz	12h	32 oz
acetamiprid		G	x	E	G	E	s	F	7d	4
Avaunt (30WDG)	22	5-6 oz	x	5-6 oz	x	5-6 oz	x	x	12h	24 oz
indoxacarb		F	x	F	x	G	x	x	14d	4
Azera 0.21EC	3A	x	32 fl oz	x	2-3.5 pt	32 fl oz	x	x	12h	NA
azadirachtin + pyrethrins		x	u	x	G	x	x	x	0d	10
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	2.75-5.57 fl oz	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
Diazinon AG 600 **(RUP)**	1B	x	x	x	x	x	12.75 fl oz/100 gal	12.75 fl oz/100 gal	4h	25.5 fl oz
diazinon		x	x	x	x	x	u	u	21d	2

(Continued)

Table 1-13. Insecticides for control of apple insects – third and summer cover[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	apple maggot	brown marm'd stink bug	codling moth	Japanese beetle	oriental fruit moth	San Jose scale	woolly apple aphid	REI[3] PHI[4]	Max amt[5] Max app[6]
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
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
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	2.1-5.75 lb	x	2.1-5.75 lb	2.1-5.75 lb	2.1-5.75 lb	2.125-5.75 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
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	see label	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 oz	x	4.8 oz	x	x	12 or 48h	14.4 oz
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

(Continued)

Table 1-13. Insecticides for control of apple insects – third and summer cover[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	apple maggot	brown marm'd stink bug	codling moth	Japanese beetle	oriental fruit moth	San Jose scale	woolly apple aphid	REI[3] PHI[4]	Max amt[5] Max app[6]
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
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 two to four 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. Do not apply ReTain to plants of fruit under stress from heat, water, disease of insects as these plants may not respond to Retain. 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

Start applying ProVide 10SG three to six weeks before cracking begins (normally by mid-June to mid-July). 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] Thinning Strategies for 2022 by Anna Wallis, Philip Schwallier, and Amy Irish-Brown. Available online at: https://www.canr.msu.edu/apples/uploads/files/Thinning%20Guide%202022%20updated.pdf

[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 oz
PoMaxa	1-Napthaleneacetic acid, sodium salt (3.5%)	liquid	3.1	4 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 http://www.uky.edu/hort/sites/www.uky.edu.hort/files/documents/HortFact3011-4.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 fertilization.
- 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 two to five 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.

Application rates for vegetative growth control in apples

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 of Apogee 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 (EBDC Products)

EBDC products have two rate recommendations, depending on how you use the fungicides.

Mancozeb cannot be used past bloom at the 6 lb per acre rate, but is 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 for the control of apple scab heavily contributes to the prevention of bitter rot in highly susceptible varieties, like Honeycrisp.

- Do not apply mancozeb within 77 days of harvest.
- Do not apply more than 24 lb of mancozeb (Roper and other generic formulations) or more than 25.6 lb of penncozeb per acre per year if using for pre-bloom (6 lb) applications.
- Do not apply more than 21 lb of mancozeb 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 "best" fungicides may lose their efficacy due to fungicide resistance evolving in the pathogens we are trying to manage. These fungicides include Topsin-M, Scala, Vangard, the sterol-inhibiting fungicides (Rally, Rhyme, Rubigan, Indar, Inspire Super, Procure, Topguard); the strobilurin fungicides (Sovran, Pristine, Merivon, and Flint); and the succinase dehydrogenase inhibiting fungicides (Aprovia, Fontelis, Luna Sensation, Luna Tranquility, Pristine and Merivon). Because they all have specific modes of action, fungi such as the apple scab, bitter rot and powdery mildew pathogens can rapidly evolve resistance to them. Fungicide resistance, or at least reduced sensitivity, has been observed for apple scab, bitter rot 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 or mancozeb.

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.

Effectiveness ratings of insecticides for control of codling moth are shown in the table for first and second cover sprays, on pages 35-36.

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.

Insecticides currently registered for control of borers on apple are Assail 30SG for dogwood borer and Warrior II and Proaxis for control of tree borer species.

For dogwood borer, the best insecticide timing is at peak egg hatch, which is in late June in the central Midwest. Pheromone mating disruption by 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.

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 aphid (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
Torino (SC)	U6	x	x	E	x	x	x	x	4h	6.8 oz
cyflufenamid									14d	1

(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]
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.

[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 aphid	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 aphid	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

(Continued)

Effectiveness of insecticides for control of minor apple insects[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	black stem borer	green aphid	oblique banded leafroller	potato leafhopper	redbanded leafroller	white apple leafhopper	REI[3] PHI[4]	Max amt[5] Max app[6]
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
Versys Inscalis (0.83DC)	9D	x	G	x	x	x	x	12h	7 fl oz
afidopyropen								7d	NA

(Continued)

Effectiveness of insecticides for control of minor apple insects[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	black stem borer	green aphid	oblique banded leafroller	potato leafhopper	redbanded leafroller	white apple leafhopper	REI[3] PHI[4]	Max amt[5] Max app[6]
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

[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.

[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 code[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
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

(Continued)

Effectiveness of insecticides for control of minor apple insects[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	apple rust mite	European red mite	two-spotted mite	REI[3] PHI[4]	Max amt[5] Max app[6]
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

[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.

[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.

2. PEAR

Pear Spray Schedule

Entomology Leads: C. Welty, E. Long, R. Bessin
Plant Pathology Lead: J. Beckerman

How to read the spray schedule tables

Every pear 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.

Pear Dormant to Bud Swell – Diseases

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

Disease management notes

- **Fire blight:** If fire blight was severe last year, a fixed copper spray (copper hydroxide, copper oxychloride, basic copper sulfate, Bordeaux mixture) at swollen bud stage is suggested. Label recommendations may vary; be sure to review product labels.

Table 2-1. Pear disease management at dormant[1]

Product and formulation Active ingredient	FRAC code[2]	fire blight	REI[3] PHI[4]	Max amt[5] Max app[6]
Badge	M	5.25-14 pt	48 h	56.3 pt
copper oxychloride		G-F	0d	NA
Bordeaux	M	8 lb	24 h	NA
limed copper sulfate		G-F	NA	NA
C-O-C-S	M	12-15.6 lb	48 h	31 lb
copper oxychloride, sulfate		G-F	NA	1 every 5d
Cuprofix Ultra 40 Disperss	M	7.5-10 lb	12h	NA
copper sulfate		G-F	NA	NA
Kocide 3000	M	7 lb	48h	53.3 lb
copper hydroxide		G-F	0d	NA

Pear Dormant to Bud Burst – Insects

Apply before buds break into green tip.

Insect management notes

Pear psylla

- Adult pear psylla become active when temperature is above 40°F. First eggs of pear psylla are laid on buds and twigs when temperature is above 50°F. Peak psylla egg laying is at the time of bud burst.
- In addition to applying oil, apply an adulticide once psylla adults are seen. Pyrethroids (Asana, Danitol, Mustang Maxx, Permethrin, Pounce) are most effective but should be avoided if resistance is a concern. Pear psylla populations at some locations are resistant to pyrethroids. Pyrethroids work best when temperatures are cool. Another option is Surround. Surround should be applied every 7-14 days beginning no later than green tip.
- Dimilin is an insect growth regulator that should be applied during egg deposition.

Oil

- Apply when temperatures are above 40°F, never during freezing weather. Do not apply within two weeks of a sulfur spray or later than delayed dormant. Insecticide may be combined with oil during dormant and delayed-dormant periods only. Oil on wood inhibits psylla egg laying/hatching. Apply oil as soon as psylla first eggs are laid and again seven days later if adults are still present.

Sulfur and lime-sulfur

- Should not be applied once green tissue is present on sensitive cultivars (Anjou, Comice or Seckle)
- Lime-sulfur can be applied at the dormant stage, using a high rate (11 gal/acre). A lower rate (3 gal/acre) can be used if not applied until the delayed dormant stage. In addition to controlling pear psylla and San Jose scale, lime sulfur controls pear rust mite and pearleaf blister mite. Elemental sulfur used during the delayed dormant period to control pearleaf blister mite also controls pear psylla. Do not use sulfur or lime-sulfur when temperatures are predicted to exceed 90°F during or within three days of application. Sulfur sprays are most effective when the temperature is above 60°F after application. Not all elemental sulfur products are registered in all Midwest states.

Table 2-2. Insect management at late dormant to green bud[1]

Product and formulation Active ingredient	IRAC code[2]	pear psylla EGG/ADULT	San Jose scale	European red mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	x	x	0.7-1 lb	12h	NA
bifenazate		x	x	G	7d	1
Agri-Mek SC (0.7SC) **(RUP)**	6	x	x	2.2-4.2 fl oz	12h	8.5 fl oz
abamectin		x	x	E	28d	2
Apollo SC (1SC)	10A	x	x	4-8 fl oz	12h	NA
clofentezine		x	x	E	21d	1
Asana XL (0.66EC) **(RUP)**	3A	4.8-19.2 fl oz	x	x	12h	72 fl oz
esfenvalerate		G[r]	x	x	28d	NA
Brigade 2EC **(RUP)**	3A	x	x	5.1-12.8 fl oz	12h	32 fl oz
bifenthrin		x	x	F	14d	NA
Centaur WDG (70WDG)	16	x	34.5-46 oz	x	12h	69 oz
buprofezin		x	E	x	14d	2
Danitol 2.4EC **(RUP)**	3A	16-21.3 fl oz	x	x	24h	42.7 fl oz
fenpropathrin		G[r]	x	x	14d	NA
Delta Gold (1.5EC) **(RUP)**	3A	1.9 fl oz	x	x	12h	3.6 fl oz
deltamethrin		s	x	x	21d	NA
Diazinon AG 600WBC **(RUP)**	1B	6.5-12.7 fl oz/100 gal	12.7 fl oz/100 gal	12.7 fl oz/100 gal	4d	102 fl oz
diazinon		F	G	u	21d	2
Dimethoate (4EC)	1B	0.5-1 pt/100 gal	x	0.5-1 pt/100 gal	10d	2 pt
dimethoate		u	x	u	28d	NA
Dimilin 2L (2AF) **(RUP)**	15	12-48 fl oz	x	x	12h	64 fl oz
diflubenzuron		E	x	x	14d	4
Envidor 2SC	23	x	x	16-18 fl oz	12h	18 fl oz
spirodiclofen		x	x	E	7d	1
Esteem 35WP	7C	x	4-5 oz	x	12h	10 oz
pyriproxyfen		x	E	x	45d	2
Grandevo	UN	x	x	2-3 lb	4h	NA
Chromobacterium subtsugae		x	x	u	0d	NA

(Continued)

Table 2-2. Insect management at late dormant to green bud[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	pear psylla EGG/ADULT	San Jose scale	European red mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Kanemite 15SC	20B	x	x	21-31 fl oz	12h	62 fl oz
acequinocyl		x	x	E	14d	2
Lime-sulfur solution	UN	3-5 gal	3-11 gal	3-11 gal	48h	NA
calcium polysulfide		E	u	u	PB/PH*	NA
Mustang Maxx (0.8EC) **(RUP)**	3A	1.2-4 fl oz	x	x	12h	24 fl oz
zeta-cypermethrin		G[r]	x	x	14d	NA
Nealta (1.67SC)	25	x	x	13.7 fl oz	12h	27.4 fl oz
cyflumetofen		x	x	E	7d	2
Nexter SC (3.75SC)	21A	x	x	11-17 fl oz	12h	NA
pyridaben		x	x	E	7d	1
Oil (superior)	UN	2%	2%	2%	4h	NA
mineral oil		G	G	G	0d	NA
Onager Optek (1EC)	10	x	x	12-24 fl oz	12h	24 fl oz
hexythiazox		x	x	E	28d	1
Permethrin 3.2EC **(RUP)**	3A	8-16 fl oz	x	x	12h	26 fl oz
permethrin		G[r]	x	x	PB	NA
Portal XLO (0.4EC)	21A	x	x	2 pt	12h	2 pt
fenpyroximate		x	x	E	14d	1
Pounce 25WP **(RUP)**	3A	12.8-25.6 oz	x	x	12h	41.6 oz
permethrin		G[r]	x	x	PB*	NA
Proaxis (0.5EC) **(RUP)**	3A	2.5-5.1 fl oz	x	x	24h	25.6 fl oz
gamma-cyhalothrin		s	x	x	21d	NA
Sivanto Prime (1.67SC)	4D	x	10.5-14 fl oz	x	12h	28 fl oz
flupyradifurone		x	s	x	14d	NA
Soap (M-Pede, Des-X, etc.)	UN	2%	2%	2%	12h	NA
potassium salts of fatty acids		F	F	u	0d	NA
Sulfur (Microfine; 90%)	UN	x	x	10-60 lb	24h	NA
sulfur		x	x	u	0d	NA
Surround WP (95WP)	UN	50 lb	x	x	4h	NA
kaolin		G	x	x	0d	NA
Vendex 50WP **(RUP)**	12B	x	x	1-2 lb	48h	4 lb
fenbutatin-oxide		x	x	G	14d	2
Vydate L (2L) **(RUP)**	1A	x	x	6-8 pt	48h	8 pt
oxamyl		x	x	G	14d	1
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 fl oz	x	x	24h	12.8 fl oz
lambda-cyhalothrin		s	x	x	21d	NA
Zeal (72WP)	10B	x	x	2-3 oz	12h	3 oz
etoxazole		x	x	E	14d	1

*PB = prebloom. PH = postharvest.

Pear Pre-bloom (Budburst up to Bloom) – Diseases

Apply every 7-10 days after bud break to protect new growth from green tip to bloom.

Disease management notes

- Syllit FL should be mixed with Mancozeb 75DF. Begin applications at 1/4- to l/2-inch green tip and continue on a 7- to 10-day schedule to bloom.

Table 2-3. Fungicides labeled for late dormant to bloom disease management[1]

Product and formulation Active ingredient	FRAC code[2]	Fabraea leaf spot	powdery mildew	scab	REI[3] PHI[4]	Max amt[5] Max app[6]
Aprovia (EC)	7	x	5.5-7 fl oz	5.5-7 fl oz	12h	27.6 fl oz
benzovindiflupyr		x	F	E-G	30d	NA
Captan 80 WDG	M	x	2.5-5 lb	5 lb	24h	40 lb
captan		x	i	G	0d	NA
Cevya	3	x	3-5 fl oz	3-5 fl oz	12h	NA
mefentrifluconazole		x	E-G	E	0d	NA
C-O-C-S	M	x	x	0.5-1 lb	48 h	31 lb
copper oxychloride, sulfate		x	x	u	NA	NA
Cuprofix Ultra 40 disperss	M	x	x	1-2.5 lb	12h	NA
copper sulfate		x	x	G-F	NA	NA
Ferbam Granulfo (76WDG)	M	3.5 lb	x	3.5 lb	24h	NA
ferbam		E	x	F	NA	3
Flint Extra	11	x	2.5-2.9 fl oz	2.5-2.9 fl oz	12h	10.5 fl oz
trifloxystrobin		x	G[r]	E[r]	14d	NA
Fontelis (SC)	7	x	16-20 fl oz	16-20 fl oz	12h	61 fl oz
penthiopyrad		x	G	E	28d	NA
Inspire Super (EW)	3+9	x	12 fl oz	12 fl oz	12h	60 fl oz
difenoconazole + cyprodinil		x	F	E	28d	NA
Kenja 400SC	7	x	12.5 fl oz	12.5 fl oz	12h	NA
isofetamid		x	s	F	20d	NA
Kocide 3000	M	x	x	0.75 lb	48h	53.3 lb
copper hydroxide		x	x	G-F	0d	NA
Luna Privilege	7	x	2.4-6.8 fl oz	4-6.8 fl oz	NA	NA
fluopyram		x	G	G-E	NA	NA
Luna Sensation (SC)	7+11	x	5-5.8 fl oz	4-5.8 fl oz	12h	21 fl oz
fluopyram + trifloxystrobin		x	G[r]	E[r]	14d	4
Luna Tranquility (SC)	7+9	x	11.2-16 fl oz	11.2-16 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		x	G	E	72d	NA
Merivon (2.09SC)	7+11	x	4-5.5 fl oz	4-5.5 fl oz	12h	22 fl oz
fluxapyroxad + pyraclostrobin		x	G	E	0d	4
Microthiol Disperss	M	x	10-20 lb	10-20 lb	24h	NA
sulfur		x	G	i-F	0d	NA

(Continued)

Table 2-3. Fungicides labeled for late dormant to bloom disease management[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	Fabraea leaf spot	powdery mildew	scab	REI[3] PHI[4]	Max amt[5] Max app[6]
Miravis (1.67 SC)	7	x	3.4 fl oz	3.4 fl oz	4h	13.6 fl oz
pydiflumetofen		x	G	E	30d	4
OSO 5% SC	19	x	6.5-13 fl oz	6.5-13 fl oz	4h	78 fl oz
polyoxin D		x	F	F	0d	6
Pristine	11+7	x	14.5-18.5 oz	14.5-18.5 oz	12h	74 oz
pyraclostrobin + boscalid		x	E[r]	E[r]	0d	4
Procure 480SC	3	x	8-16 fl oz	8-16 fl oz	12h	64 fl oz
triflumizole		x	E[r]	G[r]	14d	NA
Roper DF Rainshield	M	3 or 6 lb	6 lb	6 lb	24h	21 lb
mancozeb		E	i	G	77d	6
Scala SC	9	x	x	7-10 fl oz	12h	40 fl oz
pyrimethanil		x	x	E-G	72d	NA
Sovran (50WG)	11	x	4-6.4 oz	3.2-6.4 oz	12h	25.6 oz
kresoxim-methyl		x	G[r]	E[r]	30d	4
Syllit FL	U12	3 pt	x	3 pt	48h	9 pt
dodine		G	x	E[r]	7d	3
Topguard Specialty Crops	3	x	8-12 fl oz	13 fl oz	12h	52 fl oz
flutriafol		x	E	E-G	14d	4
Topsin-M WSB	1	1 lb	0.75-1 lb	0.75-1 lb	24h	4 lb
thiophanate methyl		E[r]	G[r]	i	1d	NA
Torino (SC)	U6	x	6.8 oz	x	4h	6.8 oz
cyflufenamid		x	E	x	14d	1
Vangard WG	9	x	x	5 oz	12h	30 oz
cyprodinil		x	x	G	0d	2
Ziram 76DF	M3	6	x	6 lb	48h	42.4 lb
ziram		E	x	G	14d	7

Green Cluster to White Bud – Insects

Insect management notes

Pear psylla

- At green cluster (tight cluster), eggs of pear psylla begin to hatch and young nymphs are found. Apply insecticide when eggs begin to hatch. If pyrethroids (Asana, Danitol, Mustang Maxx, Permethrin, Pounce) were used earlier for adult control, switch to different chemistry (e.g., Dimilin or Centaur, or Esteem, Nexter or Surround).
- Do not use sulfur or lime-sulfur within two weeks of an oil spray. Sulfur or lime-sulfur should not be applied once green tissue is present on sensitive cultivars (Anjou, Comice or Seckle). Sulfur sprays are most effective when the temperature is above 60°F after application. Do not use sulfur or lime-sulfur when temperatures are predicted to exceed 90°F during or within 3 days of application. Not all elemental sulfur or lime sulfur products are registered in all Midwest states.
- Do not apply Actara after green cluster until petal fall.

Table 2-4. Insecticides labeled for green cluster to white bud[1]

Product and formulation Active ingredient	IRAC code[2]	pear psylla NYMPH	San Jose scale	European red mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	x	x	0.7-1 lb	12h	NA
bifenazate		x	x	G	7d	1
Actara (25WDG)	4A	5.5 oz	x	x	12h	16.5 oz
thiamethoxam		E	x	x	35d	NA
Admire Pro (4.6F)	4A	7 fl oz	x	x	12h	14 fl oz
imidacloprid		G	x	x	7d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	2.2-4.2 fl oz	x	2.2-4.2 fl oz	12h	8.5 fl oz
abamectin		G	x	E	28d	2
Apollo SC (1SC)	10A	x	x	4-8 fl oz	12h	NA
clofentezine		x	x	E	21d	1
Apta (1.34SC)	21A	21-27 fl oz	x	x	12h	53.5 fl oz
tolfenpyrad		G	x	x	14d	2
Assail 30SG	4A	4-8 oz	x	x	12h	32 oz
acetamiprid		G	x	x	7d	4
Belay (2.13SC)	4A	6 fl oz	x	x	12h	12 fl oz
clothianidin		G	x	x	7d	NA
Brigade 2EC **(RUP)**	3A	x	x	5.1-12.8 fl oz	12h	32 fl oz
bifenthrin		x	x	F	14d	NA
Centaur WDG (70WDG)	16	34.5-46 oz	34.5-46 oz	x	12h	69 oz
buprofezin		u	E	x	14d	2
Closer SC (2SC)	4C	5.7 fl oz	x	x	12h	17 fl oz
sulfoxaflor		s	x	x	7d	4
Delegate WG (25WG)	5	6-7 oz	x	x	4h	28 oz
spinetoram		E	x	x	7d	4
Diazinon AG 600WBC **(RUP)**	1B	x	12.7 fl oz/ 100 gal	12.7 fl oz/ 100 gal	4d	102 fl oz
diazinon		x	G	u	21d	2
Dimethoate (4EC)	1B	x	x	0.5-1 pt/100 gal	10d	2 pt
dimethoate		x	x	u	28d	NA
Dimilin 2L (2AF) **(RUP)**	15	12-48 fl oz	x	x	12h	64 fl oz
diflubenzuron		E	x	x	14d	4
Envidor 2SC	23	x	x	16-18 fl oz	12h	18 fl oz
spirodiclofen		x	x	E	7d	1
Esteem 35WP	7C	5 oz	4-5 oz	x	12h	10 oz
pyriproxyfen		G	E	x	45d	2
Grandevo	UN	2-3 lb	x	2-3 lb	4h	NA
Chromobacterium subtsugae		u	x	u	0d	NA
Kanemite 15SC	20B	x	x	21-31 fl oz	12h	62 fl oz
acequinocyl		x	x	E	14d	2
Lime-sulfur solution	UN	x	3-11 gal	3-11 gal	48h	NA
calcium polysulfide		x	u	u	PB/PH*	NA

*PB = prebloom. PH = postharvest.

(Continued)

Table 2-4. Insecticides labeled for green cluster to white bud[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	pear psylla NYMPH	San Jose scale	European red mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Nealta (1.67SC)	25	x	x	13.7 fl oz	12h	27.4 fl oz
cyflumetofen		x	x	E	7d	2
Neemix 4.5 (0.39L)	UN	7-16 fl oz	x	x	4h	NA
azadirachtin		F	x	x	0d	NA
Nexter SC (3.75SC)	21A	11-17 fl oz	x	11-17 fl oz	12h	NA
pyridaben		G	x	E	7d	1
Oil (superior)	UN	x	2%	2%	4h	NA
mineral oil		x	G	G	0d	NA
Onager Optek (1EC)	10	x	x	12-24 fl oz	12h	24 fl oz
hexythiazox		x	x	E	28d	1
Portal XLO (0.4EC)	21A	2 pt	x	2 pt	12h	2 pt
fenpyroximate		G	x	E	14d	1
Proclaim (5SG) **(RUP)**	6	3.2-4.8 oz	x	3.2-4.8 oz	12 or 48h	14.4 oz
emamectin benzoate		s	x	s	14d	NA
Sevin XLR Plus (4F)	1A	1.5-3 qt	x	x	12h	15 qt
carbaryl		u	x	x	3d	8
Sivanto Prime (1.67SC)	4D	10.5-14 fl oz	10.5-14 fl oz	x	12h	28 fl oz
flupyradifurone		G	s	x	14d	NA
Soap (M-Pede, Des-X, etc.)	UN	2%	2%	2%	12h	NA
potassium salts of fatty acids		F	F	u	0d	NA
Sulfur (Microfine; 90%)	UN	x	x	10-60 lb	24h	NA
sulfur		x	x	u	0d	NA
Surround WP (95WP)	UN	50 lb	x	x	4h	NA
kaolin		G	x	x	0d	NA
Vendex 50WP **(RUP)**	12B	x	x	1-2 lb	48h	4 lb
fenbutatin-oxide		x	x	G	14d	2
Verdepryn 100SL (0.83SL)	28	11 fl oz	x	x	4h	33 fl oz
cyclaniliprole		u	x	x	7d	3
Vydate L (2L) **(RUP)**	1A	x	x	6-8 pt	48h	8 pt
oxamyl		x	x	G	14d	1
Zeal (72WP)	10B	x	x	2-3 oz	12h	3 oz
etoxazole		x	x	E	14d	1

Pear Bloom through Petal Fall – Diseases

Disease management notes

Fire 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 highly susceptible varieties. A minimum of two applications are necessary to provide control. Better control has been obtained by adding 1 pt of Regulaid to Streptomycin 17W (1 lb).
- In orchards with documented streptomycin resistant fire blight use Mycoshield 17WP (16 oz/200 ppm) and generic oxytetracycline products alternated with Kasumin 2L (64 oz per 100 gal). Do not exceed two sequential treatments per year for use to manage streptomycin-resistant fire blight bacteria.

Table 2-5. Fungicides labeled for pear bloom through petal fall[1]

Product and formulation Active ingredient	FRAC code[2]	Fabraea leaf spot	fire blight	powdery mildew	scab	summer rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Agri-Mycin 17	25	x	24-48 oz	x	x	x	12h	NA
streptomycin sulfate		x	G-E[r]	x	x	x	50d	NA
Aprovia (EC)	7	x	x	5.5-7 fl oz	5.5-7 fl oz	5.5-7 fl oz	12h	27.6 fl oz
benzovindiflupyr		x	x	F	E-G	E-G	30d	NA
Badge	M	x	0.5-1 pt	x	x	x	48 h	56.3 pt
copper oxychloride		x	G-F	x	x	x	0d	NA
Captan 80 WDG	M	x	x	2.5-5 lb	5 lb	2.5-5 lb	24h	40 lb
captan		x	x	i	G	G	0d	NA
Cevya	3	x	x	3-5 fl oz	3-5 fl oz	3-5 fl oz	12h	NA
mefentrifluconazole		x	x	E-G	E	x	0d	NA
C-O-C-S	M	x	0.5-1 lb	x	0.5-1 lb	x	48 h	31 lb
copper oxychloride, sulfate		x	G-F	x	u	x	NA	NA
Cuprofix Ultra 40 disperss	M	x	.75	x	1-2.5 lb	x	12h	NA
copper sulfate		x	G-F	x	G-F	x	NA	NA
Ferbam Granulfo (76WDG)	M	3.5 lb	x	x	3.5 lb	3.5 lb	24h	NA
ferbam		E	x	x	F	E-G	NA	3
Flint Extra	11	x	x	2.5-2.9 fl oz	2.5-2.9 fl oz	2.9 fl oz	12h	10.5 fl oz
trifloxystrobin		x	x	G[r]	E[r]	x	14d	NA
Fontelis (SC)	7	x	x	16-20 fl oz	16-20 fl oz	16-20 fl oz	12h	61 fl oz
penthiopyrad		x	x	G	E	x	28d	NA
Inspire Super (EW)	3+9	x	x	12 fl oz	12 fl oz	x	12h	60 fl oz
difenoconazole + cyprodinil		x	x	F	E	x	28d	NA
Kasumin 2L	24	x	64 fl oz	x	x	x	12h	256 fl oz
kasugamycin		x	G	x	x	x	90d	4
Kenja 400SC	7	x	x	12.5 fl oz	12.5 fl oz	x	12h	NA
isofetamid		x	x	s	F	x	20d	NA
Kocide 3000	M	x	0.75 lb	x	0.75 lb	x	48h	53.3 lb
copper hydroxide		x	G-F	x	G-F	x	0d	NA
Luna Privilege	7	x	x	2.4-6.8 fl oz	4-6.8 fl oz	x	NA	NA
fluopyram		x	x	G	G-E	x	NA	NA
Luna Sensation (SC)	7+11	x	x	5-5.8 fl oz	4-5.8 fl oz	4-5.8 fl oz	12h	21 fl oz
fluopyram + trifloxystrobin		x	x	G[r]	E[r]	x	14d	4

(Continued)

Table 2-5. Fungicides labeled for pear bloom through petal fall[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	Fabraea leaf spot	fire blight	powdery mildew	scab	summer rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Luna Tranquility (SC)	7+9	x	x	11.2-16 fl oz	11.2-16 fl oz	x	12h	54.7 fl oz
fluopyram + pyrimethanil		x	x	G	E	x	72d	NA
Merivon (2.09SC)	7+11	x	x	4-5.5 fl oz	4-5.5 fl oz	4-5.5 fl oz	12h	22 fl oz
fluxapyroxad + pyraclostrobin		x	x	G	E	E-G	0d	4
Microthiol Disperss	M	x	x	10-20 lb	10-20 lb	x	24h	NA
sulfur		x	x	G	i-F	x	0d	NA
Miravis (1.67 SC)	7	x	x	3.4 fl oz	3.4 fl oz	x	4h	13.6 fl oz
pydiflumetofen		x	x	G	E	x	30d	4
Mycoshield	41	x	1 lb	x	x	x	12h	9 lb
oxytetracyline		x	G	x	x	x	60d	6
OSO 5% SC	19	x	x	6.5-13 fl oz	6.5-13 fl oz	6.5 fl oz	4h	78 fl oz
polyoxin D		x	x	F	F	x	0d	6
Polyram 80 DF	M3	x	x	x	3 lb	x	24h	21 lb
metiran		x	x	x	G	x	77d	7
Pristine	11+7	x	x	14.5-18.5 oz	14.5-18.5 oz	14.5-18.5 oz	12h	74 oz
pyraclostrobin + boscalid		x	x	E[r]	E[r]	E-G[r]	0d	4
Procure 480SC	3	x	x	8-16 fl oz	8-16 fl oz	x	12h	64 fl oz
triflumizole		x	x	E[r]	G[r]	x	14d	NA
Roper DF Rainshield	M	x	x	6 lb	6 lb	3 lb	24h	21 lb
mancozeb		x	x	i	G	E-G	77d	6
Scala SC	9	x	x	x	7-10 fl oz	x	12h	40 fl oz
pyrimethanil		x	x	x	E-G	x	72d	NA
Sovran (50WG)	11	x	x	4-6.4 oz	3.2-6.4 oz	4-6.4 oz	12h	25.6 oz
kresoxim-methyl		x	x	G[r]	E[r]	x	30d	4
Topguard Specialty Crops	3	x	x	8-12 fl oz	13 fl oz	13 fl oz	12h	52 fl oz
flutriafol		x	x	E	E-G	E-F[r]	14d	4
Topsin-M WSB	1	1 lb	x	0.75-1 lb	0.75-1 lb	0.75-1 lb	24h	4 lb
thiophanate methyl		E[r]	x	G[r]	i	E-G[r]	1d	NA
Torino (SC)	U6	x	x	6.8 oz	x	x	4h	6.8 oz
cyflufenamid		x	x	E	x	x	14d	1
Vangard WG	9	x	x	x	5 oz	x	12h	30 oz
cyprodinil		x	x	x	G	x	0d	2
Ziram 76DF	M3	6 lb	x	x	6 lb	6 lb	48h	42.4 lb
ziram		E	x	x	G	E	14d	7

Pear Petal Fall – Insects

7-10 days after bloom.

Insect management notes

- **Pear psylla:** The pear psylla population should be low at this time if insecticides were applied at earlier stages. Petal fall is peak egg hatch. Nymphs are the target of spray at petal fall. Best options are Agri-Mek, Delegate and Actara. Agri-Mek is effective now through second cover because leaves are tender; it is not as effective once leaves harden off.
- **Codling moth:** If pheromone mating disruption is used, dispensers should be set up at petal fall. Recommended only in orchards that are 5 acres or larger. See list of products in Apple chapter, pages 26-27.

Table 2-6. Insecticides labeled for pear at petal fall[1]

Product and formulation Active ingredient	IRAC code[2]	pear psylla NYMPH	plum curculio	stink bug	tarnished plant bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	5.5 oz	4.5-5.5 oz	x	x	12h	16.5 oz
thiamethoxam		E	G	x	x	35d	NA
Admire Pro (4.6F)	4A	7 fl oz	x	x	x	12h	14 fl oz
imidacloprid		G	x	x	x	7d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	2.2-4.2 fl oz	x	x	x	12h	8.5 fl oz
abamectin		G	x	x	x	28d	2
Altacor (35WDG)	28	x	2.5-4.5 oz	x	x	4h	9 fl oz
chlorantraniliprole		x	s	x	x	5d	NA
Apta (1.34SC)	21A	21-27 fl oz	21-27 fl oz	x	x	12h	53.5 fl oz
tolfenpyrad		G	G	x	x	14d	2
Asana XL (0.66EC) **(RUP)**	3A	x	4.8-14.5 fl oz	x	x	12h	72 fl oz
esfenvalerate		x	F	x	x	28d	NA
Assail 30SG	4A	4-8 oz	8 oz	x	x	12h	32 oz
acetamiprid		G	G	x	x	7d	4
Baythroid XL (1EC) **(RUP)**	3A	x	2.4-2.8 fl oz	2-2.4 fl oz	2-2.4 fl oz	12h	2.8 fl oz
beta-cyfluthrin		x	F	G	E	7d	NA
Belay (2.13SC)	4A	6 fl oz	6 fl oz	6 fl oz	4-6 fl oz	12h	12 fl oz
clothianidin		G	G	E	G	7d	NA
Beleaf 50SG	29	x	x	x	2-2.8 oz	12h	8.4 oz
flonicamid		x	x	x	G	21d	3
Brigade 2EC **(RUP)**	3A	x	2.6-12.8 fl oz	2.6-12.8 fl oz	2.6-12.8 fl oz	12h	32 fl oz
bifenthrin		x	F	E	E	14d	NA
Centaur WDG (70WDG)	16	34.5-46 oz	x	x	x	12h	69 oz
buprofezin		u	x	x	x	14d	2
Closer SC (2SC)	4C	5.7 fl oz	x	x	2.7-5.7 fl oz	12h	17 fl oz
sulfoxaflor		s	x	x	G	7d	4
Danitol 2.4EC **(RUP)**	3A	x	x	16-21.3 fl oz	16-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		x	x	G	G	14d	NA
Delegate WG (25WG)	5	6-7 oz	6-7 oz	x	x	4h	28 oz
spinetoram		E	s	x	x	7d	4
Delta Gold (1.5EC) **(RUP)**	3A	x	0.9-1.9 fl oz	1.9 fl oz	0.9-1.9 fl oz	12h	3.6 fl oz
deltamethrin		x	F	u	E	21d	NA
Dimilin 2L (2AF) **(RUP)**	15	12-48 fl oz	x	x	x	12h	64 fl oz
diflubenzuron		E	x	x	x	14d	4

(Continued)

Table 2-6. Insecticides labeled for pear at petal fall[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	pear psylla NYMPH	plum curculio	stink bug	tarnished plant bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Esteem 35WP	7C	5 oz	x	x	x	12h	10 oz
pyriproxyfen		G	x	x	x	45d	2
Exirel (0.83SE)	28	13.5-20.5 fl oz	13.5-20.5 fl oz	x	x	12h	61 fl oz
cyantraniliprole		s	G	x	x	3d	3
Grandevo	UN	2-3 lb	x	x	x	4h	NA
Chromobacterium subtsugae		u	x	x	x	0d	NA
Imidan 70W	1B	x	2.1-5.7 lb	x	x	7d	16 lb
phosmet		x	G	x	x	7d	NA
Magister SC (1.7SC)	21A	32-36 fl oz	x	x	x	12h	36 fl oz
fenazaquin		G	x	x	x	7d	1
Movento (2SC)	23	6-9 fl oz	x	x	x	24h	25 fl oz
spirotetramat		G	x	x	x	7d	NA
Mustang Maxx (0.8EC) **(RUP)**	3A	x	1.2-4 fl oz	1.2-4 fl oz	1.2-4 fl oz	12h	24 fl oz
zeta-cypermethrin		x	F	G	E	14d	NA
Neemix 4.5 (0.39L)	UN	7-16 fl oz	x	7-16 fl oz	7-16 fl oz	4h	NA
azadirachtin		F	x	u	G	0d	NA
Nexter SC (3.75SC)	21A	11-17 fl oz	x	x	x	12h	NA
pyridaben		G	x	x	x	7d	1
Portal XLO (0.4EC)	21A	2 pt	x	x	x	12h	2 pt
fenpyroximate		G	x	x	x	14d	1
Proaxis (0.5EC) **(RUP)**	3A	x	2.5-5.1 fl oz	2.5-5.1 fl oz	2.5-5.1 fl oz	24h	25.6 fl oz
gamma-cyhalothrin		x	G	F	E	21d	NA
Proclaim (5SG) **(RUP)**	6	3.2-4.8 oz	x	x	x	12 or 48h	14.4 oz
emamectin benzoate		s	x	x	x	14d	NA
Sevin XLR Plus (4F)	1A	1.5-3 qt	1.5-3 qt	x	1.5-3 qt	12h	15 qt
carbaryl		u	F	x	i	3d	8
Sivanto Prime (1.67SC)	4D	10.5-14 fl oz	x	x	x	12h	28 fl oz
flupyradifurone		G	x	x	x	14d	NA
Soap (M-Pede, Des-X, etc.)	UN	2%	x	x	x	12h	NA
potassium salts of fatty acids		F	x	x	x	0d	NA
Surround WP (95WP)	UN	50 lb	x	25-50 lb	25-50 lb	4h	NA
kaolin		G	x	s	s	0d	NA
Transform WG (50WG)	4C	2.75 oz	x	x	1.5-2.7 oz	24h	8.5 oz
sulfoxaflor		s	x	x	u	7d	4
Verdepryn 100SL (0.83SL)	28	11 fl oz	5.5-11 fl oz	5.5-11 fl oz	x	4h	33 fl oz
cyclaniliprole		u	G	s	x	7d	3
Vydate L (2L) **(RUP)**	1A	x	x	1.5-4 pt	x	48h	8 pt
oxamyl		x	x	G	x	14d	1
Warrior II (2.08CS) **(RUP)**	3A	x	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		x	G	G	G	21d	NA

Pear Summer Cover – Diseases

10-14 days after petal fall, with applications every 10-14 days as needed, continuing until harvest.

Disease management notes

- Where **Febraea leaf spot** is a problem, use Flint Extra, Sovran or Ziram. Observe preharvest interval requirements.
- Use of Ferbam products is not recommended for later cover sprays due to the presence of unsightly residue at harvest.
- The following products have 28- or 30-day PHI. Be careful of their use close to harvest to avoid MRL issues: Aprovia, Fontelis, Inspire Super, Miravis, Omega and Sovran.
- Luna Tranquility has a 72-day PHI.

Table 2-7. Fungicides for pear disease management at summer cover[1]

Product and formulation Active ingredient	FRAC code[2]	bitter rot	powdery mildew	scab	sooty blotch/ flyspeck	summer rots (black and white)	Fabraea leaf spot	REI[3] PHI[4]	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	x	12h	27.6 fl oz
benzovindiflupyr		S (E-G)	F	E-G	E-G	F	x	30d	NA
Captan 80 WDG	M	2.5-5 lb	2.5-5 lb	5 lb	2.5-5 lb	2.5-5 lb	x	24h	40 lb
captan		E	i	G	G	S (G-F)	x	0d	NA
Cevya	3	3-5 fl oz	3-5 fl oz	3-5 fl oz	3-5 fl oz	3-5 fl oz	x	12h	NA
mefentrifluconazole		G	E-G	E	E	E	x	0d	NA
C-O-C-S	M	x	x	0.5-1 lb	x	x	x	48 h	31 lb
copper oxychloride, sulfate		x	x	u	x	x	x	NA	NA
Cuprofix Ultra 40 Disperss	M	x	x	1-2.5 lb	x	x	x	12h	NA
copper sulfate		x	x	G-F	x	x	x	NA	NA
Ferbam Granulfo (76WDG)	M	3.5 lb	x	3.5 lb	3.5 lb	3.5 lb	3.5 lb	24h	NA
ferbam		F	x	F	F	G	E	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	x	12h	10.5 fl oz
trifloxystrobin		s[G]	G[r]	E[r]	G	s[G]	x	14d	NA
Fontelis (SC)	7	x	16-20 fl oz	16-20 fl oz	x	16-20 fl oz	x	12h	61 fl oz
penthiopyrad		x	G	E	x	u	x	28d	NA
Inspire Super (EW)	3+9	x	12 fl oz	12 fl oz	12 fl oz	x	x	12h	60 fl oz
difenoconazole + cyprodinil		s	F	E	E	x	x	28d	NA
Kenja 400SC	7	x	12.5 fl oz	12.5 fl oz	x	x	x	12h	NA
isofetamid		x	s	F	x	x	x	20d	NA
Kocide 3000	M	x	x	0.75 lb	x	x	x	48h	53.3 lb
copper hydroxide		x	x	G-F	x	x	x	0d	NA
Luna Privilege	7	x	2.4-6.8 fl oz	4-6.8 fl oz	6.8 fl oz	x	x	NA	NA
fluopyram		x	G	G-E	F-G	x	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	x	12h	21 fl oz
fluopyram + trifloxystrobin		i-E	G[r]	E[r]	G-E	E	x	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	x	12h	22 fl oz
fluxapyroxad + pyraclostrobin		E	G	E	E	E	x	0d	4

(Continued)

Table 2-7. Fungicides for pear disease management at summer cover[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bitter rot	powdery mildew	scab	sooty blotch/ flyspeck	summer rots (black and white)	Fabraea leaf spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Microthiol Disperss	M	10-20 lb	10-20 lb	10-20 lb	x	x	x	24h	NA
sulfur		u	G	i-F	x	x	x	0d	NA
Miravis (1.67 SC)	7	x	3.4 fl oz	3.4 fl oz	3.4 fl oz	x	x	4h	13.6 fl oz
pydiflumetofen		x	G	E	G	x	x	30d	4
OSO 5% SC	19	6.5 fl oz	6.5-13 fl oz	6.5-13 fl oz	6.5 fl oz	6.5 fl oz	x	4h	78 fl oz
polyoxin D		F	F	F	F	F	x	0d	6
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	x	12h	74 oz
pyraclostrobin + boscalid		F-E	E[r]	E[r]	E	E	x	0d	4
Procure 480SC	3	x	8-16 fl oz	8-16 fl oz	x	x	x	12h	64 fl oz
triflumizole		x	E[r]	G[r]	x	x	x	14d	NA
Sovran (50WG)	11	x	4-6.4 oz	3.2-6.4 oz	4-6.4 oz	4-6.4 oz	x	12h	25.6 oz
kresoxim-methyl		x	G[r]	E[r]	G	G	x	30d	4
Topguard Specialty Crops	3	13 fl oz	8-12 fl oz	13 fl oz	x	13 fl oz	x	12h	52 fl oz
flutriafol		u	E	E-G	x	u	x	14d	4
Topsin-M WSB	1	1 lb	0.75-1 lb	0.75-1 lb	0.75-1 lb	0.75-1 lb	1 lb	24h	4 lb
thiophanate methyl		E[r]	G[r]	i	E-G [r]	G	E-G[R]	1d	NA
Torino (SC)	U6	x	6.8 oz	x	x	x	x	4h	6.8 oz
cyflufenamid		x	E	x	x	x	x	14d	1
Ziram 76DF	M3	6 lb	x	6 lb	6 lb	6 lb	6	48h	42.4 lb
ziram		G	x	G	G	i	E	14d	7

Pear First and Second Cover – Insects

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

Insect management notes

- **Codling moth:** First and second cover are the key times to control codling moth, to kill young larvae as they emerge from eggs. Read the insecticide label to see if an adjuvant is recommended. Optimal timing for the first spray can be determined by using pheromone traps to monitor codling moth, and a degree-day model to track temperature after moth flight begins. See table in Apple chapter for degree-day targets for various insecticides.
- **Pear psylla:** Pear psylla control is required in first or second covers only if control at petal-fall was not adequate. Best results occur when pear psylla is treated in its young nymphal stage.
- **Pear rust mite:** Pear rust mite is not a problem in most orchards but can be a problem in young orchards or where pyrethroids have been used. First cover is the best time to control pear rust mite if not treated pre-bloom. If pear rust mite is present, note that Agri-Mek, Nexter, Magister and Portal control both pear psylla and pear rust mite.
- **San Jose scale "crawlers":** Sprays should target the crawler stage, which usually begins in early summer, around the time of second or third cover. A pheromone trap and a degree-day model can be used to predict the timing of crawler emergence.

Table 2-8. Insecticides for pear pest management at first and second cover[1]

Product and formulation Active ingredient	IRAC code[2]	pear psylla NYMPH	plum curculio	pear rust mite	codling moth	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	5.5 oz	4.5-5.5 oz	x	x	12h	16.5 oz
thiamethoxam		E	G	x	x	35d	NA
Admire Pro (4.6F)	4A	7 fl oz	x	x	x	12h	14 fl oz
imidacloprid		G	x	x	x	7d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	2.2-4.2 fl oz	x	2.2-4.2 fl oz	x	12h	8.5 fl oz
abamectin		G	x	E	x	28d	2
Altacor (35WDG)	28	x	2.5-4.5 oz	x	2.5-4.5 oz	4h	9 fl oz
chlorantraniliprole		x	s	x	E	5d	NA
Apta (1.34SC)	21A	21-27 fl oz	21-27 fl oz	21-27 fl oz	21-27 fl oz	12h	53.5 fl oz
tolfenpyrad		G	G	u	s	14d	2
Asana XL (0.66EC) **(RUP)**	3A	x	4.8-14.5 fl oz	x	4.8-14.5 fl oz	12h	72 fl oz
esfenvalerate		x	F	x	G	28d	NA
Assail 30SG	4A	4-8 oz	8 oz	x	4-8 oz	12h	32 oz
acetamiprid		G	G	x	E	7d	4
Bacillus thuringiensis (B.t.) (Dipel DF, etc.)	11A	x	x	x	0.5-2 lb	4h	NA
Bacillus thuringiensis		x	x	x	F	0d	NA
Baythroid XL (1EC) **(RUP)**	3A	x	2.4-2.8 fl oz	x	2-2.4 fl oz	12h	2.8 fl oz
beta-cyfluthrin		x	F	x	G	7d	NA
Belay (2.13SC)	4A	6 fl oz	6 fl oz	x	6 fl oz	12h	12 fl oz
clothianidin		G	G	x	s	7d	NA
Brigade 2EC **(RUP)**	3A	x	2.6-12.8 fl oz	x	2.6-12.8 fl oz	12h	32 fl oz
bifenthrin		x	F	x	G	14d	NA
Centaur WDG (70WDG)	16	34.5-46 oz	x	x	x	12h	69 oz
buprofezin		u	x	x	x	14d	2
Closer SC (2SC)	4C	5.7 fl oz	x	x	x	12h	17 fl oz
sulfoxaflor		s	x	x	x	7d	4
Confirm 2F	18	x	x	x	20 fl oz	4h	20 fl oz
tebufenozide		x	x	x	F	14d	120 fl oz
Danitol 2.4EC **(RUP)**	3A	x	x	x	16-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		x	x	x	G	14d	NA
Delegate WG (25WG)	5	6-7 oz	6-7 oz	x	4.5-7 oz	4h	28 oz
spinetoram		E	s	x	E	7d	4
Delta Gold (1.5EC) **(RUP)**	3A	x	0.9-1.9 fl oz	x	0.9-1.9 fl oz	12h	3.6 fl oz
deltamethrin		x	F	x	G	21d	NA
Diazinon AG 600WBC **(RUP)**	1B	x	x	x	12.7 fl oz/100 gal	4d	102 fl oz
diazinon		x	x	x	F	21d	2
Dimilin 2L (2AF) (RUP)	15	12-48 fl oz	x	40-48 fl oz	12-16 fl oz	12h	64 fl oz
diflubenzuron		E	x	u	u	14d	4

(Continued)

Table 2-8. Insecticides for pear pest management at first and second cover[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	pear psylla NYMPH	plum curculio	pear rust mite	codling moth	REI[3] PHI[4]	Max amt[5] Max app[6]
Entrust SC (2SC)	5	x	x	x	6-10 fl oz	4h	29 fl oz
spinosad		x	x	x	F	7d	4
Envidor 2SC	23	x	x	16-18 fl oz	x	12h	18 fl oz
spirodiclofen		x	x	E	x	7d	1
Esteem 35WP	7C	5 oz	x	x	5 oz	12h	10 oz
pyriproxyfen		G	x	x	G	45d	2
Exirel (0.83SE)	28	13.5-20.5 fl oz	13.5-20.5 fl oz	x	8.5-17 fl oz	12h	61 fl oz
cyantraniliprole		s	G	x	E	3d	3
Grandevo	UN	2-3 lb	x	2-3 lb	1-3 lb	4h	NA
Chromobacterium subtsugae		u	x	u	F	0d	NA
Imidan 70W	1B	x	2.1-5.7 lb	x	2.1-5.7 lb	7d	16 lb
phosmet		x	G	x	G	7d	NA
Intrepid 2F	18	x	x	x	16 fl oz	4h	64 fl oz
methoxyfenozide		x	x	x	s	14d	NA
Magister SC (1.7SC)	21A	32-36 fl oz	x	32-36 fl oz	x	12h	36 fl oz
fenazaquin		G	x	G	x	7d	1
Mating disruption	UN	x	x	x	see apple	0h	NA
Isomate, Checkmate		x	x	x	G	0d	NA
Movento (2SC)	23	6-9 fl oz	x	6-9 fl oz	6-9 fl oz	24h	25 fl oz
spirotetramat		G	x	u	s	7d	NA
Mustang Maxx (0.8EC) **(RUP)**	3A	x	1.2-4 fl oz	x	1.2-4 fl oz	12h	24 fl oz
zeta-cypermethrin		x	F	x	G	14d	NA
Neemix 4.5 (0.39L)	UN	7-16 fl oz	x	x	4-16 fl oz	4h	NA
azadirachtin		F	x	x	F	0d	NA
Nexter SC (3.75SC)	21A	11-17 fl oz	x	11-17 fl oz	x	12h	NA
pyridaben		G	x	E	x	7d	1
Portal XLO (0.4EC)	21A	2 pt	x	2 pt	x	12h	2 pt
fenpyroximate		G	x	G	x	14d	1
Proaxis (0.5EC) **(RUP)**	3A	x	2.5-5.1 fl oz	x	2.5-5.1 fl oz	24h	25.6 fl oz
gamma-cyhalothrin		x	G	x	G	21d	NA
Proclaim (5SG) **(RUP)**	6	3.2-4.8 oz	x	x	4.8 oz	12 or 48h	14.4 oz
emamectin benzoate		s	x	x	F	14d	NA
Sevin XLR Plus (4F)	1A	1.5-3 qt	1.5-3 qt	1.5-3 qt	3 qt	12h	15 qt
carbaryl		u	F	G	F	3d	8
Sivanto Prime (1.67SC)	4D	10.5-14 fl oz	x	x	x	12h	28 fl oz
flupyradifurone		G	x	x	x	14d	NA
Soap (M-Pede, Des-X, etc.)	UN	2%	x	2%	x	12h	NA
potassium salts of fatty acids		F	x	u	x	0d	NA

(Continued)

Table 2-8. Insecticides for pear pest management at first and second cover[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	pear psylla NYMPH	plum curculio	pear rust mite	codling moth	REI[3] PHI[4]	Max amt[5] Max app[6]
Surround WP (95WP)	UN	50 lb	x	x	25-50 lb	4h	NA
kaolin		G	x	x	s	0d	NA
Transform WG (50WG)	4C	2.75 oz	x	x	x	24h	8.5 oz
sulfoxaflor		s	x	x	x	7d	4
Vendex 50WP **(RUP)**	12B	x	x	1-2 lb	x	48h	4 lb
fenbutatin-oxide		x	x	G	x	14d	2
Verdepryn 100SL (0.83SL)	28	11 fl oz	5.5-11 fl oz	x	5.5-11 fl oz	4h	33 fl oz
cyclaniliprole		u	G	x	E	7d	3
Virus (Cyd-X HP)	31	x	x	x	0.5-3 fl oz	4h	NA
Cydia pomonella granulovirus		x	x	x	G	0d	NA
Virus (Madex HP)	31	x	x	x	0.5-3 fl oz	4h	NA
Cydia pomonella granulovirus		x	x	x	G	0d	NA
Virus (Virosoft CP4)	31	x	x	x	1.6-3.2 fl oz	4h	NA
Cydia pomonella granulovirus		x	x	x	G	0d	NA
Warrior II (2.08CS) **(RUP)**	3A	x	1.2-2.5 fl oz	x	1.2-2.5 fl oz	24h	12.8 fl oz
lambda-cyhalothrin		x	G	x	G	21d	NA

Pear Summer Covers – Insects

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

Insect management notes

- **Pear psylla:** For cultural control, it is very important to prune water sprouts, which appear in early summer. This removal destroys the favorite habitat of pear psylla. Make two applications 10-12 days apart to target second-generation young nymphs, in early summer, usually in about mid-June. The first new summer adults appear about three weeks after full bloom. Adults are found on terminals and water sprouts. The adults are more difficult to control than young nymphs. The first new summer adults appear about three weeks after full bloom. Adults are found on terminals and water sprouts. Third generation nymphs can be controlled in mid-summer, around mid-July.
- **San Jose scale:** Sprays should target the crawler stage, which usually begins in early summer, around the time of second or third cover. A pheromone trap and a degree-day model can be used to predict the timing of crawler emergence.
- **Codling moth:** Fifth and sixth cover sprays target the new generation of young larvae as they emerge from eggs.
- **Stink bug:** The time that stink bugs arrive is variable, sometimes in the pre-bloom period, sometimes in early summer, sometimes not until late summer. Native stink bugs can be present pre-bloom or post-bloom. At locations where brown marmorated stink bug is present, it is most commonly controlled in third, fourth and fifth cover sprays.

Table 2-9. Insecticides for pear at summer cover[1]

Product and formulation Active ingredient	IRAC code[2]	European red mite	mealybug	pear psylla NYMPH	San Jose scale CRAWLERS	codling moth	stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	0.7-1 lb	x	x	x	x	x	12h	NA
bifenazate		G	x	x	x	x	x	7d	1
Actara (25WDG)	4A	x	4.5-5.5 oz	5.5 oz	x	x	x	12h	16.5 oz
thiamethoxam		x	G	E	x	x	x	35d	NA
Admire Pro (4.6F)	4A	x	7 fl oz	7 fl oz	2.8 fl oz	x	x	12h	14 fl oz
imidacloprid		x	G	G	F	x	x	7d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	2.2-4.2 fl oz	x	2.2-4.2 fl oz	x	x	x	12h	8.5 fl oz
abamectin		E	x	G	x	x	x	28d	2
Altacor (35WDG)	28	x	x	x	x	2.5-4.5 oz	x	4h	9 fl oz
chlorantraniliprole		x	x	x	x	E	x	5d	NA
Apollo SC (1SC)	10A	4-8 fl oz	x	x	x	x	x	12h	NA
clofentezine		E	x	x	x	x	x	21d	1
Apta (1.34SC)	21A	x	21-27 fl oz	21-27 fl oz	x	21-27 fl oz	x	12h	53.5 fl oz
tolfenpyrad		x	u	G	x	s	x	14d	2
Asana XL (0.66EC) (RUP)	3A	x	x	x	x	4.8-14.5 fl oz	x	12h	72 fl oz
esfenvalerate		x	x	x	x	G	x	28d	NA
Assail 30SG	4A	x	4-8 oz	4-8 oz	8 oz	4-8 oz	x	12h	32 oz
acetamiprid		x	G	G	s	E	x	7d	4
Avaunt eVo (30WDG)	22	x	x	x	x	5-6 oz	x	12h	24 oz
indoxacarb		x	x	x	x	G	x	28d	4

(Continued)

Table 2-9. Insecticides for pear at summer cover[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	European red mite	mealybug	pear psylla NYMPH	San Jose scale CRAWLERS	codling moth	stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Bacillus thuringiensis (B.t.) (Dipel DF, etc.)	11A	x	x	x	x	0.5-2 lb	x	4h	NA
Bacillus thuringiensis		x	x	x	x	F	x	0d	NA
Baythroid XL (1EC) **(RUP)**	3A	x	x	x	2.4-2.8 fl oz	2-2.4 fl oz	2-2.4 fl oz	12h	2.8 fl oz
beta-cyfluthrin		x	x	x	F	G	G	7d	NA
Belay (2.13SC)	4A	x	6 fl oz	6 fl oz	6 fl oz	6 fl oz	6 fl oz	12h	12 fl oz
clothianidin		x	G	G	G	s	E	7d	NA
Brigade 2EC **(RUP)**	3A	5.1-12.8 fl oz	x	x	2.6-12.8 fl oz	2.6-12.8 fl oz	2.6-12.8 fl oz	12h	32 fl oz
bifenthrin		F	x	x	F	G	E	14d	NA
Centaur WDG (70WDG)	16	x	34.5-46 oz	34.5-46 oz	34.5-46 oz	x	x	12h	69 oz
buprofezin		x	G	u	E	x	x	14d	2
Closer SC (2SC)	4C	x	x	5.7 fl oz	5.7 fl oz	x	x	12h	17 fl oz
sulfoxaflor		x	x	s	s	x	x	7d	4
Confirm 2F	18	x	x	x	x	20 fl oz	x	4h	120 fl oz
tebufenozide		x	x	x	x	F	x	14d	NA
Danitol 2.4EC **(RUP)**	3A	x	x	x	x	16-21.3 fl oz	16-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		x	x	x	x	G	G	14d	NA
Delegate WG (25WG)	5	x	x	6-7 oz	x	4.5-7 oz	x	4h	28 oz
spinetoram		x	x	E	x	E	x	7d	4
Delta Gold (1.5EC) **(RUP)**	3A	x	x	x	0.9-1.9 fl oz	0.9-1.9 fl oz	1.9 fl oz	12h	3.6 fl oz
deltamethrin		x	x	x	u	G	u	21d	NA
Diazinon AG 600WBC **(RUP)**	1B	12.7 fl oz/ 100 gal	12.7 fl oz/ 100 gal	x	12.7 fl oz/ 100 gal	12.7 fl oz/ 100 gal	x	4d	102 fl oz
diazinon		u	G	x	G	F	x	21d	2
Dimethoate (4EC)	1B	0.5-1 pt/100 gal	x	x	x	x	x	10d	2 pt
dimethoate		u	x	x	x	x	x	28d	NA
Dimilin 2L (2AF) **(RUP)**	15	x	x	12-48 fl oz	x	12-16 fl oz	x	12h	64 fl oz
diflubenzuron		x	x	E	x	u	x	14d	4
Entrust SC (2SC)	5	x	x	x	x	6-10 fl oz	x	4h	29 fl oz
spinosad		x	x	x	x	F	x	7d	4
Envidor 2SC	23	16-18 fl oz	x	x	x	x	x	12h	18 fl oz
spirodiclofen		E	x	x	x	x	x	7d	1
Esteem 35WP	7C	x	x	5 oz	4-5 oz	5 oz	x	12h	10 oz
pyriproxyfen		x	x	G	E	G	x	45d	2

(Continued)

Table 2-9. Insecticides for pear at summer cover[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	European red mite	mealybug	pear psylla NYMPH	San Jose scale CRAWLERS	codling moth	stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Exirel (0.83SE)	28	x	x	13.5-20.5 fl oz	x	8.5-17 fl oz	x	12h	61 fl oz
cyantraniliprole		x	x	s	x	E	x	3d	3
Grandevo	UN	2-3 lb	2-3 lb	2-3 lb	2-3 lb	1-3 lb	x	4h	NA
Chromobacterium subtsugae		u	u	u	u	F	x	0d	NA
Imidan 70W	1B	x	2.1-5.7 lb	x	x	2.1-5.7 lb	x	7d	16 lb
phosmet		x	F	x	x	G	x	7d	NA
Intrepid 2F	18	x	x	x	x	16 fl oz	x	4h	64 fl oz
methoxyfenozide		x	x	x	x	s	x	14d	NA
Kanemite 15SC	20B	21-31 fl oz	x	x	x	x	x	12h	62 fl oz
acequinocyl		E	x	x	x	x	x	14d	2
Magister SC (1.7SC)	21A	32-36 fl oz	x	32-36 fl oz	x	x	x	12h	36 fl oz
fenazaquin		G	x	G	x	x	x	7d	1
Mating disruption	UN	x	x	x	x	see apple	x	0h	NA
Isomate, Checkmate		x	x	x	x	G	x	0d	NA
Movento (2SC)	23	6-9 fl oz	6-9 fl oz	6-9 fl oz	6-9 fl oz	6-9 fl oz	x	24h	25 fl oz
spirotetramat		s	G	G	E	s	x	7d	NA
Mustang Maxx (0.8EC) **(RUP)**	3A	x	x	x	x	1.2-4 fl oz	1.2-4 fl oz	12h	24 fl oz
zeta-cypermethrin		x	x	x	x	G	G	14d	NA
Nealta (1.67SC)	25	13.7 fl oz	x	x	x	x	x	12h	27.4 fl oz
cyflumetofen		E	x	x	x	x	x	7d	2
Neemix 4.5 (0.39L)	UN	x	7-16 fl oz	7-16 fl oz	6-16 fl oz	4-16 fl oz	7-16 fl oz	4h	NA
azadirachtin		x	i	F	u	F	u	0d	NA
Nexter SC (3.75SC)	21A	11-17 fl oz	x	11-17 fl oz	x	x	x	12h	NA
pyridaben		E	x	G	x	x	x	7d	1
Oil (superior)	UN	see label	x	x	see label	x	x	4h	NA
mineral oil		G	x	x	G	x	x	0d	NA
Onager Optek (1EC)	10	12-24 fl oz	x	x	x	x	x	12h	24 fl oz
hexythiazox		E	x	x	x	x	x	28d	1
Portal XLO (0.4EC)	21A	2 pt	2 pt	2 pt	x	x	x	12h	2 pt
fenpyroximate		E	u	G	x	x	x	14d	1
Proaxis (0.5EC) **(RUP)**	3A	x	x	x	2.5-5.1 fl oz	2.5-5.1 fl oz	2.5-5.1 fl oz	24h	25.6 fl oz
gamma-cyhalothrin		x	x	x	G	G	F	21d	NA
Proclaim (5SG) **(RUP)**	6	3.2-4.8 oz	x	3.2-4.8 oz	x	4.8 oz	x	12 or 48h	14.4 oz
emamectin benzoate		s	x	s	x	F	x	14d	NA

(Continued)

Table 2-9. Insecticides for pear at summer cover[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	European red mite	mealybug	pear psylla NYMPH	San Jose scale CRAWLERS	codling moth	stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Sevin XLR Plus (4F)	1A	x	x	1.5-3 qt	1.5-3 qt	3 qt	x	12h	15 qt
carbaryl		x	x	u	F	F	x	3d	8
Sivanto Prime (1.67SC)	4D	x	x	10.5-14 fl oz	10.5-14 fl oz	x	x	12h	28 fl oz
flupyradifurone		x	x	G	G	x	x	14d	NA
Soap (M-Pede, Des-X, etc.)	UN	2%	2%	2%	2%	x	x	12h	NA
potassium salts of fatty acids		u	G	F	F	x	x	0d	NA
Sulfur (Microfine; 90%)	UN	10-60 lb	x	x	x	x	x	24h	NA
sulfur		u	x	x	x	x	x	0d	NA
Surround WP (95WP)	UN	x	x	50 lb	x	25-50 lb	25-50 lb	4h	NA
kaolin		x	x	G	x	s	s	0d	NA
Transform WG (50WG)	4C	x	x	2.75 oz	2.75 oz	x	x	24h	8.5 oz
sulfoxaflor		x	x	s	s	x	x	7d	4
Vendex 50WP **(RUP)**	12B	1-2 lb	x	x	x	x	x	48h	4 lb
fenbutatin-oxide		G	x	x	x	x	x	14d	2
Verdepryn 100SL (0.83SL)	28	x	x	11 fl oz	x	5.5-11 fl oz	5.5-11 fl oz	4h	33 fl oz
cyclaniliprole		x	x	u	x	E	s	7d	3
Virus (Cyd-X HP)	31	x	x	x	x	0.5-3 fl oz	x	4h	NA
Cydia pomonella granulovirus		x	x	x	x	G	x	0d	NA
Virus (Madex HP)	31	x	x	x	x	0.5-3 fl oz	x	4h	NA
Cydia pomonella granulovirus		x	x	x	x	G	x	0d	NA
Virus (Virosoft CP4)	31	x	x	x	x	1.6-3.2 fl oz	x	4h	NA
Cydia pomonella granulovirus		x	x	x	x	G	x	0d	NA
Vydate L (2L) **(RUP)**	1A	6-8 pt	x	x	x	x	1.5-4 pt	48h	8 pt
oxamyl		G	x	x	x	x	G	14d	1
Warrior II (2.08CS) **(RUP)**	3A	x	x	x	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		x	x	x	F	G	G	21d	NA
Zeal (72WP)	10B	2-3 oz	x	x	x	x	x	12h	3 oz
etoxazole		E	x	x	x	x	x	14d	1

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] Max app[6]
Aprovia (EC) benzovindiflupyr	7	s	E-G	x	G-E	F	12h 30d	27.6 fl oz NA
Captan 4L captan	M3	G	G	x	G	x	24h 0d	32 qt NA
Cevya (formulation) mefentrifluconazole	3	x	G	x	G	x	12h 0d	NA NA
Ferbam Granulfo ferbam	M	G	F	x	F	x	24h Not listed	10.5 lb 3
FireLine 17WP oxytetracycline	41	x	x	x	x	x	12h 60d	9 lb 6
Fixed copper pesticides basic copper sulfate	M	x	x	F[r]	x	x	48h see label	30 lb NA
Flint Extra trifloxystrobin	11	x	F-G	x	G	G	12h 14d	10.5 fl oz NA
Fontelis (SC) penthiopyrad	7	G	G-E	x	x	G	12h 28d	61 fl oz NA
Inspire Super (EW) difenoconazole + cyprodinil	3+9	x	G-E	x	E	G	12h 28d	60 fl oz NA
Kasumin 2L kasugamycin hydrochloride	24	x	x	G	x	x	12h 90d	256 fl oz 4
Luna Sensation (SC) fluopyram + trifloxystrobin	7+11	G	G-E	x	E-F	E[r]	12h 14d	21 fl oz 4
Luna Tranquility (SC) fluopyram + pyrimethanil	7+9	s	G-E	x	x	G	12h 72d	54.7 fl oz NA
Mancozeb 75DF mancozeb	M3	G	G	x	x	x	24h 77d	21 lb NA
Merivon (2.09SC) fluxapyroxad + pyraclostrobin	7+11	G	G-E	x	E	E	12h 0d	22 fl oz 4
Mycoshield 17WP oxytetracycline	41	x	x	F-G	x	x	12h 60d	NA 6
Pristine pyaclostrobin + boscalid	7+11	F	G-E[r]	x	E	G-F	12h 0d	74 oz 4
Procure 480SC triflumizole	3	x	G[r]	x	x	E[r]	12h 14d	64 fl oz NA
Scala SC pyrimethanil	9	x	G	x	x	x	12h 7d	40 fl oz NA
Sovran (50WG) kresoxim-methyl	11	x	G[r]	x	G-E	G	12h 30d	25.6 oz 4
Streptomycin 17W streptomycin sulfate	25	x	x	E-G[r]	x	x	12h 30d	NA 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] Max app[6]
Sulfur, Microthiol Disperss	M	x	x	x	x	G	24h	NA
sulfur							0d	NA
Syllit	U12	x	F-G	x	x	x	48h	9 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.

[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 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
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

(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]**
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
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
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

(Continued)

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]
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
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

(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]**
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.

[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.

3. CHERRY

Cherry Spray Schedule

Entomology Section Editor: D. Lewis, C. Guedot
Pathology Section Editor: J. Beckerman

How to read the spray schedule tables

Every cherry 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.

Cherry Dormant – Diseases

Before buds break in the spring.

Notes on disease management

- **Bacterial canker:** Bacterial canker is generally more serious on sweet than tart cherry. Dormant copper sprays are an effective method for control of bacterial canker. All stone fruit, including cherry, are extremely sensitive to copper. Sprays must be timed to reduce *P. syringae* inoculum without causing phytotoxicity. Tart cherries may require continued protection through bloom.
- Application of copper for bacterial canker at this time may reduce the overwintering inoculum of the cherry leaf spot pathogen.
- Make first application before fall rains and a second at late dormant.
- **Phytophthora:** See Phytophthora Disease Management of Stone Fruit on page 153.

Table 3-1. Products registered for disease management at dormant[1]

Product and formulation Active ingredient	FRAC code[2]	bacterial canker	cherry leaf spot DORMANT	REI[3] PHI[4]	Max amt[5] Max app[6]
Badge SC	M	3.5-14 pt	3.5-14 pt	24h	63.4 pt
copper sulfate + oxychloride		G-P	F	0d	NA
C-O-C-S WDG	M	x	8-15 lb	48h	35 lb
copper oxychloride		x	F	21d	3
Cuprofix Ultra 40 Disperss	M	5-8 lb	5-8 lb	48h	45 lb
copper sulfate		G-P*	G-P	120d	NA
Kocide 3000	M	x	2.2-3.5 lb	48h	60 lb
copper hydroxide		x	G	0d	4

Cherry Late Dormant through Pre-bloom – Insects

Notes on insect management

- **European red mite:** If European red mites have been a problem in the past, apply superior oil or Envidor 2SC during the dormant stage to control mite eggs. Other miticides will be more effective if delayed until eggs are hatching (petal-fall). Oil applied by late dormant will also control aphid eggs. When spraying oil, check labels for temperature restrictions (e.g., only when temperatures are above 40F° or never during freezing weather).
- **San Jose scale:** Generally controlled dormant to delayed dormant where they have been a problem. Do not use Imidan 70W on sweet cherries.

Table 3-2. Insecticides for cherry management from dormant to pre-bloom[1]

Product and formulation Active ingredient	IRAC code[2]	aphid	European red mite	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	x	1 lb	x	12h	1 lb
bifenazate		x	G	x	3d	1
Actara (25WDG)	4A	3-4 oz	x	x	12h	11 oz
thiamethoxam		E	x	x	14d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	2.25-4.25 fl oz	x	12h	8.5 fl oz
abamectin		x	G	x	21d	2
Apta (1.34SC)	21A	17-21 fl oz	x	x	12h	53.5 fl oz
tolfenpyrad		u	x	x	14d	2
Apollo SC (1SC)	10A	x	2-8 fl oz	x	12h	NA
clofentezine		x	E	x	21d	1
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	x	x	12h	72.5 fl oz
esfenvalerate		u	x	x	14d	NA
Assail 30SG	4A	2.5-5.3 oz	x	5.3-8 oz	12h	32 oz
acetamiprid		E	x	F	7d	4
Baythroid XL (1EC) **(RUP)**	3A	2.4-2.8 fl oz	x	x	12h	5.6 fl oz
beta-cyfluthrin		E	x	x	7d	NA
Beleaf 50SG	29	2-2.8 oz	x	x	12h	8.4 fl oz
flonicamid		E	x	x	14d	3
Centaur WDG (70WDG)	16	x	x	34.5 oz	12h	69 oz
buprofezin		x	x	E	14d	2
Closer SC (2SC)	4C	1.5-2.75 fl oz	x	5.74 fl oz	12h	17 fl oz
sulfoxaflor		E	x	s	7d	4
Danitol 2.4EC **(RUP)**	3A	10.3-21.3 fl oz	10.3-21.3 fl oz	x	24h	42.7 fl oz
fenpropathrin		u	F	x	3d	NA
Diazinon AG600 WBC **(RUP)**	1B	12.75 fl oz/100 gal	6.5-12.25 fl oz/100 gal	x	4d	102 fl oz
diazinon		u	u	x	21d	2
Envidor 2SC	23	x	16-18 fl oz	x	12h	18 fl oz
spirodiclofen		x	E	x	7d	1
Esteem 35WP	7C	x	x	4-5 oz	12h	15 oz
pyriproxyfen		x	x	E	14d	3
Exirel (0.83SE)	28	13.5-20.5 fl oz	x	x	12h	61.5 fl oz
cyantraniliprole		E	x	x	3d	3

(Continued)

Table 3-2. Insecticides for cherry management from dormant to pre-bloom[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	aphid	European red mite	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Imidan 70W	1B	x	x	2.13-4.25 lb	7d	13 lb
phosmet		x	x	E	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	1.28-4 fl oz	x	x	12h	24 fl oz
zeta-cypermethrin		u	x	x	14d	NA
Nexter (75WP)	21	x	4.4-10.7 oz	x	12h	21.3 oz
pyridaben		x	G	x	7d	2
Oil (superior)	UN	x	see label	see label	4h	NA
mineral oil		x	E	G	0d	NA
Onager Optek (1EC)	10A	x	12-24 oz	x	12h	24 fl oz
hexythiazox		x	E	x	7d	1
Portal XLO (0.4EC)	21A	x	2 pt	x	12h	4 pt
fenpyroximate		x	E	x	7d	2
PQZ (1.87SC)	9B	2.4-3.2 fl oz	x	x	12h	4.8 fl oz
pyrifluquinazon		E	x	x	7h	2
Proaxis (0.5EC) **(RUP)**	3A	2.56-5.12 fl oz	x	x	24h	1.6 pt
gamma-cyhalothrin		u	x	x	14d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	12h	NA
pyrethrins		u	u	u	0d	10
Savey 50DF	10A	x	3-6 oz	x	12h	6 oz
hexythiazox		x	E	x	28d	1
Sevin XLR Plus (4F)	1A	2-3 qt	x	4-5 qt	12h	14 qt
carbaryl		u	x	u	3d	3
Sivanto Prime (1.67SC)	4D	7-14 fl oz	x	10.5-14 fl oz	4h	28 fl oz
flupyradifurone		E	x	G	14d	NA
Vendex 50WP **(RUP)**	12B	x	1-2 lb	x	2d	3 lb
fenbutatin-oxide		x	G	x	14d	2
Versys Inscalis (0.83DC)	9D	1.5 fl oz	x	x	12h	3 fl oz
afidopyropen		G	x	x	7d	NA
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 fl oz	x	x	24h	12.8 fl oz
lambda-cyhalothrin		u	x	x	14d	NA
Zeal (72WP)	10B	x	2-3 oz	x	12h	3 oz
etoxazole		x	E	x	7d	1

Cherry Early Bloom through Petal Fall and Shuck Split – Diseases

Early bloom is also referred to as popcorn or white bud, followed by bloom. Petal fall describes when flower petals are dropping. Shuck split describes when the shucks fall from expanding fruit.

Disease management notes

The two major diseases of concern are brown rot and leaf spot. Many fungicides are labeled for disease management at this time.

- Rovral is recommended early, as use after petal fall is prohibited.
- Vanguard is only labeled for tart cherries. Make the second and final application at full bloom.
- Bravo may not be used after shuck split.

Brown rot: Infection is rare at early bloom but may occur if brown rot cankers and mummies are present coupled with warm (above 60°F), wet weather. It continues to be a risk throughout bloom, and whenever weather is warm and wet.

Cherry leaf spot

- Cherry leaf spot management begins at early bloom for tart cherries; for sweet cherries, it begins at petal fall.
- Syllit F is labeled for use west of the Mississippi River.

Bacterial canker: For sour cherries only: Badge SC one to two times after petal fall, using lower to moderate rates. Do not apply to sweet cherry or the English Morello variety as severe injury may result.

Table 3-3. Fungicides for disease management from early to full bloom through shuck split[1]

Product and formulation Active ingredient	FRAC code[2]	brown rot	cherry leaf spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	12-15.5 fl oz	12-15 fl oz	4h	90 fl oz
azoxystrobin		G[r]	G[r]	0d	5
Badge SC	M	3.5-5 pt	1.5-5 pt	24h	63.4 pt
copper sulfate + oxychloride		F	G-F	0d	NA
Bravo Weather Stik	M5	3-4 pt	3-4 pt	12h	20.5 pt
chlorothalonil		F-G	E	thru SS	NA
C-O-C-S WDG	M	1-2.9 lb	1-2.9 lb	48h	35 lb
copper oxychloride		F	F	21d	3
Cabrio EG (20EG)	11	9.5 oz	9.5 oz	12h	47.5 oz
pyraclostrobin		F-E	G[r]	0d	5
Captan 80WDG	M	2.5 lb	2.5 lb	24h	17.5 lb
captan		G	F-G	0d	NA
Cevya	3	3-5 fl oz	3-5 fl oz	12h	NA
mefentrifluconazole		E	E	0d	see label
Elevate 50WDG	17	1-1.5 lb	x	12h	6 lb
fenhexamid		G-E	x	0d	NA
Elite 45DF	3	4-8 fl oz	4-8 oz	12h	3 lb
tebuconazole		E [r]	E-G[r]	0d	NA
Flint Extra	11	2.5-3.8 fl oz	2.5-3.8 fl oz	12h	15.2 fl oz
trifloxystrobin		E	E	1d	4
Fontelis (SC)	7	14-20 fl oz	14-20 fl oz	12h	61 fl oz
penthiopyrad		E	F-G	0d	NA
Indar 2F	3	6 fl oz	6 fl oz	12h	48 fl oz
fenbuconazole		E[r]	E[r]	0d	8
Inspire Super (EW)	3+9	16-20 fl oz	x	12h	80 fl oz
difenoconazole + cyprodinil		E	x	2d	4

(Continued)

Table 3-3. Fungicides for disease management from early to full bloom through shuck split[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	brown rot	cherry leaf spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Kenja 400SC	7	12.5 fl oz	x	12	37.5 fl oz
isofetamid		E	x	1d	3
Luna Experience (SC)	7+3	6-10 fl oz	6-10 fl oz	12h	34 fl oz
fluopyram + tebuconazol		G-E	x	0d	NA
Luna Privilege	7	4-6.8 fl oz	6.8 fl oz	12h	13.7 fl oz
fluopyram		E-G	s	0d	NA
Luna Sensation (SC)	7+11	5-5.6 fl oz	5-6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		E	E-G	1d	4
Merivon	7+11	4-6.7 fl oz	4-6.7 fl oz	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		E	E-G	0d	3
Pristine	7+11	10.5-14.5 oz	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		G	E	0d	5
Procure 480SC	3	10-16 fl oz	10-16 fl oz	12h	56 fl oz
triflumizole		G[r]	G[r]	1d	4
Quadris Top	11+3	12-14 fl oz	x	12h	56 fl oz
azoxystrobin + difenoconazole		E	x	0d	NA
Quash	3	2.5-4 oz	4 oz	12h	10.5-12 oz
metconazole		G[r]	G[r]	14d	3
Quilt Xcel	11+3	14 fl oz	14 fl oz	12h	70 fl oz
azoxystrobin + propiconazole		E	G	0d	5
Rally 40WSP	3	2.5-6 oz	2.5-6 oz	24h	3.2 lb
myclobutanil		E	E[r]	0d	NA
Rovral 4F	2	1-2 pt	x	24h	4 pt
iprodione		E	x	60d	2
Sulfur, Microthiol Disperss	M2	18 lb	x	24h	NA
sulfur		F	x	NA	NA
Syllit F	U12	3 pt	1.5-3 pt	48h	12 pt
dodine		s	G	7d	6
Tilt (EC)	3	4 fl oz	4 fl oz	12h	20 fl oz
propiconazole		G	G[r]	0d	5
Topguard EQ	3+11	6-8 oz	x	6-8 oz	12h
flutriafol + azoxystrobin		G	x	E	7d
Topguard Specialty Crop	3	14 fl oz	14 fl oz	12h	56 fl oz
flutriafol		E	G	7d	4
Topsin M WSB	1	1-1.5 lb	1.5 lb	48h	4 lb
thiophanate-methyl		G	F-G	1d	NA
Vangard WG (75WG)	9	5 oz	x	12h	30 oz
cyprodinil		G	x	2d	4
Ziram 76DF	M3	5-6 lb	5-6 lb	48hr	24.2 lb
ziram		F-i	F-i	14d	4

Cherry Full Bloom – Insects

Insect management notes

- ***Save the bees! Do not apply insecticides during bloom.***

Cherry Petal Fall through Shuck Split – Insects

When petals are shed from blooms through shucks split, with shucks falling from expanding fruit.

Insect management notes

- **Plum curculio:** Do not use Imidan 70W on sweet cherries.
- **European red mites:** Agri-Mek SC, Apollo SC, or Zeal miticides may be applied to suppress developing populations of European red mites.

Table 3-4. Insecticides for use at petal fall through shuck split[1]

Product and formulation Active ingredient	IRAC code[2]	European red mite	leafroller	plum curculio	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20	0.75-1 lb	x	x	12h	NA
bifenazate		E	x	x	3d	1
Actara (25WDG)	4A	x	x	4.5-5.5 oz	12h	11 oz
thiamethoxam		x	x	G	14d	NA
Admire Pro (4.6F)	4A	x	x	2.8 fl oz	12h	10.5/14 fl oz
imidacloprid		x	x	s	7/21d	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	21d	2
Apollo SC (1SC)	10A	2-8 fl oz	x	x	12h	NA
clofentezine		E	x	x	21d	1
Apta (1.34SC)	21A	x	21-27 fl oz	21-27 fl oz	12h	53.5 fl oz
tolfenpyrad		x	G	G	14d	2
Asana XL (0.66EC) **(RUP)**	3A	x	x	4.8-14.5 fl oz	12h	72.5 fl oz
esfenvalerate		x	x	G	14d	NA
Assail 30SG	4A	x	x	5.3-8 oz	12h	32 oz
acetamiprid		x	x	G	7d	4
Avaunt eVo (30WDG)	22	x	x	5-6 oz	12h	24 oz
indoxacarb		x	x	E	14d	4
Baythroid XL (1EC) **(RUP)**	3A	x	4.8-14.5 fl oz	2.4-2.8 fl oz	12h	5.6 fl oz
beta-cyfluthrin		x	E	G	7d	NA
Danitol 2.4EC **(RUP)**	3A	x	10.6-21.3 fl oz	10.6-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		x	G	G	3d	NA
Delegate WG (25WG)	5	x	4.5-7 oz	6-7 oz	4h	28 oz
spinetoram		x	E	s	7d	4
Envidor 2SC	23	16-18 fl oz	x	x	12h	18 fl oz
spirodiclofen		E	x	x	7d	1
Exirel (0.83SE)	28	x	10-20.5 fl oz	13.5-20.5 fl oz	12h	61.5 fl oz
cyantraniliprole		x	E	G	3d	3
Imidan 70W	1B	x	2.12-4.25 lb	2.12 lb	72h	7.5 lb
phosmet		x	E	G	7d	NA

(Continued)

Table 3-4. Insecticides for use at petal fall through shuck split[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	European red mite	leafroller	plum curculio	REI[3] PHI[4]	Max amt[5] Max app[6]
Magister SC (1.7SC)	21A	32-36 fl oz	x	x	12h	36 fl oz
fenazaquin		u	x	x	3d	1
Movento (2SC)	23	6-9 fl oz	x	x	24h	15.3 fl oz
spirotetramat		s	x	x	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	x	1.2-4 fl oz	1.2-4 fl oz	12h	24 fl oz
zeta-cypermethrin		x	E	G	14d	NA
Nexter (75WP)	21	4.4-10.6 oz	x	x	12h	21.3 oz
pyridaben		u	x	x	300d	2
Nexter SC (3.75SC)	21A	7.5-17 fl oz	x	x	12h	NA
pyridaben		u	x	x	300d	2
Oil (superior)	UN	see label	see label	x	4h	UN
mineral oil		u	u	x	dormant	NA
Onager Optek (1EC)	10	12-24 fl oz	x	x	12h	24 fl oz
hexythiazox		u	x	x	7d	1
Portal XLO (0.4EC)	21A	2 pts.	x	x	12h	4 pt
fenpyroximate		u	x	x	7d	2
Pounce 25WP	3A	x	x	6.4-12.8 oz	12h	38.4 oz
permethrin		x	x	G	3d	3
Proaxis (0.5EC) **(RUP)**	3A	x	x	2.5-5.1 fl oz	24h	25.6 fl oz
gamma-cyhalothrin		x	x	G	14d	NA
Savey 50DF	10A	3-6 oz	x	x	12h	6 oz
hexythiazox		E	x	x	28d	1
Sevin XLR Plus (4F)	1A	x	2-3 qt	2-3 qt	12h	14 qt
carbaryl		x	F	F	3d	NA
Surround WP (95WP)	UN	x	25-50 lb	25-50 lb	4h	NA
kaolin		x	u	s	0d	NA
Vendex 50WP **(RUP)**	12B	1.5-3 lb	x	x	48h	4.5 lb
fenbutatin-oxide		G	x	x	14d	2
Verdepryn 100SL	28	x	5.5-11 fl oz	8.2-11 fl oz	4h	33 fl oz
cyclaniliprole		x	E	u	7d	3
Warrior II (2.08CS) **(RUP)**	3A	x	1.2-2.5 fl oz	1.2-2.5 fl oz	24h	12.8 fl oz
lambda-cyhalothrin		x	u	G	14d	NA
Zeal (72WP)	10B	2-3 oz	x	x	12h	3 oz
etoxazole		E	x	x	7d	1

Cherry Shuck Split to First Cover – Insects

Insect management notes

- Do not use Imidan 70W on sweet cherries.

Table 3-5. Insecticides labeled for shuck split to first cover[1]

Product and formulation Active ingredient	IRAC code[2]	cherry fruit fly	Japanese beetle	plum curculio	REI[3] PHI[4]	Max amt[5] Max app[6]
Admire Pro (4.6F)	4A	2-2.8 fl oz	1.4-2.8 fl oz	2.8 fl oz	12h	10.5/14 fl oz
imidacloprid		G	F	s	7/21d	NA
Apta (1.34SC)	21A	14-27 fl oz	x	21-27 fl oz	12h	53.5 fl oz
tolfenpyrad		u	x	G	14d	2
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	x	4.8-14.5 fl oz	12h	72.5 fl oz
esfenvalerate		G	x	G	14d	NA
Assail 30SG	4A	5.3-8 oz	5.3-8 oz	5.3-8 oz	12h	32 oz
acetamiprid		G	G	G	7d	4
Avaunt eVo (30WDG)	22	x	x	5-6 oz	12h	24 oz
indoxacarb		x	x	E	14d	4
Baythroid XL (1EC) **(RUP)**	3A	2.4-2.8 fl oz	x	2.4-2.8 fl oz	12h	5.6 fl oz
beta-cyfluthrin		G	x	G	7d	NA
Danitol 2.4EC **(RUP)**	3A	16-21.3 fl oz	10.7-21.3 fl oz	10.7-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		x	E	G	3d	NA
Delegate WG (25WG)	5	6-7 oz	x	6-7 oz	4h	28 oz
spinetoram		s	x	s	7d	4
Exirel (0.83SE)	28	10-17 fl oz	13.5-20.5 fl oz	13.5-20.5 fl oz	12h	61.5 fl oz
cyantraniliprole		E	G	G	3d	3
Imidan 70W	1B	2.1 lb	2.1 lb	2.1 lb	72h	7.5 lb
phosmet		E	G	G	7d	NA
Malathion 5EC	1B	2.8 pt	2.8 pt	x	12h	NA
malathion		G	G	x	3d	4
Mustang Maxx (0.83EC) **(RUP)**	3A	1.28-4 fl oz	x	1.28-4 fl oz	12h	24 fl oz
zeta-cypermethrin		F	x	G	14d	NA
Pounce 25WP	3A	x	x	6.4-12.8 oz	12h	38.4 oz
permethrin		x	x	G	3d	3
Proaxis (0.5EC) **(RUP)**	3A	2.5-5.1 fl oz	2.5-5.1 fl oz	2.5-5.1 fl oz	24h	25.6 fl oz
gamma-cyhalothrin		G	u	G	14d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	4.5-15.6 fl oz	x	12h	NA
pyrethrins		i	F	x	0d	10
Sevin XLR Plus (4F)	1A	2-3 qt	2-3 qt	2-3 qt	12h	14 qt
carbaryl		G	E	F	3d	NA
Surround WP (95WP)	UN	25-50 lb	25-50 lb	25-50 lb	4h	NA
kaolin		s	F	s	0d	NA
Verdepryn 100SL	28	8.2-11 fl oz	5.5-11 fl oz	8.2-11 fl oz	4h	33 fl oz
cyclaniliprole		G	u	u	7d	3
Warrior II (2.08CS) **(RUP)**	3A	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		G	E	G	14d	NA

Cherry Summer Cover through Harvest Sprays – Diseases

Applications begin 10-14 days after shuck split as needed through harvest.

Notes on disease management

- **Leaf spot:** Syllit is labeled for use west of the Mississippi River.

Table 3-6. Fungicides for summer cover disease management[1]

Product and formulation Active ingredient	FRAC code[2]	brown rot	cherry leaf spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	12-15.5 fl oz	12-15 fl oz	4h	90 fl oz
azoxystrobin		G[r]	G[r]	0d	5
Badge SC	M	3.5-5 pt	1.5-5 pt	24h	63.4 pt
copper sulfate + oxychloride		F	G-F	0d	NA
C-O-C-S WDG	M	1-2.9 lb	1-2.9 lb	48h	35 lb
copper oxychloride		F	F	21d	3
Cabrio EG (20EG)	11	9.5 oz	9.5 oz	12h	47.5 oz
pyraclostrobin		F-E	G[r]	0d	5
Captan 80WDG	M	2.5 lb	2.5 lb	24h	17.5 lb
captan		G	F-G	0d	NA
CaptEvate 68WDG	M+17	3.7 lb	3.75 lb	24h	18.7 lb
captan + fenhexamid		E	G	0d	NA
Cevya	3	3-5 fl oz	3-5 fl oz	12h	NA
mefentrifluconazole		E	E	0d	see label
Elevate 50WDG	17	1-1.5 lb	x	12h	6 lb
fenhexamid		G-E	x	0d	NA
Elite 45DF	3	4-8 fl oz	4-8 oz	12h	3 lb
tebuconazole		E [r]	E-G[r]	0d	NA
Flint Extra	11	2.5-3.8 fl oz	2.5-3.8 fl oz	12h	15.2 oz
trifloxystrobin		E	E	1d	4
Fontelis (SC)	7	14-20 fl oz	14-20 fl oz	12h	61 fl oz
penthiopyrad		E	F-G	0d	NA
Indar 2F	3	6 fl oz	6 fl oz	12h	48 fl oz
fenbuconazole		E[r]	E[r]	0d	8
Inspire Super (EW)	3+9	16-20 fl oz	x	12h	80 fl oz
difenoconazole + cyprodinil		E	x	2d	4
Kenja 400SC	7	12.5 fl oz	x	12	37.5 fl oz
isofetamid		E	x	1d	3
Luna Experience (SC)	7+3	6-10 fl oz	6-10 fl oz	12h	34 fl oz
fluopyram + tebuconazol		G-E	x	0d	NA
Luna Privilege	7	4-6.8 fl oz	6.8 fl oz	12h	13.7 fl oz
fluopyram		E-G	s	0d	NA

(Continued)

Table 3-6. Fungicides for summer cover disease management[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	brown rot	cherry leaf spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Luna Sensation (SC)	7+11	5-5.6 fl oz	5-6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		E	E-G	1d	4
Merivon XBF	7+11	4-6.7 fl oz	4-6.7 fl oz	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		E	E-G	0d	3
Pristine	7+11	10.5-14.5 oz	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		G	E	0d	5
Procure 480SC	3	10-16 fl oz	10-16 fl oz	12h	56 fl oz
triflumizole		G[r]	G[r]	1d	4
Quadris Top	11+3	12-14 fl oz	x	12h	56 fl oz
azoxystrobin + difenoconazole		E	x	0d	NA
Quash	3	2.5-4 oz	4 oz	12h	10.5-12 oz
metconazole		G[r]	G[r]	14d	3
Quilt Xcel	11+3	14 fl oz	x	12h	70 fl oz
azoxystrobin + propiconazole		E	G	0d	5
Rally 40WSP	3	2.5-6 oz	2.5-6 oz	24h	3.2 lb
myclobutanil		E	E[r]	0d	NA
Sulfur, Microthiol Disperss	M2	18 lb	x	24h	NA
sulfur		F	x	NA	NA
Syllit F	U12	3 pt	1.5-3 pt	48h	12 pt
dodine		s	G	7d	6
Tilt (EC)	3	4 fl oz	4 fl oz	12h	20 fl oz
propiconazole		G	G[r]	0d	5
Topguard EQ	3+11	6-8 oz	x	6-8 oz	12h
flutriafol + azoxystrobin		G	x	E	7d
Topguard Specialty Crop	3	14 fl oz	14 fl oz	12h	56 fl oz
flutriafol		E	G	7d	4
Topsin M WSB	1	1-1.5 lb	1.5 lb	48h	4 lb
thiophanate-methyl		G	F-G	1d	NA
Vangard WG (75WG)	9	5 oz	x	12h	30 oz
cyprodinil		G	x	2d	4
Ziram 76DF	M3	5-6 lb	x	48hr	24.2 lb
ziram		F	x	14d	4

Additional Summer Cover Sprays to Harvest – Insects

Insect management notes

- Imidan 70W: Do not use on sweet cherries.
- **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 152.
- **Spotted-wing Drosophila:** Can begin to attack fruit when they change color and soften before harvest.

Table 3-7. Additional summer cover sprays for insect management[1]

Product and formulation Active ingredient	IRAC code[2]	cherry fruit fly	Japanese beetle	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	4.5-5.5 oz	x	x	12h	11 oz
thiamethoxam		G	x	x	14d	NA
Admire Pro (4.6F)	4A	2-2.8 fl oz	1.4-2.8 fl oz	x	12h	10.5/14 fl oz
imidacloprid		G	F	x	7/21d	NA
Altacor (35WDG)	28	3-4.5 oz	x	x	4h	9 oz
chlorantraniliprole		G	x	x	10d	NA
Apta (1.34SC)	21A	14-27 fl oz	x	14-27 fl oz	12h	53.5 fl oz
tolfenpyrad		u	x	s	14d	2
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	x	see label	12h	72.5 fl oz
esfenvalerate		G	x	x	14d	NA
Assail 30SG	4A	5.3-8 oz	5.3-8 oz	x	12h	32 oz
acetamiprid		G	G	x	7d	4
Baythroid XL (1EC) **(RUP)**	3A	2.4-2.8 fl oz	x	see label	12h	5.6 fl oz
beta-cyfluthrin		G	x	G	7d	NA
Danitol 2.4EC (RUP)	3A	16-21.3 fl oz	10.6-21.3 fl oz	10.6-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		x	E	E	3d	NA
Delegate WG (25WG)	5	6-7 fl oz	x	4.5-7 oz	4h	28 oz
spinetoram		s	x	G	7d	4
Diazinon AG 600WBC **(RUP)**	1B	6.5-12.7 fl oz/ 100 gal	x	x	72h	102 fl oz
diazinon		G	x	x	21d	2
Entrust SC (2SC)	5	4-8 fl oz	x	4-8 fl oz	4h	29 fl oz
spinosad		F	x	G-E	7d	3
Exirel (0.83SE)	28	10-17 fl oz	13.5-20.5 fl oz	13.5-20.5 fl oz	12h	61.5 fl oz
cyantraniliprole		E	G	E	3d	3
Imidan 70W	1B	2.12 lb	2.12 lb	2.1 lb	72h	7.5 lb
phosmet		E	G	E	7d	NA
Malathion 5EC	1B	2.8 pt	2.8 pt	see label	12h	NA
malathion		G	G	G	3d	4
Movento (2SC)	23	6-9 fl oz	x	6-9 fl oz	24h	15.3 fl oz
spirotetramat		u	x	G	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	1.28-4 fl oz	x	4 fl oz	12h	24 fl oz
zeta-cypermethrin		F	x	E	14d	NA

(Continued)

Table 3-7. Additional summer cover sprays for insect management[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	cherry fruit fly	Japanese beetle	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Pounce 25WP	3A	x	x	see label	12h	38.4 oz
permethrin		x	x	u	3d	3
Proaxis (0.5EC) **(RUP)**	3A	2.5-5.1 fl oz	2.5-5.1 fl oz	x	24h	25.6 fl oz
gamma-cyhalothrin		G	u	x	14d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	12h	NA
pyrethrins		i	F	F	0d	10
Rimon 0.83EC	15	20-40 fl oz	x	20-40 fl oz	12h	150 fl oz
novaluron		u	x	G	8d	NA
Sevin XLR Plus (4F)	1A	2-3 qt	2-3 qt	x	12h	14 qt
carbaryl		G	E	x	3d	NA
Surround WP (95WP)	UN	25-50 lb	25-50 lb	x	4h	NA
kaolin		s	F	x	0d	NA
Verdepryn 100SL	28	8.2-11 fl oz	5.5-11 fl oz	5.5-11 fl oz	4h	33 fl oz
cyclaniliprole		G	u	u	7d	3
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 fl oz	1.2-2.5 fl oz	see label	24h	12.8 fl oz
lambda-cyhalothrin		G	E	E	14d	NA

Cherry Post-harvest – Disease

Disease management notes

- The goal is to keep trees from defoliating without driving fungicide resistance. Rely on Bravo, coppers and sulfur for disease management at this time.

Table 3-8. Post-harvest fungicides[1]

Product and formulation Active ingredient	FRAC code[2]	cherry leaf spot	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Badge SC	M	1.5-5 pt	x	24h	63.4 pt
copper sulfate + oxychloride		G-F	x	0d	NA
Bravo Weather Stik	M5	3-4 pt	x	12h	20.5 pt
chlorothalonil		E	x	through shuck split	NA
C-O-C-S WDG	M	1-2.9 lb	x	48h	35 lb
copper oxychloride		F	x	21d	3
Captan 80WDG	M	2.5 lb	x	24h	17.5 lb
captan		F-G	x	0d	NA
Cuprofix Ultra 40 Disperss	M	3.75 lb	x	48h	45 lb
copper sulfate		G-P	x	120d	NA
Sulfur, Microthiol Disperss	M2	x	10-30 lb	24h	NA
sulfur		x	G	NA	NA

(Continued)

Table 3-8. Post-harvest fungicides[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	cherry leaf spot	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Syllit F	U12	1.5-3 pt	x	48h	12 pt
dodine		G	x	7d	6
Ziram 76DF	M3	x	x	48hr	24.2 lb
ziram		F-i	x	14d	4

Cherry Post-harvest – Insects (see Summer Covers)

Insect management notes

Japanese beetle

- Damage by adult beetles feeding on leaves is sporadic and transient in July to August in most of the region.
- Leaves are skeletonized and may turn brown and fall. Defoliation is not fatal but may be stressful.

Special Comments on Cherry Schedule

Edited by J. Strang, E. Long

Spotted lanternfly

The spotted lanternfly is an invasive planthopper that has spread 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 two or three 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.

Fungicides for Phytophthora root rot management

See page 153 for Phytophthora Management on Bearing and Non-bearing Stone Fruit.

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-O-C-S WDG	M	E	F	F	x	48h	36 lb
copper oxychloride						21d	3

(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]
Cuprofix Ultra 40 Disperss	M	E	F	F	P	48h		45 lb
basic copper sulfate							120d	NA
Elevate 50WDG	17	x	G-E	x	x	12h		6 lb
fenhexamid							0d	NA
Elite 45DF	3	x	E [r]	E-G[r]	G[r]	12h		3 lb
tebuconazole							0d	NA
Flint Extra	11	x	E	E	E	12h		15.2 oz
trifloxystrobin (higher rate)							1d	4
Fontelis (SC)	7	x	E	F-G	G	12h		61 fl oz
penthiopyrad							0d	NA
Gatten	U13	x	x	x	E	12		32 fl oz
flutianil							3 d	4
Indar 2F	3	x	E[r]	E[r]	G[r]	12h		48 fl oz
fenbuconazole							0d	8
Inspire Super (EW)	3+9	x	E	x	E	12h		80 fl oz
difenoconazole + cyprodinil							2d	4
Kenja 400SC	7	x	E	x	x	12		37.5 fl oz
isofetamid							1 d	3
Kocide 3000	M	E	G-F	G	F	48h		60 lb
copper hydroxide							0d	4
Luna Experience (SC)	7+3	x	G-E	x	E	12h		34 fl oz
fluopyram + tebuconazole							0d	NA
Luna Privilege	7	E	E-G	s	G	12h		13.7 fl oz
fluopyram							0d	NA
Luna Sensation (SC)	7+11	x	E	EG	G	12h		27.1 fl oz
fluopyram + trifloxystrobin							1d	4
Merivon XBF	7+11	x	E	E-G	G	12h		20.1 fl oz
fluxapyroxad + pyraclostrobin							0d	3
PhD	19	x	x	x	G	4 h		NA
polyoxin D							0d	NA
Pristine	7+11	x	G	E	E	12h		72.5 oz
pyaclostrobin + boscalid							0d	5
Procure 480SC2	3	x	G	G[r]	E	12h		56 fl oz
triflumizole							1d	4
Quadris Top	11+3	x	E	F-G	G	12h		56 fl oz
azoxystrobin + difenoconazole							0d	NA
Quash	3	x	G	GR	E	12h		10.5-12 oz
metconazole							14d	3
Quilt Xcel	11+3	x	E	G	G	12h		70 fl oz
azoxystrobin + propiconazole							0d	5

(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]
Quintec (2.08F) quinoxyfen	13	x	x	x	G	12h	7d	32 fl oz NA
Rally 40WSP2 myclobutanil	3	x	E	ER	E	24h	0d	3.25 lb NA
Rovral 4F iprodione	2	x	E	F-G	E	24h	60d	4 pt 2
Microthiol Disperss sulfur	M2	x	F	x	G	24h	N/A	N/A NA
Syllit F2 dodine	U12	x	G	G	x	48h	7d	12 pt 6
Tilt (EC) propiconazole	3	x	G[r]	G[r]	E[r]	12h	0d	20 fl oz 5
Topguard Specialty Crop flutriafol	3	x	E	G	G	12h	7d	56 fl oz 4
Topsin M70 WSB 2 thiophanate-methyl	1	E	G	F-G	F[r]	48h	1d	4 lb NA
Vanguard WG (75WG) cyprodinil	9	x	G	x	u	12h	2d	30 oz 4
Ziram 76DF ziram	M3	E	F-i	F-i	x	48hr	14d	24.2 lb 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.

[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	20	x	x	E	x	x	12h		NA
bifenazate								3d	1
Actara (25WDG)	4A	x	F	x	G	x	12h		11 oz
thiamethoxam								14d	NA
Admire Pro (4.6F)	4A	i	F	G	s	x	12h		8.4-10.5 fl oz
imidacloprid								0-21d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	x	u	x	x	12h		8.5 fl oz
abamectin								21d	2
Altacor (35WDG)	28	x	s	x	x	x	4h		9 oz
chlorantraniliprole								10d	NA
Apollo SC (1SC)	10A	x	x	E	x	x	12h		NA
clofentezine								21d	NA
Apta (1.34SC)	21A	x	u	x	G	s	12h		53.5 fl oz
tolfenpyrad								14d	2
Asana XL (0.66EC) **(RUP)**	3A	G	G	x	G	x	12h		72.5 fl oz
esfenvalerate								14d	NA
Assail 30SG	4A	G	F	x	G	F	12h		32 oz
acetamiprid								7d	4
Avaunt (30WDG)	22	x	x	x	E	x	12h		24 oz
indoxacarb								14d	4
Baythroid XL (1EC) **(RUP)**	3A	G	G	x	G	x	12h		5.6 fl oz
cyfluthrin								7d	NA
Beleaf 50SG	29	x	x	x	x	x	12h		8.4 oz
flonicamid								14d	3
Centaur WDG (70WDG)	16	x	x	x	x	x	12h		69 oz
buprofezin								14d	2
Closer SC (2SC)	4C	x	x	x	x	x	12h		17 fl oz
sulfoxaflor								7d	4
Danitol 2.4EC **(RUP)**	3A	x	x	F	G	E	24h		42.7 fl oz
fenpropathrin								3d	NA
Delegate WG (25WG)	5	x	s	x	s	G	4h		28 oz
spinetoram								7d	4
Diazinon AG 600WBC **(RUP)**	1B	x	G	u	x	x	72h		102 fl oz
diazinon								21d	2
Dimilin 25W, 2L **(RUP)**	15	x	x	x	x	x	12h		NA
diflubenzuron								10d	NA
Entrust SC (2SC)	5	x	F	x	x	x	4h		29 fl oz
spinosad								7d	3

(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]
Envidor 2SC	23	x	x	E	x	x	12h		18 fl oz
spirodiclofen								7d	1
Esteem 35WP, 0.86EC	7C	x	x	x	x	x	12h		15 oz
pyriproxyfen								14d	3
Exirel (0.83SE)	28	x	E	x	G	E	12h		61.5 fl oz
cyantraniliprole								3d	3
Imidan 70W	1B	x	G	x	G	E	72h		5.25 lb
phosmet								7d	NA
Intrepid 2F	18	x	x	x	x	x	4h		64 fl oz
methoxyfenozide								7d	NA
Magister SC (1.7SC)	21A	x	x	u	x	x	12h		36 fl oz
fenazaquin								3d	1
Malathion	1B	x	G	x	x	G	12h		7 pt
malathion								3d	4
Movento (2SC)	23	x	u	u	x	u	24h		15.3 fl oz
spirotetramat								7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	x	F	x	G	E	12h		24 fl oz
zeta-cypermethrin								14d	NA
Neemix 4.5 (0.39L), AzaDirect	un	F	x	x	i	x	4h		NA
azadirachtin								0d	NA
Nexter (75WP)	21	x	x	u	x	x	12h		21.34 oz
pyridaben								300d	2
Nexter SC (3.75SC)	21A	x	x	u	x	x	12h		34 fl oz
pyridaben								300d	2
Oil (superior)	UN	x	x	u	x	x	12h		UN
mineral oil								dormant	NA
Onager (1EC)	10	x	x	u	x	x	12h		24 oz
hexythiazox								7d	1
Portal XLO (0.4EC)	21A	x	x	u	x	x	12h		4 pt
fenpyroximate								7d	2
Pounce 25WP	3A	F	x	x	G	x	12h		38.4 oz
permethrin								3d	3
PQZ (1.87SC)	9B	x	x	x	x	x	12h		4.8 fl oz
pyrifluquinazon								7d	2
Proaxis (0.5EC) **(RUP)**	3A	x	G	x	G	x	24h		1.6 pt
gamma-cyhalothrin								14d	NA
Pyganic 5EC, 1.4EC	3A	x	i	x	i	i	12h		15.61 fl oz
pyrethrins								0d	10
Rimon 0.83EC	15	x	x	x	x	G	12h		150 fl oz
novaluron								8d	NA

(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]
Savey 50DF	10A	x	x	E	x	x	12h		6 oz
hexythiazox								28d	1
Sevin XLR Plus (4F)	1A	x	G	x	F	x	12h		14 qt
carbaryl								3d	3
Sivanto Prime (1.67SC)	4D	x	x	x	x	x	4h		28 fl oz
flupyradifurone								14d	NA
Surround WP (95WP)	UN	x	s	x	s	x	4h		NA
kaolin								0d	NA
Transform WG	4C	x	x	x	x	x	24h		8.5 oz
sulfoxaflor								7d	4
Vendex 50WP **(RUP)**	12B	x	x	G	x	x	48h		4.5 lb
fenbutatin-oxide								14d	2
Verdepryn 100SL	28	x	G	x	u	u	4h		33 fl oz
cyclaniliprole								7d	3
Versys Inscalis (0.83DC)	9D	x	x	x	x	x	12h		3 fl oz
afidopyropen								7d	NA
Warrior II (2.08CS) **(RUP)**	3A	G	G	x	G	x	24h		12.8 fl oz
lambda-cyhalothrin								14d	NA
Zeal (72WP)	10 B	x	x	E	x	x	12h		3 oz
etoxazole								7d	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.

[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.

4. PEACH

Peach Insect Pests

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

The shaded boxes represent the crop stages where common pests in the Midwest are active; scouting and preventative sprays may be necessary/recommended. Weather and degree day accumulation will impact the exact timing of pest appearance in the orchard. **MD= mating disruption and pheromone traps.**

Dormant	Pink	Full Bloom	Petal Fall	Shuck Split	First Cover	Second Cover	Additional Covers	Pre-Harvest
							green June beetle	
							Japanese beetle	
					peachtree borer			peachtree borer
	MD and traps		oriental fruit moth					
			plum curculio					
	stink bugs		stink bugs					
San Jose scale					San Jose scale			
				European red mite				
				green peach aphid				
								spotted-wing Drosophilia
tarnished plant bug			tarnished plant bug					
				two-spotted spider mite				

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

Peach Spray Schedule

How to read the spray schedule tables

Every peach 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.

Peach Dormant and Delayed Dormant – Diseases

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

Notes on disease management

Peach leaf curl

- To effectively control peach leaf curl, fungicides must be applied before bud swell. Best control is achieved by applying in late autumn at 50% leaf fall and again at delayed dormant in late February before floral buds begin to open; second best time is in early spring prior to bud break.

Bacterial diseases (bacterial canker and shot hole)

- Copper pesticides: Using copper at the dormant stage may 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 mixes with a pH of less than 6.5 may result in phytotoxicity issues.
- Be sure to incorporate oxytetracycline compounds to reduce the risk of bacterial pathogens evolving resistance to copper products.
- The addition of 1 to 3 pounds of hydrated lime per copper application may reduce crop injury.

Table 4-1. Fungicides for disease control at dormant[1]

Product and formulation Active ingredient	FRAC code[2]	bacterial canker	bacterial spot dormant	peach leaf curl	Phytophthora crown, collar and root rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Badge SC	M	3.5-14 pt	3.5-14 pt	3.5-14 pt	x	24h	63.4 pt
copper sulfate + oxychloride		x	G-F	F-G	x	0d	NA
Bravo Weather Stik	M3	x	x	3.1-4.1 pt	x	12h	20.5 pt
chlorothalonil		x	x	G	x	shuck-split	NA
C-O-C-S WDG	M	12-15.6 lb	12-15.6 lb	1-2.9 lb	x	48h	35 lb
copper oxychloride		G	G-F	F-G	x	21d	3
Cuprofix Ultra 40 disperss	M	5-7.5 lb	5-7.5 lb	5-7.5 lb	x	12h	45 lb
copper hydroxide		G	G-F	F-G	x	120d	NA
Ferbam Granuflo	M	x	x	4.5 lb	x	24h	3.4 lb
ferbam		x	x	E-G	x	21d	3
Kocide 3000	M	3.5-7 lb	3.5-7 lb	3.5-7 lb	x	48h	60 lb
copper hydroxide		G	G-F	F-G	x	0d	NA
Ridomil Gold SL	4	x	x	x	2 qt/A or 1.5 oz per 1000 sq ft	48	1.5 gal
mefenoxam		x	x	x	E	NA	3
Thiram Granuflo	M3	x	x	3.5 lb	x	24h	21.2 lb
thiram		x	x	G	x	7d	NA
Ziram 76DF	M3	x	x	3.75-8 lb	x	48h	48.2 lb
ziram		x	x	E	x	30d	6

Peach Dormant – Insects

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

Notes on insect management

- **Mites and San Jose scale:** When spraying superior oil, check labels for temperature restrictions (e.g., only when temperatures are above 40F or never during freezing weather).

Table 4-2. Insecticide applications during dormant[1]

Product and formulation Active ingredient	IRAC code[2]	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Assail 30SG	4A	5.3-8 oz	12h	32 oz
acetamiprid		F	7d	4
Belay (2.13SC)	4A	6 fl oz	12h	12 fl oz
clothianidin		G	21d	NA
Centaur WDG (70WDG)	16	34.5 oz	12h	69 oz
buprofezin		E	14d	2
Diazinon AG 600WBC **(RUP)**	1B	12.75 fl oz/100 gal	4d	51 fl oz
diazinon		F	21d	2
Esteem 35WP	7C	4-5 oz	12h	15 oz
pyriproxyfen		E	14d	3

(Continued)

Table 4-2. Insecticide applications during dormant[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Imidan 70W	1B	2.1-4.25 lb	4d	17 lb
phosmet		E	14d	NA
Malathion 8 (8EC)	1B	1.25 pt	24h	3.75 pt
malathion		F	7d	3
Neemix 4.5 (0.39L)	UN	7-16 fl oz	4h	NA
azadirachtin		G	0d	NA
Oil (superior)	UN	1.5-2 gal/100 g	4h	NA
mineral oil		G	dormant	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	12h	15.6 fl oz
pyrethrins		u	0d	1
Sevin XLR Plus (4F)	1A	4-5 qt	12h	14 qt
carbaryl		u	3d	3
Sivanto Prime	4D	10.5-14 fl oz	4h	28 fl oz
flupyradifurone		G	14d	NA

Peach Pink – Diseases

Notes on disease management

Copper pesticides: Copper rates are tied to crop development, with rates reduced as the season progresses to minimize the risk of phytotoxicity. When using coppers post-bloom, do not apply during extended dews or foggy conditions. Spotting of leaves and defoliation may occur from copper use after bud swell. The addition of 1 to 3 pounds of hydrated lime may reduce crop injury.

- Under severe disease pressure, use the Ziram 76DF higher rate.
- Fungicides with the FRAC code 3, 7, or 11 are not recommended at this time, unless disease pressures are particularly high. They are better deployed later in the season.

Table 4-3. Fungicide applications during pink[1]

Product and formulation Active ingredient	FRAC code[2]	bacterial spot/shot hole	brown rot	peach leaf curl	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	x	12-15.5 fl oz	x	4h	90 fl oz
azoxystrobin		x	F-E[r]	x	0d	See label
Badge SC	M	0.5-2 pt	3.5–5.25 pt	3.5–5.25 pt	24h	63.4 pt
copper sulfate + oxychloride		G-F	F	F-G	0d	NA
Bravo Weather Stik	M3	x	3.1-4.1 pt	3.1-4.1 pt	12h	20.5 pt
chlorothalonil		x	G	G	shuck-split	NA
Captan	M4	x	2.5-5 lb	x	24h	40 lb
captan		x	G	x	0d	NA
Cevya	3	x	3-5 fl oz	x	12h	15 fl oz
mefentrifluconazole		x	E	x	0d	See label
C-O-C-S WDG	M	1-2.9 lb	1-2.9 lb	1-2.9 lb	48h	35 lb
copper oxychloride		G-F	F	F-G	21d	3
Cuprofix Ultra 40 disperss	M	1.5 lb	1.5 lb	1.5 lb	12h	45 lb
copper hydroxide		G-F	F	F-G	120d	NA

(Continued)

Table 4-3. Fungicide applications during pink *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bacterial spot/shot hole	brown rot	peach leaf curl	REI[3] PHI[4]	Max amt[5] Max app[6]
Elevate 50 WDG	17	x	1-1.5 lb	x	12h	6 lb
fenhexamid		x	E-G	x	0d	NA
Elite 45DF	3	x	4-8 oz	x	12h	3 lb
tebuconazole		x	E	x	0d	NA
Ferbam Granuflo	M	x	x	4.5 lb	24h	3.4 lb
ferbam		x	x	E-G	21d	3
Flint Extra	11	x	2.5-3.8 fl oz	x	12h	15.2 fl oz
trifloxystrobin		x	s (G)	E	1d	4
Fontelis (SC)	7	x	14-20 fl oz	x	12h	61 fl oz
penthiopyrad		x	E-G	x	0d	NA
Indar 2F	3	x	6 fl oz	x	12h	48 fl oz
fenbuconazole		x	E[r]	x	0d	8
Inspire Super (EW)	3+9	x	16-20 fl oz	x	12h	80 fl oz
difenoconazole + cyprodinil		x	E	x	2d	4
Kenja 400 SC	7	x	12.5 fl oz	x	12h	37.5 fl oz
isofetamid		x	E	x	1d	3
Kocide 3000	M	3.5-5 lb	3-5 lb	3.5-5 lb	48h	60 lb
copper hydroxide		G-F	F	F-G	0d	NA
Luna Experience (SC)	7+3	x	6-10 fl oz	6-10 fl oz	12h	34 fl oz
fluopyram + tebuconazol		x	G-E	E-G	0d	NA
Luna Privilege	7	x	4-6.8 fl oz	x	12h	13.7 fl oz
fluopyram		x	E	x	0d	NA
Luna Sensation (SC)	7+11	x	5-7.6 fl oz	5-7.6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		x	E	E-G	1d	4
Merivon XBF	7+11	x	4-6.7 fl oz	x	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		x	E	x	0d	3
Microthiol Disperss	M	x	10-20 lb	10-20 lb	24h	NA
sulfur		x	F-P	E-G	0d	NA
Miravis	7	x	3.4-5.1 fl oz	x	4h	20.4 fl oz
pydiflumetofen		x	E	x	0d	4
Ph-D	19	x	x	x	4h	NA
polyoxin D		x	x	x	0h	NA
Pristine	7+11	x	10.5-14.5 oz	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		x	E-G[r]	s(G)	0d	5
Quadris Top	11+3	x	12-14 fl oz	x	12h	56 fl oz
azoxystrobin + difenoconazole		x	E	x	0d	4
Quash	3	x	2.5-3.5 fl oz	x	12h	12 fl oz
metconazole		x	E-G	x	14d	3
Quilt Xcel	11+3	x	14 fl oz	x	12h	70 fl oz
azoxystrobin + propiconazole		x	E	x	0d	5

(Continued)

Table 4-3. Fungicide applications during pink *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bacterial spot/shot hole	brown rot	peach leaf curl	REI[3] PHI[4]	Max amt[5] Max app[6]
Rally 40WSP	3	x	2.5-6 oz	x	24h	3.25 lb
myclobutanil		x	G	x	0h	NA
Rovral 4F	2	x	1-2 pt	x	24h	4 pt
iprodione		x	E	x	PF	2
Scala (SC)	9	x	9-18 fl oz	x	12h	54 fl oz
pyrimethanil		x	E-G	x	2d	3
Syllit F	U12	x	3 pt	3 pt	48h	9 pt
dodine		x	s	E	petal fall	3
Thiram Granuflo	M3	x	3.5 lb	3.5 lb	24h	21.2 lb
thiram		x	G	G	7d	NA
Tilt (EC)	3	x	4 fl oz	x	12h	20 fl oz
propiconazole		x	E	x	0d	5
Topguard EQ	3+11	x	6-8 fl oz	x	12h	NA
flutriafol + azoxystrobin		x	G	x	7d	4
Topguard Specialty Crop	3	x	14 fl oz	14 fl oz	12h	56 fl oz
flutriafol		x	E	G	7d	4
Topsin M WSB	1	x	1-1.5 lb	x	48h	4 lb
thiophanate-methyl		x	E[r]	x	1d	NA
Vangard WG (75WG)	9	x	5 oz	x	12h	30 oz
cyprodinil		x	E-G	x	2d	4
Ziram 76DF	M3	x	4.5-8 lb	3.75-8 lb	48h	48.2 lb
ziram		x	G	E	30d	6

Peach Pink – Insects

Notes on insect management

- **Oriental fruit moth monitoring:** Put pheromone traps to monitor oriental fruit moth in place now to determine the need for sprays at petal fall. **See mating disruption for peach pest, page 153.**
- **Tarnished plant bug, stink bugs:** Apply insecticides before any blooms open.

Table 4-4. Insecticide applications at pink[1]

Product and formulation Active ingredient	IRAC code[2]	plant bug/stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	12h	72.5 fl oz
esfenvalerate		G	14d	NA
Assail 30SG	4A	5.3-8 oz	12h	32 oz
acetamiprid		F	7d	4
Baythroid XL (1EC) **(RUP)**	3A	2-2.4 fl oz	12h	5.6 fl oz
beta-cyfluthrin		E	7d	NA
Belay (2.13SC)	4A	6 fl oz	12h	12 fl oz
clothianidin		E	21d	NA

(Continued)

Table 4-4. Insecticide applications at pink *(continued)*

Product and formulation Active ingredient	IRAC code[2]	plant bug/stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Beleaf 50SG	29	2-2.8 oz	12h	8.4 oz
flonicamid		G	14d	3
Danitol 2.4EC **(RUP)**	3A	10.7-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		E	3d	NA
Lannate LV	1A	3 pt	4d	18 pt
methomyl		G	4d	6
Mustang Maxx (0.83EC) **(RUP)**	3A	1.28-4 fl oz	12h	24 fl oz
zeta-cypermethrin		E	14d	NA
Neemix 4.5 (0.39L)	UN	7-16 fl oz	4h	NA
azadirachtin		E	0d	NA
Proaxis (0.5EC) **(RUP)**	3A	2.5-5.1 fl oz	24h	1.6 pt
gamma-cyhalothrin		u	14d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	12h	15.6 fl oz
pyrethrins		u	0d	1
Rimon 0.83EC	15	20-40 fl oz	12h	150 fl oz
novaluron		u	8d	NA
Scorpion 35SL	4A	5.25-7 fl oz	12h	14.25 fl oz
dinotefuran		E	3/21d	NA
Sevin XLR Plus (4F)	1A	2-3 qt	12h	14 qt
carbaryl		F	3d	3
Venom (70SG)	4A	3-4 oz	12h	6 oz
dinotefuran		E	3d	NA
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 fl oz	24h	12.8 fl oz
lambda-cyhalothrin		E	14d	NA

Peach Full Bloom – Diseases

Notes on disease management

- Use 12 oz of Mycoshield/100 gallons of water (=150 ppm), varying volume depending upon tree size and foliar development.
- Quadris Top and Quilt Xcel contain azoxystrobin, which is known to be phytotoxic to certain apple varieties. Do not use where drift might affect apples.
- Application of Captan or Bravo as a tank mix is not recommended at this time due to the risk of phytotoxicity.
- The use of copper is not recommended during bloom to reduce phytotoxicity and protect pollinators.

Table 4-5. Fungicides application at full bloom[1]

Product and formulation Active ingredient	FRAC code[2]	brown rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	12-15.5 fl oz	4h	90 fl oz
azoxystrobin		F-E[r]	0d	See label
Bravo Weather Stik	M3	3.1-4.1 pt	12h	20.5 pt
chlorothalonil		G	shuck-split	NA

(Continued)

Table 4-5. Fungicides application at full bloom *(continued)*

Product and formulation Active ingredient	FRAC code[2]	brown rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Captan	M4	2.5-5 lb	24h	40 lb
captan		G	0d	NA
Cevya	3	3-5 fl oz	12h	15 fl oz
mefentrifluconazole		E	0d	See label
Elevate 50 WDG	17	1-1.5 lb	12h	6 lb
fenhexamid		E-G	0d	NA
Elite 45DF	3	4-8 oz	12h	3 lb
tebuconazole		E	0d	NA
Flint Extra	11	2.5-3.8 fl oz	12h	15.2 fl oz
trifloxystrobin		s (G)	1d	4
Fontelis (SC)	7	14-20 fl oz	12h	61 fl oz
penthiopyrad		E-G	0d	NA
Indar 2F	3	6 fl oz	12h	48 fl oz
fenbuconazole		E[r]	0d	8
Inspire Super (EW)	3+9	16-20 fl oz	12h	80 fl oz
difenoconazole + cyprodinil		E	2d	4
Kenja 400 SC	7	12.5 fl oz	12h	37.5 fl oz
isofetamid		E	1d	3
Luna Experience (SC)	7+3	6-10 fl oz	12h	34 fl oz
fluopyram + tebuconazol		G-E	0d	NA
Luna Privilege	7	4-6.8 fl oz	12h	13.7 fl oz
fluopyram		E	0d	NA
Luna Sensation (SC)	7+11	5-7.6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		E	1d	4
Merivon XBF	7+11	4-6.7 fl oz	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		E	0d	3
Microthiol Disperss	M	10-20 lb	24h	NA
sulfur		F-P	0d	NA
Miravis	7	3.4-5.1 fl oz	4h	20.4 fl oz
pydiflumetofen		E	0d	4
Mycoshield	41	x	12h	12 lb
oxytetracyline		x	21d	8
Ph-D	19	6.2 oz	4h	NA
polyoxin D		x	0h	NA
Pristine	7+11	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		E-G[r]	0d	5
Quadris Top	11+3	12-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		E	0d	4
Quash	3	2.5-3.5 fl oz	12h	12 fl oz
metconazole		E-G	14d	3

(Continued)

Table 4-5. Fungicides application at full bloom *(continued)*

Product and formulation Active ingredient	FRAC code[2]	brown rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Quilt Xcel	11+3	14 fl oz	12h	70 fl oz
azoxystrobin + propiconazole		E	0d	5
Rally 40WSP	3	2.5-6 oz	24h	3.25 lb
myclobutanil		G	0h	NA
Rovral 4F	2	1-2 pt	24h	4 pt
iprodione		E	PF	2
Scala (SC)	9	9-18 fl oz	12h	54 fl oz
pyrimethanil		E-G	2d	3
Thiram Granuflo	M3	3.5 lb	24h	21.2 lb
thiram		G	7d	NA
Tilt (EC)	3	4 fl oz	12h	20 fl oz
propiconazole		E	0d	5
Topguard EQ	3+11	6-8 fl oz	12h	NA
flutriafol + azoxystrobin		G	7d	4
Topguard Specialty Crop	3	14 fl oz	12h	56 fl oz
flutriafol		E	7d	4
Topsin M WSB	1	1-1.5 lb	48h	4 lb
thiophanate-methyl		E[r]	1d	NA
Vangard WG (75WG)	9	5 oz	12h	30 oz
cyprodinil		E-G	2d	4
Ziram 76DF	M3	4.5-8 lb	48h	48.2 lb
ziram		G	30d	6

Peach Full Bloom – Insects

Save the bees! *Insecticide use for insects or mites is not recommended at this time.*

Peach Petal Fall through Shuck Split – Diseases

Brown rot

- Last application for Rovral (iprodione) at petal fall. Do not apply Rovral after petal fall.
- Last application of Bravo or chlorothalonil product for control of brown rot and scab at shuck split.

Bacterial spot management:

- Some labels specify shuck-split, first and /or second cover sprays for application timings. Carefully read the label whenever using copper products to avoid phytotoxicity.
- If bacterial spot has been a problem, apply at 7-day intervals from petal fall (<5% shuck split) through first cover.
- For control of bacterial spot, reduce the rate of copper as the season progresses to reduce the risk of phytotoxicity. Do not apply under extended wet or humid conditions.
- Last application of Cuprofix; Do not apply after shuck split.

Peach scab applications begin now and are critical from shuck split through second-third cover.

Table 4-6. Fungicides for petal fall through shuck split[1]

Product and formulation Active ingredient	FRAC code[2]	bacterial spot/shot hole	brown rot	peach scab	powdery mildew/peach rusty spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	x	12-15.5 fl oz	12-15.5 fl oz	12-15.5 fl oz	4h	90 fl oz
azoxystrobin		x	F-E[r]	G	F	0d	See label
Badge SC	M	0.5–2 pt	x	x	x	24h	63.4 pt
copper sulfate + oxychloride		G-F	x	x	x	0d	NA
Bravo Weather Stik	M3	x	3.1-4.1 pt	3.1-4.1 pt	3.1-4.1 pt	12h	20.5 pt
chlorothalonil		x	G	G	x	shuck-split	NA
Captan	M4	x	2.5-5 lb	2.5-5 lb	2.5-5 lb	24h	40 lb
captan		x	G	G	F	0d	NA
Cevya	3	x	3-5 fl oz	3-5 fl oz	4-5 fl oz	12h	15 fl oz
mefentrifluconazole		x	E	E	E	0d	See label
C-O-C-S WDG	M	1-2.9 lb	1-2.9 lb	x	x	48h	35 lb
copper oxychloride		G-F	F	x	x	21d	3
Cuprofix Ultra 40 disperss	M	1 lb	1 lb	x	x	12h	45 lb
copper hydroxide		G-F	F	x	x	120d	NA
Elevate 50 WDG	17	x	1-1.5 lb	x	x	12h	6 lb
fenhexamid		x	E-G	x	x	0d	NA
Elite 45DF	3	x	4-8 oz	x	4-8 oz	12h	3 lb
tebuconazole		x	E	x	E	0d	NA
Flint Extra	11	x	2.5-3.8 fl oz	2.5-3.8 fl oz	2.5-3.8 fl oz	12h	15.2 fl oz
trifloxystrobin		x	s (G)	E	E	1d	4
Fontelis (SC)	7	x	14-20 fl oz	14-20 fl oz	14-20 fl oz	12h	61 fl oz
penthiopyrad		x	E-G	F-G	F-G	0d	NA
Indar 2F	3	x	6 fl oz	6 fl oz	x	12h	48 fl oz
fenbuconazole		x	E[r]	F	x	0d	8
Inspire Super (EW)	3+9	x	16-20 fl oz	16-20 fl oz	16-20 fl oz	12h	80 fl oz
difenoconazole + cyprodinil		x	E	G-F	G-F	2d	4
Kenja 400 SC	7	x	12.5 fl oz	12.5 fl oz	x	12h	37.5 fl oz
isofetamid		x	E	G	x	1d	3
Kocide 3000	M	02.5-0.5 lb	x	x	x	48h	60 lb
copper hydroxide		G-F	x	x	x	0d	NA
Luna Experience (SC)	7+3	x	6-10 fl oz	8-10 fl oz	6-10 fl oz	12h	34 fl oz
fluopyram + tebuconazol		x	G-E	E	G	0d	NA
Luna Privilege	7	x	4-6.8 fl oz	4.8-6.8 fl oz	4-6.84 fl oz	12h	13.7 fl oz
fluopyram		x	E	F	G	0d	NA
Luna Sensation (SC)	7+11	x	5-7.6 fl oz	5-7.6 fl oz	5-7.6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		x	E	F	E-G	1d	4
Merivon XBF	7+11	x	4-6.7 fl oz	4-6.7 fl oz	4-6.7 fl oz	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		x	E	E-G	E-G	0d	3

(Continued)

Table 4-6. Fungicides for petal fall through shuck split *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bacterial spot/shot hole	brown rot	peach scab	powdery mildew/peach rusty spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Microthiol Disperss	M	x	10-20 lb	x	10-20 lb	24h	NA
sulfur		x	F-P	x	F-P	0d	NA
Miravis	7	x	3.4-5.1 fl oz	3.4-5.1 fl oz	3.4-5.1 fl oz	4h	20.4 fl oz
pydiflumetofen		x	E	E-G	E-G	0d	4
Mycoshield	41	12 oz/100 g	x	x	x	12h	12 lb
oxytetracyline		E[r]	x	x	x	21d	8
Ph-D	19	x	x	6.2 oz	6.2 oz	4h	NA
polyoxin D		x	x	G	u	0h	NA
Pristine	7+11	x	10.5-14.5 oz	10.5-14.5 oz	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		x	E-G[r]	E-G	E[r]	0d	5
Quadris Top	11+3	x	12-14 fl oz	12-14 fl oz	12-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		x	E	u	G	0d	4
Quash	3	x	2.5-3.5 fl oz	2.5-3.5 fl oz	3.5-4 fl oz	12h	12 fl oz
metconazole		x	E-G	G	E	14d	3
Quilt Xcel	11+3	x	14 fl oz	14 fl oz	14 fl oz	12h	70 fl oz
azoxystrobin + propiconazole		x	E	G	G	0d	5
Quintec	13	x	x	x	7 fl oz	12h	28 fl oz
quinoxyfen		x	x	x	E	7d	4
Rally 40WSP	3	x	2.5-6 oz	x	2.5-6 oz	24h	3.25 lb
myclobutanil		x	G	x	E-G	0h	NA
Rovral 4F	2	x	1-2 pt	1-2 qt	x	24h	4 pt
iprodione		x	E	u	x	PF	2
Scala (SC)	9	x	9-18 fl oz	x	x	12h	54 fl oz
pyrimethanil		x	E-G	x	x	2d	3
Syllit F	U12	x	3 pt	3 pt	x	48h	9 pt
dodine		x	s	F	x	petal fall	3
Thiram Granuflo	M3	x	3.5 lb	3.5 lb	x	24h	21.2 lb
thiram		x	G	G	x	7d	NA
Tilt (EC)	3	x	4 fl oz	x	4 fl oz	12h	20 fl oz
propiconazole		x	E	x	G	0d	5
Topguard EQ	3+11	x	6-8 fl oz	6-8 fl oz	6-8 fl oz	12h	NA
flutriafol + azoxystrobin		x	G	u	E	7d	4
Topguard Specialty Crop	3	x	14 fl oz	14 fl oz	14 fl oz	12h	56 fl oz
flutriafol		x	E	s(G)	G	7d	4
Topsin M WSB	1	x	1-1.5 lb	1-1.5 lb	1-1.5 lb	48h	4 lb
thiophanate-methyl		x	E[r]	G	G[r]	1d	NA
Vangard WG (75WG)	9	x	5 oz	x	x	12h	30 oz
cyprodinil		x	E-G	x	x	2d	4
Ziram 76DF	M3	x	4.5-8 lb	4.5-8 lb	x	48h	48.2 lb
ziram		x	G	G	x	30d	6

Peach Petal Fall through Shuck Split – Insects

Table 4-7. Insecticide applications at petal fall through shuck split[1]

Product and formulation Active ingredient	IRAC code[2]	borers	cherry fruit fly	European red mite	green peach aphid	Japanese beetle	oriental fruit moth	plant bug/ stink bug	plum curculio	San Jose scale	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	4.5-5.5 oz	x	3-4 oz	x	x	4.5-5.5 oz	4.5-5.5 oz	x	x	12h	11 oz
thiamethoxam		x	F	x	E	x	x	G	G	x	x	14d	NA
Admire Pro (4.6F)	4A	x	2-2.8 fl oz	x	1.4-2.8 fl oz	1.4-2.8 fl oz	x	2.8 fl oz	2.8 fl oz	1.4-2.8 fl oz	x	12h	8.4 fl oz
imidacloprid		x	F	x	E	G	x	u	s	F	x	0d	NA
Altacor (35WDG)	28	x	3-4.5 oz	x	x	x	3-4.5 oz	x	x	x	x	4h	9 oz
chlorantraniliprole		x	s	x	x	x	E	x	x	x	x	10d	NA
Apta (1.34SC)	21A	x	14-27 fl oz	x	17-27 fl oz	x	x	21-27 fl oz	21-27 fl oz	x	21-27 fl oz	12h	53.5 fl oz
tolfenpyrad		x	u	x	G	x	x	S	G	x	s	14d	2
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	4.8-14.5 fl oz	x	x	x	4.8-14.5 fl oz	4.8-14.5 fl oz	4.8-14.5 fl oz	x	x	12h	72.5 fl oz
esfenvalerate		G	G	x	x	x	E[r]	G	G	x	x	14d	NA
Assail 30SG	4A	5.3-8 oz	5.3-8 oz	x	2.5-5.3 oz	5.3-8 oz	5.3-8 oz	5.3-8 oz	5.3-8 oz	5.3-8 oz	x	12h	32 oz
acetamiprid		G	F	x	E	G	E	F	G	F	x	7d	4
Avaunt eVo (30WDG)	22	x	x	x	x	x	6 oz	x	5-6 oz	x	x	12h	24 oz
indoxacarb		x	x	x	x	x	G	x	E	x	x	14d	4
Baythroid XL (1EC) **(RUP)**	3A	1.4-2 fl oz	2.4-2.8 fl oz	x	x	x	2-2.4 fl oz	2-2.4 fl oz	2.4-2.8 fl oz	x	x	12h	5.6 fl oz
beta-cyfluthrin		G	G	x	x	x	E[r]	E	G	x	x	7d	NA
Belay (2.13SC)	4A	x	x	x	3 - 6 fl oz	x	x	6 fl oz	6 fl oz	6 fl oz	x	12h	12 fl oz
clothianidin		x	x	x	E	x	x	E	G	G	x	21d	NA
Beleaf 50SG	29	x	x	x	2-2.8 oz	x	x	2-2.8 oz	x	x	x	12h	8.4 oz
flonicamid		x	x	x	E	x	x	G	x	x	x	14d	3
Danitol 2.4EC **(RUP)**	3A	x	16-21.3 fl oz	10.7-21.3 fl oz	10.7-21.3 fl oz	10.7-21.3 fl oz	10.7-21.3 fl oz	10.7-21.3 fl oz	10.7-21.3 fl oz	x	10.7-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		x	G	i	F	E	E[r]	E	G	x	E	3d	NA
Delegate WG (25WG)	5	x	6-7 oz	x	x	x	6-7 oz	x	6-7 oz	x	4.5-7 oz	4h	28 oz
spinetoram		x	s	x	x	x	E	x	s	x	G	1d	4

(Continued)

Table 4-7. Insecticide applications at petal fall through shuck split *(continued)*

Product and formulation Active ingredient	IRAC code[2]	borers	cherry fruit fly	European red mite	green peach aphid	Japanese beetle	oriental fruit moth	plant bug/ stink bug	plum curculio	San Jose scale	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Diazinon AG 600WBC **(RUP)**	1B	x	x	12.75 fl oz/100 gal	12.75 fl oz/100 gal	x	12.75 fl oz/100 gal	x	x	12.75 fl oz/100 gal	x	4d	51 fl oz
diazinon		x	x	i	G	x	G	x	x	F	x	21d	2
Entrust SC (2SC)	5	x	4-8 fl oz	x	x	x	4-8 fl oz	x	x	x	4-8 fl oz	4h	29 fl oz
spinosad		x	F	x	x	x	F	x	x	x	G-E	7d	3
Esteem 35WP	7C	x	x	x	x	x	4-5 oz	x	x	4-5 oz	x	12h	15 oz
pyriproxyfen		x	x	x	x	x	F	x	x	E	x	14d	3
Exirel (0.83SE)	28	x	10-17 fl oz	x	x	13.5-20.5 fl oz	10-20.5 fl oz	x	13.5-20.5 fl oz	x	13.5-20.5 fl oz	12h	61.5 fl oz
cyantraniliprole		x	E	x	x	G	E	x	G	x	E	3d	3
Imidan 70W	1B	x	2.1-2.5 lb	x	x	2.1-4.25 lb	2.13-4.25 lb	x	2.1-4.25 lb	2.1-4.25 lb	2.1-4.25 lb	4d	17 lb
phosmet		x	G	x	x	G	E[r]	x	G	E	E	14d	NA
Intrepid 2F	18	x	x	x	x	x	10-16 fl oz	x	x	x	x	4h	64 fl oz
methoxyfenozide		x	x	x	x	x	G	x	x	x	x	7d	NA
Lannate LV	1A	x	x	x	3 pt	x	3 pt	3 pt	x	x	x	4d	18 pt
methomyl		x	x	x	G	x	F	G	x	x	x	4d	6
Malathion 8 (8EC)	1B	1.25 pt	x	x	x	x	1.25 pt	x	1.25 pt	1.25 pt	x	24h	3.75 pt
malathion		u	x	x	x	x	u	x	u	F	x	7d	3
Mustang Maxx (0.83EC) **(RUP)**	3A	1.28-4 fl oz	1.28-4 fl oz	x	x	x	1.2-4 fl oz	1.2-4 fl oz	1.2-4 fl oz	x	4 fl oz	12h	24 fl oz
zeta-cypermethrin		G	F	x	x	x	E[r]	E	G	x	E	14d	NA
Neemix 4.5 (0.39L)	UN	7-16 fl oz	7-16 fl oz	x	5-7 fl oz	x	7-16 fl oz	7-16 fl oz	x	7-16 fl oz	x	4h	NA
azadirachtin		F	u	x	G	x	u	E	i	G	x	0d	NA
Pounce 25WP	3A	6.4-16 oz	x	x	x	x	6.4-16 oz	x	6.4-16 oz	x	x	12h	48 oz
permethrin		F	x	x	x	x	E[r]	x	G	x	x	14d	NA
Proaxis (0.5EC) **(RUP)**	3A	2.5-5.1 fl oz	2.5-5.1 fl oz	x	x	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	x	24h	1.6 pt
gamma-cyhalothrin		G	G	x	x	F	G[r]	u	G	x	x	14d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	x	4.5-15.6 fl oz	x	4.5-15.6 fl oz	4.5-15.6 fl oz	12h	15.6 fl oz
pyrethrins		u	i	u	G	u	x	u	x	u	F	0d	1

(Continued)

Table 4-7. Insecticide applications at petal fall through shuck split *(continued)*

Product and formulation Active ingredient	IRAC code[2]	borers	cherry fruit fly	European red mite	green peach aphid	Japanese beetle	oriental fruit moth	plant bug/ stink bug	plum curculio	San Jose scale	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Rimon 0.83EC	15	20 fl oz	20-40 fl oz	x	x	x	20-40 fl oz	20-40 fl oz	x	x	20-40 fl oz	12h	150 fl oz
novaluron		u	u	x	x	x	E	u	x	x	G	8d	NA
Scorpion 35SL	4A	5.25-7 fl oz	x	x	3.5-7 fl oz	x	x	5.25-7 fl oz	5.25-7 fl oz	x	x	12h	14.25 fl oz
dinotefuran		s	x	x	s	x	x	E	s	x	x	3/21d	NA
Sevin XLR Plus (4F)	1A	2-3 qt	2-3 qt	x	x	2-3 qt	2-3 qt	2-3 qt	2-3 qt	4-5 qt	x	12h	14 qt
carbaryl		u	G	x	x	E	F	F	F	u	x	3d	3
Surround WP (95WP)	UN	x	25-50 lb	x	x	25-50 lb	25-50 lb	x	25-50 lb	x	x	4h	NA
kaolin		x	s	x	x	F	u	x	s	x	x	0d	NA
Venom (70SG)	4A	3-4 oz	x	x	2-4 oz	x	x	3-4 oz	3-4 oz	x	x	12h	.
dinotefuran		u	x	x	s	x	x	E	u	x	x	3d	NA
Verdepryn 100SL (0.83SL)	28	x	5.5-11 fl oz	x	5.5-11 fl oz	x	5.5-11 fl oz	5.5-11 fl oz	5.5-11 fl oz	x	5.5-11 fl oz	4h	33 fl oz
cyclaniliprole		x	G	x	E	x	E	s	u	x	u	7d	3
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 fl oz	1.2-2.5 fl oz	x	x	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	x	24h	12.8 fl oz
lambda-cyhalothrin		G	G	x	x	E	G[r]	E	G	x	x	14d	NA

Peach First Cover – Diseases

7-10 days after shuck split.

Table 4-8. Fungicides for control of diseases at first cover[1]

Product and formulation Active ingredient	FRAC code[2]	bacterial spot/ shot hole	brown rot	peach scab	powdery mildew/ peach rusty spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	x	12-15.5 fl oz	9-15.5 fl oz	12-15.5 fl oz	4h	90 fl oz
azoxystrobin		x	F-E[r]	G	F	0d	See label
Badge SC	M	0.5–2 pt	x	x	x	24h	63.4 pt
copper sulfate + oxychloride		G-F	x	x	x	0d	NA
Captan	M4	x	2.5-5 lb	2.5-5 lb	2.5-5 lb	24h	40 lb
captan		x	G	G	F	0d	NA
Cevya	3	x	3-5 fl oz	3-5 fl oz	4-5 fl oz	12h	15 fl oz
mefentrifluconazole		x	E	E	E	0d	See label
Elevate 50 WDG	17	x	1-1.5 lb	x	x	12h	6 lb
fenhexamid		x	E-G	x	x	0d	NA
Elite 45DF	3	x	4-8 oz	x	4-8 oz	12h	3 lb
tebuconazole		x	E	x	E	0d	NA
Flint Extra	11	x	2.5-3.8 fl oz	2.5-3.8 fl oz	2.5-3.8 fl oz	12h	15.2 fl oz
trifloxystrobin		x	s (G)	E	E	1d	4
Fontelis (SC)	7	x	14-20 fl oz	14-20 fl oz	14-20 fl oz	12h	61 fl oz
penthiopyrad		x	E-G	F-G	F-G	0d	NA
Indar 2F	3	x	6 fl oz	6 fl oz	x	12h	48 fl oz
fenbuconazole		x	E[r]	F	x	0d	8
Inspire Super (EW)	3+9	x	16-20 fl oz	16-20 fl oz	16-20 fl oz	12h	80 fl oz
difenoconazole + cyprodinil		x	E	G-F	G-F	2d	4
Kenja 400 SC	7	x	12.5 fl oz	12.5 fl oz	x	12h	37.5 fl oz
isofetamid		x	E	G	x	1d	3
Kocide 3000	M	0.25-0.5 lb	x	x	x	48h	60 lb
copper hydroxide		G-F	x	x	x	0d	NA
Luna Experience (SC)	7+3	x	6-10 fl oz	8-10 fl oz	6-10 fl oz	12h	34 fl oz
fluopyram + tebuconazol		x	G-E	E	G	0d	NA
Luna Privilege	7	x	4-6.8 fl oz	4.8-6.8 fl oz	4-6.8 fl oz	12h	13.7 fl oz
fluopyram		x	E	F	G	0d	NA
Luna Sensation (SC)	7+11	x	5-7.6 fl oz	5-7.6 fl oz	5-7.6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		x	E	F	E-G	1d	4
Merivon XBF	7+11	x	4-6.7 fl oz	4-6.7 fl oz	4-6.7 fl oz	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		x	E	E-G	E-G	0d	3
Microthiol Disperss	M	x	10-20 lb	x	10-20 lb	24h	NA
sulfur		x	F-P	x	F-P	0d	NA

(Continued)

Table 4-8. Fungicides for control of diseases at first cover *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bacterial spot/ shot hole	brown rot	peach scab	powdery mildew/ peach rusty spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Miravis	7	x	3.4-5.1 fl oz	3.4-5.1 fl oz	3.4-5.1 fl oz	4h	20.4 fl oz
pydiflumetofen		x	E	E-G	E-G	0d	4
Mycoshield	41	12 oz/100 g	x	x	x	12h	12 lb
oxytetracyline		E[r]	x	x	x	21d	8
Ph-D	19	x	x	6.2 oz	6.2 oz	4h	NA
polyoxin D		x	x	G	u	0h	NA
Pristine	7+11	x	10.5-14.5 oz	10.5-14.5 oz	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		x	E-G[r]	E-G	E[r]	0d	5
Quadris Top	11+3	x	12-14 fl oz	12-14 fl oz	12-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		x	E	u	G	0d	4
Quash	3	x	2.5-3.5 fl oz	2.5-3.5 fl oz	3.5-4 fl oz	12h	12 fl oz
metconazole		x	E-G	G	E	14d	3
Quilt Xcel	11+3	x	14 fl oz	14 fl oz	14 fl oz	12h	70 fl oz
azoxystrobin + propiconazole		x	E	G	G	0d	5
Quintec	13	x	x	x	7 fl oz	12h	28 fl oz
quinoxyfen		x	x	x	E	7d	4
Rally 40WSP	3	x	2.5-6 oz	x	2.5-6 oz	24h	3.25 lb
myclobutanil		x	G	x	E-G	0h	NA
Scala (SC)	9	x	9-18 fl oz	x	x	12h	54 fl oz
pyrimethanil		x	E-G	x	x	2d	3
Thiram Granuflo	M3	x	3.5 lb	3.5 lb	x	24h	21.2 lb
thiram		x	G	G	x	7d	NA
Tilt (EC)	3	x	4 fl oz	x	4 fl oz	12h	20 fl oz
propiconazole		x	E	x	G	0d	5
Topguard EQ	3+11	x	6-8 fl oz	6-8 fl oz	6-8 fl oz	12h	NA
flutriafol + azoxystrobin		x	G	u	E	7d	4
Topguard Specialty Crop	3	x	14 fl oz	x	14 fl oz	12h	56 fl oz
flutriafol		x	E	s(G)	G	7d	4
Topsin M WSB	1	x	1-1.5 lb	1-1.5 lb	1-1.5 lb	48h	4 lb
thiophanate-methyl		x	E[r]	G	G[r]	1d	NA
Vangard WG (75WG)	9	x	5 oz	x	x	12h	30 oz
cyprodinil		x	E-G	x	x	2d	4
Ziram 76DF	M3	x	4.5-8 lb	4.5-8 lb	x	48h	48.2 lb
ziram		x	G	G	x	30d	6

Peach First and Second Cover – Insects

7-10 days after shuck split. Second cover occurs 7-14 days after first cover.

Notes on insect management

San Jose scale

- Movento 2SC, must be tank mixed with a spray adjuvant.

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 152.

Table 4-9. Insect management at first and second cover[1]

Product and formulation Active ingredient	IRAC code[2]	borers	oriental fruit moth	plant bug/ stink bug	plum curculio	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	x	4.5-5.5 oz	4.5-5.5 oz	x	12h	11 oz
thiamethoxam		x	x	G	G	x	14d	NA
Admire Pro (4.6F)	4A	x	x	2.8 fl oz	2.8 fl oz	1.4-2.8 fl oz	12h	8.4 fl oz
imidacloprid		x	x	u	s	F	0d	NA
Altacor (35WDG)	28	x	3-4.5 oz	x	x	x	4h	9 oz
chlorantraniliprole		x	E	x	x	x	10d	NA
Apta (1.34SC)	21A	x	x	21-27 fl oz	21-27 fl oz	x	12h	53.5 fl oz
tolfenpyrad		x	x	s	G	x	14d	2
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	4.8-14.5 fl oz	4.8-14.5 fl oz	4.8-14.5 fl oz	x	12h	72.5 fl oz
esfenvalerate		G	E[r]	G	G	x	14d	NA
Assail 30SG	4A	x	5.3-8 oz	5.3-8 oz	5.3-8 oz	5.3-8 oz	12h	32 oz
acetamiprid		x	E	F	G	F	7d	4
Avaunt eVo (30WDG)	22	x	5.6 oz	x	5-6 oz	x	12h	24 oz
indoxacarb		x	G	x	E	x	14d	4
Baythroid XL (1EC) **(RUP)**	3A	1.4-2 fl oz	2-2.4 fl oz	2-2.4 fl oz	2.4-2.8 fl oz	x	12h	5.6 fl oz
beta-cyfluthrin		G	E[r]	E	G	x	7d	NA
Belay (2.13SC)	4A	x	x	6 fl oz	6 fl oz	6 fl oz	12h	12 fl oz
clothianidin		x	x	E	G	G	21d	NA
Beleaf 50SG	29	x	x	2-2.8 oz	x	x	12h	8.4 oz
flonicamid		x	x	G	x	x	14d	3
Centaur WDG (70WDG)	16	x	x	x	x	34.5 oz	12h	69 oz
buprofezin		x	x	x	x	E	14d	2
Danitol 2.4EC **(RUP)**	3A	x	10.7-21.3 fl oz	10.7-21.3 fl oz	10.7-21.3 fl oz	x	24h	42.7 fl oz
fenpropathrin		x	E[r]	E	G	x	3d	NA
Delegate WG (25WG)	5	x	6-7 oz	x	6-7 oz	x	4h	28 oz
spinetoram		x	E	x	s	x	1d	4
Diazinon AG 600WBC **(RUP)**	1B	x	12.75 fl oz/100 gal	x	x	12.75 fl oz/100 gal	4d	51 fl oz
diazinon		x	G	x	x	F	21d	2
Entrust SC (2SC)	5	x	4-8 fl oz	x	x	x	4h	29 fl oz
spinosad		x	F	x	x	x	7d	3

(Continued)

Table 4-9. Insect management at first and second cover *(continued)*

Product and formulation Active ingredient	IRAC code[2]	borers	oriental fruit moth	plant bug/ stink bug	plum curculio	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Esteem 35WP	7C	x	4-5 oz	x	x	4-5 oz	12h	15 oz
pyriproxyfen		x	F	x	x	E	14d	3
Exirel (0.83SE)	28	x	10-20.5 fl oz	x	13.5-20.5 fl oz	x	12h	61.5 fl oz
cyantraniliprole		x	E	x	G	x	3d	3
Imidan 70W	1B	x	2.13-4.25 lb	x	2.1-4.25 lb	2.1-4.25 lb	4d	17 lb
phosmet		x	E[r]	x	G	E	14d	NA
Intrepid 2F	18	x	10-16 fl oz	x	x	x	4h	64 fl oz
methoxyfenozide		x	G	x	x	x	7d	NA
Lannate LV	1A	x	3 pt	3 pt	x	x	4d	18 pt
methomyl		x	F	G	x	x	4d	6
Malathion 8 (8EC)	1B	1.25 pt	1.25 pt	x	1.25 pt	1.25 pt	24h	3.75 pt
malathion		u	u	x	u	F	7d	3
Movento (2SC)	23	x	x	x	x	6-9 fl oz	24h	15.3 fl oz
spirotetramat		x	x	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	1.2-4 fl oz	x	12h	24 fl oz
zeta-cypermethrin		G	E[r]	E	G	x	14d	NA
Neemix 4.5 (0.39L)	UN	7-16 fl oz	7-16 fl oz	7-16 fl oz	x	7-16 fl oz	4h	NA
azadirachtin		F	u	E	i	G	0d	NA
Pounce 25WP	3A	6.4-16 oz	6.4-16 oz	x	6.4-16 oz	x	12h	48 fl oz
permethrin		F	E[r]	x	G	x	14d	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	x	24h	1.6 pt
gamma-cyhalothrin		G	G[r]	u	G	x	14d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	x	4.5-15.6 fl oz	x	4.5-15.6 fl oz	12h	15.6 fl oz
pyrethrins		u	x	u	x	u	0d	1
Rimon 0.83EC	15	20 fl oz	20-40 fl oz	20-40 fl oz	x	x	12h	150 fl oz
novaluron		u	E	u	x	x	8d	NA
Scorpion 35SL	4A	5.25-7 fl oz	x	5.25-7 fl oz	5.25-7 fl oz	x	12h	14.25 fl oz
dinotefuran		s	x	E	s	x	3/21d	NA
Sevin XLR Plus (4F)	1A	2-3 qt	2-3 qt	2-3 qt	2-3 qt	2-3 qt	12h	14 qt
carbaryl		u	F	F	F	u	3d	3
Sivanto Prime (1.67 SL)	4D	x	x	x	x	10.5-14 fl oz	4h	28 fl oz
flupyradifurone		x	x	x	x	G	14d	NA
Surround WP (95WP)	UN	25-50 lb	25-50 lb	x	25-50 lb	x	4h	NA
kaolin		x	u	x	s	x	0d	NA
Venom (70SG)	4A	3-4 oz	x	3-4 oz	3-4 oz	x	12h	6 oz
dinotefuran		u	x	E	u	x	3d	NA
Verdepryn 100SL (0.83SL)	28	x	5.5-11 fl oz	5.5-11 fl oz	5.5-11 fl oz	x	4h	33 fl oz
cyclaniliprole		x	E	s	u	x	7d	3
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	x	24h	12.8 fl oz
lambda-cyhalothrin		G	G[r]	E	G	x	14d	NA

Peach Summer Cover Sprays – Diseases

10 days after first cover. Until ~3 weeks prior to harvest

- Be aware of PHI when applying fungicides to early harvested varieties.
- Remember application limits when applying coppers to control bacterial spot.
- When environmental conditions are conducive for brown rot, scab or powdery mildew, maintain fungicide schedule every 7-10 days.

Table 4-10. Fungicide recommendations for disease management at summer cover[1]

Product and formulation Active ingredient	FRAC code[2]	bacterial spot/shot hole	brown rot	peach scab	powdery mildew/peach rusty spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	x	12-15.5 fl oz	9-15.5 fl oz	12-15.5 fl oz	4h	90 fl oz
azoxystrobin		x	F-E[r]	G	F	0d	See label
Badge SC	M	0.5–2 pt	x	x	x	24h	63.4 pt
copper sulfate + oxychloride		G-F	x	x	x	0d	NA
Captan	M4	x	2.5-5 lb	2.5-5 lb	2.5-5 lb	24h	40 lb
captan		x	G	G	F	0d	NA
Cevya	3	x	3-5 fl oz	3-5 fl oz	4-5 fl oz	12h	15 fl oz
mefentrifluconazole		x	E	E	E	0d	See label
Elevate 50 WDG	17	x	1-1.5 lb	x	x	12h	6 lb
fenhexamid		x	E-G	x	x	0d	NA
Elite 45DF	3	x	4-8 oz	x	4-8 oz	12h	3 lb
tebuconazole		x	E	x	E	0d	NA
Flint Extra	11	x	2.5-3.8 fl oz	2.5-3.8 fl oz	2.5-3.8 fl oz	12h	15.2 fl oz
trifloxystrobin		x	s (G)	E	E	1d	4
Fontelis (SC)	7	x	14-20 fl oz	14-20 fl oz	14-20 fl oz	12h	61 fl oz
penthiopyrad		x	E-G	F-G	F-G	0d	NA
Indar 2F	3	x	6 fl oz	6 fl oz	x	12h	48 fl oz
fenbuconazole		x	E[r]	F	x	0d	8
Inspire Super (EW)	3+9	x	16-20 fl oz	16-20 fl oz	16-20 fl oz	12h	80 fl oz
difenoconazole + cyprodinil		x	E	G-F	G-F	2d	4
Kenja 400 SC	7	x	12.5 fl oz	12.5 fl oz	x	12h	37.5 fl oz
isofetamid		x	E	G	x	1d	3
Kocide 3000	M	02.5-0.5 lb	x	x	x	48h	60 lb
copper hydroxide		G-F	x	x	x	0d	NA
Luna Experience (SC)	7+3	x	6-10 fl oz	8-10 fl oz	6-10 fl oz	12h	34 fl oz
fluopyram + tebuconazol		x	G-E	E	G	0d	NA
Luna Privilege	7	x	4-6.8 fl oz	4.8-6.8 fl oz	4-6.8 fl oz	12h	13.7 fl oz
fluopyram		x	E	F	G	0d	NA
Luna Sensation (SC)	7+11	x	5-7.6 fl oz	5-7.6 fl oz	5-7.6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		x	E	F	E-G	1d	4
Merivon XBF	7+11	x	4-6.7 fl oz	4-6.7 fl oz	4-6.7 fl oz	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		x	E	E-G	E-G	0d	3

(Continued)

Table 4-10. Fungicide recommendations for disease management at summer cover *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bacterial spot/shot hole	brown rot	peach scab	powdery mildew/peach rusty spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Microthiol Disperss	M	x	10-20 lb	x	10-20 lb	24h	NA
sulfur		x	F-P	x	F-P	0d	NA
Miravis	7	x	3.4-5.1 fl oz	3.4-5.1 fl oz	3.4-5.1 fl oz	4h	20.4 fl oz
pydiflumetofen		x	E	E-G	E-G	0d	4
Mycoshield	41	12 oz/100 g	x	x	x	12h	12 lb
oxytetracyline		E[r]	x	x	x	21d	8
Ph-D	19	x	x	6.2 oz	6.2 oz	4h	NA
polyoxin D		x	x	G	u	0d	NA
Pristine	7+11	x	10.5-14.5 oz	10.5-14.5 oz	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		x	E-G[r]	E-G	E[r]	0d	5
Quadris Top	11+3	x	12-14 fl oz	12-14 fl oz	12-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		x	E	u	G	0d	4
Quash	3	x	2.5-3.5 fl oz	2.5-3.5 fl oz	3.5-4 fl oz	12h	12 fl oz
metconazole		x	E-G	G	E	14d	3
Quilt Xcel	11+3	x	14 fl oz	14 fl oz	14 fl oz	12h	70 fl oz
azoxystrobin + propiconazole		x	E	G	G	0d	5
Quintec	13	x	x	x	7 fl oz	12h	28 fl oz
quinoxyfen		x	x	x	E	7d	4
Rally 40WSP	3	x	2.5-6 oz	x	2.5-6 oz	24h	3.25 lb
myclobutanil		x	G	x	E-G	0h	NA
Scala (SC)	9	x	9-18 fl oz	x	x	12h	54 fl oz
pyrimethanil		x	E-G	x	x	2d	3
Thiram Granuflo	M3	x	3.5 lb	3.5 lb	x	24h	21.2 lb
thiram		x	G	G	x	7d	NA
Tilt (EC)	3	x	4 fl oz	x	4 fl oz	12h	20 fl oz
propiconazole		x	E	x	G	0d	5
Topguard EQ	3+11	x	6-8 fl oz	6-8 fl oz	6-8 fl oz	12h	NA
flutriafol + azoxystrobin		x	G	u	E	7d	4
Topguard Specialty Crop	3	x	14 fl oz	x	14 fl oz	12h	56 fl oz
flutriafol		x	E	s(G)	G	7d	4
Topsin M WSB	1	x	1-1.5 lb	1-1.5 lb	1-1.5 lb	48h	4 lb
thiophanate-methyl		x	E[r]	G	G[r]	1d	NA
Vangard WG (75WG)	9	x	5 oz	x	x	12h	30 oz
cyprodinil		x	E-G	x	x	2d	4
Ziram 76DF	M3	x	4.5-8 lb	4.5-8 lb	x	48h	48.2 lb
ziram		x	G	G	x	30d	6

Peach Summer Covers – Insects

Apply at 10- to 14-day intervals.

Table 4-11. Insecticide recommendations at summer cover[1]

Product and formulation Active ingredient	IRAC code[2]	green June beetle	Japanese beetle	oriental fruit moth	plant bug/ stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	x	x	4.5-5.5 oz	12h	11 oz
thiamethoxam		x	x	x	G	14d	NA
Admire Pro (4.6F)	4A	1.4-2.8 fl oz	1.4-2.8 fl oz	x	2.8 fl oz	12h	8.4 fl oz
imidacloprid		G	G	x	u	0d	NA
Altacor (35WDG)	28	x	x	3-4.5 oz	x	4h	9 oz
chlorantraniliprole		x	x	E	x	10d	NA
Asana XL (0.66EC) **(RUP)**	3A	x	x	4.8-14.5 fl oz	4.8-14.5 fl oz	12h	72.5 fl oz
esfenvalerate		x	x	E[r]	G	14d	NA
Assail 30SG	4A	x	5.3-8 oz	5.3 - 8 oz	5.3-8 oz	12h	32 oz
acetamiprid		x	G	E	F	7d	4
Avaunt eVo (30WDG)	22	x	x	6 oz	x	12h	24 oz
indoxacarb		x	x	G	x	14d	4
Baythroid XL (1EC) **(RUP)**	3A	x	x	2-2.4 fl oz	2-2.4 fl oz	12h	5.6 fl oz
beta-cyfluthrin		x	x	E[r]	E	7d	NA
BeetleGone!	11	1-17.5 lb	1-17.5 lb	x	x	4h	NA
B. thuringiensis		G	G	x	x	0d	NA
Belay (2.13SC)	4A	x	x	x	6 fl oz	12h	12 fl oz
clothianidin		x	x	x	E	21d	NA
Beleaf 50SG	29	x	x	x	2-2.8 oz	12h	8.4 oz
flonicamid		x	x	x	G	14d	3
Danitol 2.4EC **(RUP)**	3A	x	10.7-21.3 fl oz	10.7-21.3 fl oz	10.7-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		x	E	E[r]	E	3d	NA
Delegate WG (25WG)	5	x	x	6-7 oz	x	4h	28 oz
spinetoram		x	x	E	x	1d	4
Diazinon AG 600WBC **(RUP)**	1B	x	x	12.75 fl oz/100 gal	x	4d	51 fl oz
diazinon		x	x	G	x	21d	2
Entrust SC (2SC)	5	x	x	4-8 fl oz	x	4h	29 fl oz
spinosad		x	x	F	x	7d	3
Esteem 35WP	7C	x	x	4-5 oz	x	12h	15 oz
pyriproxyfen		x	x	F	x	14d	3
Exirel (0.83SE)	28	x	13.5-20.5 fl oz	10-20.5 fl oz	x	12h	61.5 fl oz
cyantraniliprole		x	G	E	x	3d	3
Imidan 70W	1B	x	2.1-4.25 lb	2.1-4.25 lb	x	4d	17 lb
phosmet		x	G	E[r]	x	14d	NA
Intrepid 2F	18	x	x	10-16 fl oz	x	4h	64 fl oz
methoxyfenozide		x	x	G	x	7d	NA

(Continued)

Table 4-11. Insecticide recommendations at summer cover *(continued)*

Product and formulation Active ingredient	IRAC code[2]	green June beetle	Japanese beetle	oriental fruit moth	plant bug/ stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Lannate LV	1A	x	x	3 pt	3 pt	4d	18 pt
methomyl		x	x	F	G	4d	6
Malathion 8 (8EC)	1B	x	x	1.25 pt	x	24h	3.75 pt
malathion		x	x	u	x	7d	3
Mustang Maxx (0.83EC) **(RUP)**	3A	x	x	1.28-4 fl oz	1.28-4 fl oz	12h	24 fl oz
zeta-cypermethrin		x	x	E[r]	E	14d	NA
Neemix 4.5 (0.39L)	UN	x	x	7-16 fl oz	7-16 fl oz	4h	NA
azadirachtin		x	x	u	E	0d	NA
Pounce 25WP	3A	x	x	6.4-16 oz	x	12h	48 oz
permethrin		x	x	E[r]	x	14d	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		F	F	G[r]	u	14d	NA
Pyganic 5EC	3A	x	4.5-15.6 fl oz	x	4.5-15.6 fl oz	12h	15.6 fl oz
pyrethrins		x	u	x	u	0d	1
Rimon 0.83EC	15	x	x	20-40 fl oz	20-40 fl oz	12h	150 fl oz
novaluron		x	x	E	u	8d	NA
Scorpion 35SL	4A	x	x	x	5.25-7 fl oz	12h	14.25 fl oz
dinotefuran		x	x	x	E	3/21d	NA
Sevin XLR Plus (4F)	1A	x	2-3 qt	2-3 qt	2-3 qt	12h	14 qt
carbaryl		x	E	F	F	3d	3
Surround WP (95WP)	UN	x	25-50 lb	25-50 lb	x	4h	NA
kaolin		x	F	u	x	0d	NA
Venom (70SG)	4A	x	x	x	3-4 oz	12h	6 oz
dinotefuran		x	x	x	E	3d	NA
Verdepryn 100SL (0.83SL)	28	x	x	5.5-11 fl oz	5.5-11 fl oz	4h	33 fl oz
cyclaniliprole		x	x	E	s	7d	3
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	G[r]	E	14d	NA

Peach Pre-harvest – Diseases

Apply according to label directions beginning three weeks before harvest.

- Continued applications of fungicides may be necessary in orchards with moderate to high disease pressure (due to cultivar susceptibility, rainfall and/ or fungicide resistance).

Table 4-12. Pre-harvest fungicide recommendations[1]

Product and formulation Active ingredient	FRAC code[2]	brown rot	peach scab	powdery mildew/ peach rusty spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	12-15.5 fl oz	9-15.5 fl oz	12-15.5 fl oz	4h	90 fl oz
azoxystrobin		F-E[r]	G	F	0d	See label
Captan	M4	2.5-5 lb	2.5-5 lb	2.5-5 lb	24h	40 lb
captan		G	G	F	0d	NA
Cevya	3	3-5 fl oz	3-5 fl oz	4-5 fl oz	12h	15 fl oz
mefentrifluconazole		E	E	E	0d	See label
Elevate 50 WDG	17	1-1.5 lb	x	x	12h	6 lb
fenhexamid		E-G	x	x	0d	NA
Elite 45DF	3	4-8 oz	x	4-8 oz	12h	3 lb
tebuconazole		E	x	E	0d	NA
Flint Extra	11	2.5-3.8 fl oz	2.5-3.8 fl oz	2.5-3.8 fl oz	12h	15.2 fl oz
trifloxystrobin		s (G)	E	E	1d	4
Fontelis (SC)	7	14-20 fl oz	14-20 fl oz	14-20 fl oz	12h	61 fl oz
penthiopyrad		E-G	F-G	F-G	0d	NA
Indar 2F	3	6 fl oz	6 fl oz	x	12h	48 fl oz
fenbuconazole		E[r]	F	x	0d	8
Inspire Super (EW)	3+9	16-20 fl oz	16-20 fl oz	16-20 fl oz	12h	80 fl oz
difenoconazole + cyprodinil		E	G-F	G-F	2d	4
Kenja 400 SC	7	12.5 fl oz	12.5 fl oz	x	12h	37.5 fl oz
isofetamid		E	G	x	1d	3
Kocide 3000	M	3-5 lb	x	x	48h	60 lb
copper hydroxide		F	x	x	0d	NA
Luna Experience (SC)	7+3	6-10 fl oz	8-10 fl oz	6-10 fl oz	12h	34 fl oz
fluopyram + tebuconazol		G-E	E	G	0d	NA
Luna Privilege	7	4-6.8 fl oz	4.8-6.8 fl oz	4-6.84 fl oz	12h	13.7 fl oz
fluopyram		E	F	G	0d	NA
Luna Sensation (SC)	7+11	5-7.6 fl oz	5-7.6 fl oz	5-7.6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		E	F	E-G	1d	4
Merivon XBF	7+11	4-6.7 fl oz	4-6.7 fl oz	4-6.7 fl oz	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		E	E-G	E-G	0d	3
Microthiol Disperss	M	10-20 lb	x	10-20 lb	24h	NA
sulfur		F-P	x	F-P	0d	NA
Miravis	7	3.4-5.1 fl oz	3.4-5.1 fl oz	3.4-5.1 fl oz	4h	20.4 fl oz
pydiflumetofen		E	E-G	E-G	0d	4
Ph-D	19	x	6.2 oz	6.2 oz	4h	NA
polyoxin D		x	G	u	0d	NA
Pristine	7+11	10.5-14.5 oz	10.5-14.5 oz	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		E-G[r]	E-G	E[r]	0d	5
Quadris Top	11+3	12-14 fl oz	12-14 fl oz	12-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		E	u	G	0d	4

(Continued)

Table 4-12. Pre-harvest fungicide recommendations *(continued)*

Product and formulation Active ingredient	FRAC code[2]	brown rot	peach scab	powdery mildew/ peach rusty spot	REI[3] PHI[4]	Max amt[5] Max app[6]
Quash	3	2.5-3.5 fl oz	2.5-3.5 fl oz	3.5-4 fl oz	12h	12 fl oz
metconazole		E-G	G	E	14d	3
Quilt Xcel	11+3	14 fl oz	14 fl oz	14 fl oz	12h	70 fl oz
azoxystrobin + propiconazole		E	G	G	0d	5
Quintec	13	x	x	7 fl oz	12h	28 fl oz
quinoxyfen		x	x	E	7d	4
Rally 40WSP	3	2.5-6 oz	x	2.5-6 oz	24h	3.25 lb
myclobutanil		G	x	E-G	0d	NA
Scala (SC)	9	9-18 fl oz	x	x	12h	54 fl oz
pyrimethanil		E-G	x	x	2d	3
Thiram Granuflo	M3	3.5 lb	3.5 lb	x	24h	21.2 lb
thiram		G	G	x	7d	NA
Tilt (EC)	3	4 fl oz	x	4 fl oz	12h	20 fl oz
propiconazole		E	x	G	0d	5
Topguard EQ	3+11	6-8 fl oz	6-8 fl oz	6-8 fl oz	12h	NA
flutriafol + azoxystrobin		G	u	E	7d	4
Topguard Specialty Crop	3	14 fl oz	x	14 fl oz	12h	56 fl oz
flutriafol		E	s(G)	G	7d	4
Topsin M WSB	1	1-1.5 lb	1-1.5 lb	1-1.5 lb	48h	4 lb
thiophanate-methyl		E[r]	G	G[r]	1d	NA
Vangard WG (75WG)	9	5 oz	x	x	12h	30 oz
cyprodinil		E-G	x	x	2d	4
Ziram 76DF	M3	4.5-8 lb	4.5-8 lb	x	48h	48.2 lb
ziram		G	G	x	30d	6

Peach Pre-harvest – Insects

Apply any insecticides according to label directions beginning three weeks before harvest.

- If not using peachtree borer mating disruption, peach tree 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 152.

Table 4-13. Pre-harvest insecticide recommendations[1]

Product and formulation Active ingredient	IRAC code[2]	borers	Japanese beetle and green June beetle	oriental fruit moth	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Admire Pro (4.6F)	4A	x	1.4-2.8 fl oz	x	x	12h	8.4 fl oz
imidacloprid		x	G	x	x	0d	NA
Altacor (35WDG)	28	x	x	3-4.5 oz	x	4h	9 oz
chlorantraniliprole		x	x	E	x	10d	NA
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	x	4.8-14.5 fl oz	x	12h	72.5 fl oz
esfenvalerate		G	x	E[r]	x	14d	NA

(Continued)

Table 4-13. Pre-harvest insecticide recommendations *(continued)*

Product and formulation Active ingredient	IRAC code[2]	borers	Japanese beetle and green June beetle	oriental fruit moth	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Assail 30SG	4A	5.3-8 oz	5.3-8 oz	5.3-8 oz	x	12h	32 oz
acetamiprid		G	G	E	x	7d	4
Avaunt eVo (30WDG)	22	x	x	6 oz	x	12h	24 oz
indoxacarb		x	x	G	x	14d	4
Baythroid XL (1EC) **(RUP)**	3A	1.4-2 fl oz	x	2-2.4 fl oz	x	12h	5.6 fl oz
beta-cyfluthrin		G	x	E[r]	x	7d	NA
BeetleGone!	11	x	1-17.5 lb	x	x	4h	NA
B. thuringiensis		x	G	x	x	0d	NA
Danitol 2.4EC **(RUP)**	3A	x	10.7-21.3 fl oz	10.7-21.3 fl oz	10.7-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		x	E	E[r]	E	3d	NA
Delegate WG (25WG)	5	x	x	6-7 oz	4.5-7 oz	4h	28 oz
spinetoram		x	x	E	G	1d	4
Entrust SC (2SC)	5	x	x	4-8 fl oz	4-8 fl oz	4h	29 fl oz
spinosad		x	x	F	G-E	7d	3
Esteem 35WP	7C	x	x	4-5 oz	x	12h	15 oz
pyriproxyfen		x	x	F	x	14d	3
Exirel (0.83SE)	28	x	13.5-20.5 fl oz	10-20.5 fl oz	13.5-20.5 fl oz	12h	61.5 fl oz
cyantraniliprole		x	G	E	E	3d	3
Imidan 70W	1B	x	2.1-4.25 lb	2.1-4.25 lb	2.1-4.25 lb	4d	17 lb
phosmet		x	G	E[r]	E	14d	NA
Intrepid 2F	18	x	x	10-16 fl oz	x	4h	64 fl oz
methoxyfenozide		x	x	G	x	7d	NA
Lannate LV	1A	x	x	3 pt	x	4d	18 pt
methomyl		x	x	F	x	4d	6
Malathion 8 (8EC)	1B	1.25 pt	x	1.25 pt	x	24h	3.75 pt
malathion		u	x	u	x	7d	3
Movento (2SC)	23	x	x	x	6-9 fl oz	24h	15.3 fl oz
spirotetramat		x	x	x	u	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	1.28-4 fl oz	x	1.28-4 fl oz	4 fl oz	12h	24 fl oz
zeta-cypermethrin		G	x	E[r]	E	14d	NA
Neemix 4.5 (0.39L)	UN	7-16 fl oz	x	7-16 fl oz	x	4h	NA
azadirachtin		F	x	u	x	0d	NA
Pounce 25WP	3A	6.4-16 oz	x	6.4-16 oz	x	12h	48 oz
permethrin		F	x	E[r]	x	14d	NA
Proaxis (0.5EC) **(RUP)**	3A	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	F	G[r]	x	14d	NA

(Continued)

Table 4-13. Pre-harvest insecticide recommendations *(continued)*

Product and formulation Active ingredient	IRAC code[2]	borers	Japanese beetle and green June beetle	oriental fruit moth	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Pyganic 5EC	3A	4.5-15.6 fl oz	4.5-15.6 fl oz	x	4.5-15.6 fl oz	12h	15.6 fl oz
pyrethrins		u	u	x	F	0d	1
Rimon 0.83EC	15	20 fl oz	x	20-40 fl oz	20-40 fl oz	12h	150 fl oz
novaluron		u	x	E	G	8d	NA
Sevin XLR Plus (4F)	1A	2-3 qt	2-3 qt	2-3 qt	x	12h	14 qt
carbaryl		u	E	F	x	3d	3
Surround WP (95WP)	UN	x	25-50 lb	25-50 lb	x	4h	NA
kaolin		x	F	u	x	0d	NA
Venom (70SG)	4A	3-4 oz	x	x	x	12h	6 oz
dinotefuran		u	x	x	x	3d	NA
Verdepryn 100SL (0.83SL)	28	x	x	5.5-11 fl oz	5.5-11 fl oz	4h	33 fl oz
cyclaniliprole		x	x	E	u	7d	3
Warrior II (2.08CS) **(RUP)**	3A	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		G	E	G[r]	x	14d	NA

Special Notes on Peach Schedule

Spotted lanternfly

The spotted lanternfly is an invasive planthopper that has spread 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 orchard and vineyard 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)	11	x	F-E[r]	x	G	F	4h	92.3 fl oz
azoxystrobin							0d	15
Badge SC	M	G-F	F	G	x	x	24h	18 lb
copper oxychloride+copper hydroxide							0d	NA
Bravo Weather Stick	M5	x	G	G	u	F	12h	18.8 lb
chlorothalonil							shuck-split	NA
Captan	M3	x	G	F	G	x	24h	30 lb
captan							0d	NA
Cevya	3	x	E	x	E	x	12h	NA
mefentrifluconazole							0d	see label
copper oxychloride (C-O-C-S WDG)	M	G-F	F	G	x	x	48h	36 lb
copper oxychloride							21d	3

(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]
Cuprofix Ultra 40 Disperss	M	G-F	F	G	x	x	48h	45 lb
basic copper sulfate							120d	NA
Elevate 50 WDG	17	x	E-G	x	x	x	12h	6 lb
fenhexamid							0d	NA
Elite 45DF	3	x	E	x	x	G	12h	3 lb
tebuconazole							0d	NA
Ferbam Granuflo	M	x	F	E-G	F	x	24h	3-4 lb
ferbam							21d	NA
Flint Extra	11	x	E-G	x	E	E	12h	15.2 fl oz
trifloxystrobin (higher rate)							1d	3
Fontelis (SC)	7	x	E-G	x	F-G	F-G	12h	61 fl oz
penthiopyrad							0d	4
Indar 2F2	3	x	E[r]	x	F	E-G	12h	48 fl oz
fenbuconazole							0d	NA
Inspire Super (EW)	3+9	x	E	x	G-F	G-F	12h	80 fl oz
difenoconazole+cyprodinil							2d	8
Kenja 400 SC	7	x	E	x	x	x	12h	37.5 fl oz
isofetamid							1 day	3
Kocide 3000	M	G-F	F	G	x	x	48h	60 lb
copper hydroxide							0d	4
Luna Privilege	7	x	E	x	F	G	12h	34 fl oz
fluopyram							0d	6
Luna Sensation (SC)	7+11	x	E	x	F	E-G	12h	27.1 fl oz
fluopyram+trifloxystrobin							1d	NA
Merivon XBF	7+11	x	E	x	E-G	E-G	12h	20.1 fl oz
fluxapyroxad+pyraclostrobin							0d	4
Mycoshield	41	E[r]	x	x	x	x	12h	N/A
xxytetracycline							21d	3
Pristine	7+11	x	E-G[r]	x	E-G	E[r]	12h	72.5 oz
pyaclostrobin+boscalid							0d	9
Quadris Top	11+ 3	x	E	x	x	G	12h	56 fl oz
azoxystrobin+difenoconazole							0d	5
Quash	3	x	E-G	x	G	E	12h	10.5-12 oz
metconazole							14d	NA
Quilt Xcel	11+ 3	x	E	x	G	G	12h	70 fl oz
azoxystrobin+propiconazole							0d	3
Quintec	13	x	x	x	x	E	12h	28 fl oz
quinoxyfen							7d	5
Rally 40WSP	3	x	G	x	x	E-G	24h	3.25 lb
myclobutanil							1d	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]
Rovral 4F iprodione	2	x	E	x	x	x	24h N/A	4 pt NA
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
Vangard 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.

[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
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
Pounce 25WP permethrin	3A	x	x	x	E[r]	G	G	G	x	x	12h 14d	48 oz NA
PQZ (1.87SC) pyrifluquinazon	9B	x	E	x	x	x	x	x	x	x	12h 7d	4.8 fl oz 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]
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.

[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.

5. PLUM

Plum Spray Schedule

Entomology Lead: K. Athey, R. Bessin
Pathology Lead: J. Beckerman

How to read the spray schedule tables

Every plum 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.

Plum Dormant (before buds break in the spring) – Diseases

Notes on disease management

- **Bacterial spot and copper pesticides:** Plum is on most, but not all, copper fungicide labels. Check label before use. Using copper at the dormant stage may also reduce the overwintering inoculum of the bacterium that cause bacterial canker, but have limited efficacy in suppressing bacterial spot, plum pockets and black knot. As season progresses, reduce the rate of copper applied to reduce the risk of phytotoxicity. Copper applied with tanks having a pH of less than 6.5 may cause phytotoxicity issues.
- **Black knot:** Prune out and destroy knots during the dormant season with pruning cuts at least 8" below knots. Continue knot removal all season long, whenever they are observed. Remove nearby wild plums and cherry seedlings.
- **Cytospora canker:** Paint trunks with whitewash to prevent winter injury and sunscald.
- **Plum pockets (leaf curl):** Autumn application during leaf fall is the best time for application, followed by spring application at budswell. Unless disease pressure is severe, Luna Experience and Luna Sensation are better deployed later in the season for control of brown rot and powdery mildew.

Table 5-1. Fungicides labeled for disease control at dormant[1]

Product and formulation Active ingredient	FRAC code[2]	bacterial spot DORMANT	black knot	plum pockets *(Taphrina spp.)*	REI[3] PHI[4]	Max amt[5] Max app[6]
Badge SC	M	1.5-5 pt	1.5-5 pt	1.5-5 pt	24h	18 lb
copper sulfate + oxychloride		G-F	x	s	0d	NA
Bravo Weather Stik	M3	3-4 pt	3-4 pt	3-4 pt	12h	18.8 lb
chlorothalonil		G	G	G	shuck-split	NA
C-O-C-S WDG	M	1-2.9 lb	x	1-2.9 lb	48h	35 lb
copper oxychloride		G-F	x	G	21d	3
Champ FL	M	5.3-8 pt	x	5.3-8 pt	48 h	49.6 pt
copper hydroxide		s	x	s	NA	NA
Cuprofix Ultra 40 disperss	M	5-8 lb	3-3.75	5-7.5 lb	48h	45 lb
copper sulfate		G-F	F	G	120d	NA
Kocide 3000	M	3.5-7 lb	1.75-3.5 lb	1.75-3.5 lb	48h	60 lb
copper hydroxide		G-F	F	G-F	0d	4

Plum Dormant (before buds break in the spring) – Insects

Notes on insect management

- **European red mite and scale insects:** Apply dormant oil at a rate of 2 gal per 100 gals (2%). Check labels carefully for temperature restrictions (e.g., when temperatures are above 40F° or never during freezing weather).

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

Notes on disease management

- Copper pesticides: Copper rates are tied to crop development, with rates reduced as the season progresses to minimize the risk of phytotoxicity. Do not apply during cooler conditions with extended dews or fog. Note: Copper has limited efficacy for control of bacterial spot. For more information see Bacterial Spot of Peach, Nectarine and Plum on pages 152-153.

Table 5-2. Fungicides labeled for disease control pre-bloom through popcorn[1]

Product and formulation Active ingredient	FRAC code[2]	bacterial spot	black knot	plum pockets *(Taphrina spp.)*	REI[3] PHI[4]	Max amt[5] Max app[6]
Badge SC	M	1.5-5 pt	1.5-5 pt	1.5-5 pt	24h	18 lb
copper sulfate + oxychloride		G-F	F	s	0d	NA
Bravo Weather Stik	M3	3-4 pt	3-4 pt	3-4 pt	12h	18.8 lb
chlorothalonil		G	G	G	shuck-split	NA
C-O-C-S WDG	M	1-2.9 lb	x	x	48h	35 lb
copper oxychloride		G-F	x	x	21d	3
Captan 80WDG	M	x	3.75 lb	3.75 lb	24h	40 lb
captan		x	s	F	0d	NA
Champ FL	M	4.2 pt	x	x	48 h	49.6 pt
copper hydroxide		s	x	S	NA	NA

(Continued)

Table 5-2. Fungicides labeled for disease control pre-bloom through popcorn *(continued)*

Product and formulation Active ingredient	FRAC code[2]	bacterial spot	black knot	plum pockets *(Taphrina spp.)*	REI[3] PHI[4]	Max amt[5] Max app[6]
Cuprofix Ultra 40 disperss	M	1-2.5 lb	3-3.75	5-7.5 lb	48h	45 lb
copper sulfate		G-F	F	G	120d	NA
Kocide 3000	M	0.25-0.5 lb	1.75-3.5 lb	1.75-3.5 lb	48h	60 lb
copper hydroxide		G-F	F	G-F	0d	4
Luna Experience (SC)	7+3	x	x	6-10 fl oz	12 h	34 fl oz
fluopyram + tebuconazol		x	x	u	1d	varies
Luna Sensation (SC)	7+11	x	x	5 to 7.6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		x	x	E	1d	4
Pristine	7+11	x	x	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		x	x	s	0d	9
Topguard Specialty Crop	3	x	x	13 fl oz	12h	56 fl oz
flutriafol		x	x	G	7d	4

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

Notes on insect management

- **Oriental fruit moth:** Pheromone traps for oriental fruit moth should be deployed pre bloom. For mating disruption, see Mating Disruption for Peach Pests page 153.

Table 5-3. Insecticides labeled for insect management delayed dormant to pre-bloom[1]

Product and formulation Active ingredient	IRAC code[2]	aphid	European red mite	leafroller	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	x	1 lb	x	x	12h	1 lb
bifenazate		x	G	x	x	3d	1
Actara (25WDG)	4A	3-4 oz	x	x	x	12h	11 oz
thiamethoxam		E	x	x	x	14d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	2.25-4.25 fl oz	x	x	12h	8.5 fl oz
abamectin		x	G	x	x	21d	2
Altacor (35WDG)	28	x	x	3-4.5 oz	x	4h	9 oz
chlorantraniliprole		x	x	E	x	10d	NA
Apta (1.34SC)	21A	17-21 fl oz	x	21-27 fl oz	x	12h	53.5 fl oz
tolfenpyrad		u	x	G	x	14d	2
Asana XL (0.66EC) **(RUP)**	3A	4.8-14.5 fl oz	x	4.8-14.5 fl oz	x	12h	72.5 fl oz
esfenvalerate		u	x	E	x	14d	NA
Assail 30SG	4A	2.5-5.3 oz	x	x	5.3-8 oz	12h	32 oz
acetamiprid		E	x	x	F	7d	4
Baythroid XL (1EC) **(RUP)**	3A	2.4-2.8 fl oz	x	2.4-2.8 fl oz	x	12h	5.6 fl oz
beta-cyfluthrin		E	x	u	x	7d	NA
Beleaf 50SG	29	2-2.8 oz	x	x	x	12h	8.4 fl oz
flonicamid		E	x	x	x	14d	3

(Continued)

Table 5-3. Insecticides labeled for insect management delayed dormant to pre-bloom *(continued)*

Product and formulation Active ingredient	IRAC code[2]	aphid	European red mite	leafroller	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Centaur WDG (70WDG)	16	x	x	x	34.5 oz	12h	69 oz
buprofezin		x	x	x	E	14d	2
Closer SC (2SC)	4C	1.5-2.75 fl oz	x	x	5.7 fl oz	12h	17 fl oz
sulfoxaflor		E	x	x	s	7d	4
Danitol 2.4EC **(RUP)**	3A	10.3-21.3 fl oz	10.3-21.3 fl oz	10.3-21.3 fl oz	x	24h	42.7 fl oz
fenpropathrin		u	F	u	x	3d	NA
Delegate WG (25WG)	5	x	x	4.5-7 oz	x	4h	28 oz
spinetoram		x	x	E	x	1d	4
Diazinon AG600 WBC **(RUP)**	1B	12.75 fl oz/100 gal	6.5-12.25 fl oz/100 gal	x	12.75 fl oz/100 gal	4d	102 fl oz
diazinon		u	u	x	F	21d	2
Dimilin 2L **(RUP)**	15	x	x	8-16 fl oz	x	12h	32 fl oz
diflubenzuron		x	x	u	x	14d	2
Entrust SC (2SC)	5	x	x	4-8 fl oz	x	4h	29 fl oz
spinosad		x	x	u	x	1d	3
Envidor 2SC	23	x	16-18 fl oz	x	x	12h	18 fl oz
spirodiclofen		x	E	x	x	7d	1
Esteem 35WP	7C	x	x	x	4-5 oz	12h	15 oz
pyriproxyfen		x	x	x	E	14d	3
Exirel (0.83SE)	28	13.5-20.5 fl oz	x	10-20.5 fl oz	x	12h	61.5 fl oz
cyantraniliprole		E	x	E	x	3d	3
Imidan 70W	1B	x	x	2.13-4.25 lb	2.13-4.25 lb	7d	13 lb
phosmet		x	x	E	E	7d	NA
Intrepid 2F	18	x	x	8-16 fl oz	x	4h	64 fl oz
methoxyfenozide		x	x	E	x	7d	NA
Magister SC (1.7SC)	21A	x	32-36 fl oz	x	x	12h	36 fl oz
fenazaquin		x	E	x	x	3d	1
Mustang Maxx (0.83EC) **(RUP)**	3A	x	x	1.28-4 fl oz	x	12h	24 fl oz
zeta-cypermethrin		x	x	E	x	14d	NA
Nexter (75WP)	21	x	4.4-10.7 oz	x	x	12h	21.3 oz
pyridaben		x	G	x	x	7d	2
Oil (superior)	UN	x	1.5-2%	x	1.5-2%	4h	NA
mineral oil		x	E	x	G	0d	NA
Onager (1EC)	10A	x	12-24 oz	x	x	12h	24 fl oz
hexythiazox		x	E	x	x	7d	1
Portal XLO (0.4EC)	21A	x	2 pt	x	x	12h	4 pt
fenpyroximate		x	E	x	x	7d	2
PQZ (1.87SC)	9B	2.4-3.2 fl oz	x	x	x	12h	4.8 fl oz
pyrifluquinazon		E	x	x	x	7h	2

(Continued)

Table 5-3. Insecticides labeled for insect management delayed dormant to pre-bloom *(continued)*

Product and formulation Active ingredient	IRAC code[2]	aphid	European red mite	leafroller	San Jose scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Proaxis (0.5EC) **(RUP)**	3A	2.5-5.1 fl oz	x	2.5-5.1 fl oz	x	24h	1.6 pt
gamma-cyhalothrin		u	x	E	x	14d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	12h	NA
pyrethrins		u	u	u	u	0d	10
Rimon 0.83EC	15	x	x	20-50 fl oz	x	12h	150 fl oz
novaluron		x	x	E	x	8d	NA
Savey 50DF	10A	x	3-6 oz	x	x	12h	6 oz
hexythiazox		x	E	x	x	28d	1
Sevin XLR Plus (4F)	1A	2-3 qt	x	2-3 qt	4-5 qt	12h	14 qt
carbaryl		u	x	F	u	3d	3
Sivanto Prime (1.67SC)	4D	7-14 fl oz	x	x	10.5-14 fl oz	4h	28 fl oz
flupyradifurone		E	x	x	G	14d	NA
Surround WP (95WP)	UN	x	x	25-50 lb	x	4h	NA
kaolin		x	x	u	x	0d	NA
Vendex 50WP **(RUP)**	12B	x	1-2 lb	x	x	2d	3 lb
fenbutatin-oxide		x	G	x	x	14d	2
Verdepryn 100SL (0.83SL)	28	x	x	5.5-11 fl oz	x	4h	33 fl oz
cyclaniliprole		x	x	E	x	7d	3
Versys Inscalis (0.83DC)	9D	1.5 fl oz	x	x	x	12h	3 fl oz
afidopyropen		G	x	x	x	7d	NA
Warrior II (2.08CS) **(RUP)**	3A	1.2-2.5 fl oz	x	1.2-2.5 fl oz	x	24h	12.8 fl oz
lambda-cyhalothrin		u	x	u	x	14d	NA
Zeal (72WP)	10B	x	2-3 oz	x	x	12h	3 oz
etoxazole		x	E	x	x	7d	1

Plum Full Bloom – Diseases

Notes on disease management

- Copper pesticides: Copper is not recommended after early bloom, to protect both flowers and bees.

Table 5-4. Fungicides labeled for disease control at bloom[1]

Product and formulation Active ingredient	FRAC code[2]	brown rot	bacterial spot	black knot	REI[3] PHI4	Max amt[5] Max app[6]
Abound (SC)	11	12-15.5 fl oz	x	x	4h	92.3 fl oz
azoxystrobin		F-E[r]	x	x	0d	15
Badge SC	M	3.5-5 pt	1.5-5 pt	1.5-5 pt	24h	18 lb
copper sulfate + oxychloride		F	G-F	s	0d	NA
Bravo Weather Stik	M3	3.1-4.1 pt	x	3-4 pt	12h	18.8 lb
chlorothalonil		G	G	G	shuck split	NA
C-O-C-S WDG	M	1-2.9 lb	1-2.9 lb	x	48h	35 lb
copper oxychloride		F	G-F	x	21d	3
Captan 80WDG	M	3.7 lb	x	x	24h	40 lb
captan		G	x	s	0d	NA
Cevya	3	5 oz	x	x	12h	15 fl oz
mefentrifluconazole		E	x	x	0d	5
Champ FL	M	4.2 pt	4.2 pt	4.2 pt	48 h	49.6 pt
copper hydroxide		F	s	s	NA	NA
Cuprofix Ultra 40 Disperss	M	3.75 lb	1-2.5 lb	3-3.75	48h	45 lb
copper sulfate		F	G-F	F	120d	NA
Elevate 50 WDG	17	1-1.5 lb	x	x	12h	6 lb
fenhexamid		E-G	x	x	0d	NA
Elite 45DF	3	2 oz	x	x	12h	3 lb
tebuconazole		E	x	x	0d	NA
Flint Extra	11	2.5-3.8 oz	x	x	12h	15.2 fl oz
trifloxystrobin		E-G	x	x	1d	3
Fontelis (SC)	7	14-20 fl oz	x	x	12h	61 fl oz
penthiopyrad		E-G	x	x	0d	4
Indar 2F	3	6 fl oz	x	x	12h	48 fl oz
fenbuconazole		E[r]	x	x	0d	NA
Inspire Super (EW)	3+9	16-20 fl oz	x	x	12h	80 fl oz
difenoconazole + cyprodinil		E	x	x	2d	8
Kenja 400 SC	7	12.5 fl oz	x	x	12h	37.5 fl oz
isofetamid		E	x	x	1 day	3
Kocide 3000	M	3.5-5 lb	0.25-0.5 lb	1.75-3.5 lb	48h	60 lb
copper hydroxide		F	G-F	s	0d	4
Luna Experience (SC)	7+3	6-10 oz	x	x	12h	34 fl oz
fluopyram + tebuconazol		G-E	x	x	1d	varies

(Continued)

Table 5-4. Fungicides labeled for disease control at bloom *(continued)*

Product and formulation Active ingredient	FRAC code[2]	brown rot	bacterial spot	black knot	REI[3] PHI4	Max amt[5] Max app[6]
Luna Privilege	7	4-6.8 fl oz	x	x	12h	13.7 fl oz
fluopyram		E	x	x	0d	6
Luna Sensation (SC)	7+11	6-10 fl oz	x	x	12h	27.1 fl oz
fluopyram + trifloxystrobin		E	x	x	1d	4
Merivon XBF	7+11	4-6.7 fl oz	x	x	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		E	x	x	0d	4
Microthiol Disperss	M	10-20 lb	x	x	24h	NA
sulfur		F	x	x	0d	3
Miravis	7	3.4-5.1 fl oz	x	x	4 hr	20.4 fl oz
pydiflumetofen		E-G	x	x	0d	4
Ph-D	19	6.2 oz	x	x	0d	NA
polyoxin D		G	x	x	NA	NA
Pristine	7+11	10.5-14.5 oz	x	x	12h	72.5 oz
pyaclostrobin + boscalid		E-G[r]	x	x	0d	9
Quadris Top	11+3	12-14 fl oz	x	x	12h	56 fl oz
azoxystrobin + difenoconazole		E	x	x	0d	5
Quash	3	2.5-3.5 oz	x	x	12h	12 oz
metconazole		E-G	x	x	14d	3
Quilt Xcel	11+3	14 fl oz	x	x	12h	70 fl oz
azoxystrobin + propiconazole		E	x	x	0d	5
Rally 40WSP	3	2.5-6 oz	x	x	24h	2.75 lb
myclobutanil		G	x	x	1d	NA
Rovral 4F	2	1-2 pt	x	x	24h	4 pt
iprodione		E	x	x	N/A	NA
Scala (SC)	9	9-18 fl oz	x	x	12h	54 fl oz
pyrimethanil		E-G	x	x	2d	2
Tilt (EC)	3	4 fl oz	x	x	12h	20 fl oz
propiconazole		E	x	x	0d	5
Topguard EQ	3+11	6-8 oz	x	x	12h	NA
flutriafol + azoxystrobin		G	x	x	7d	4
Topguard Specialty Crop	3	13 fl oz	x	x	12h	56 fl oz
flutriafol		E	x	x	7d	4
Topsin M WSB	1	1-1.5 lb	x	1-1.5 lb	48h	4 lb
thiophanate-methyl		E[r]	x	E[r]	1d	NA
Vanguard WG (75WG)	9	5 oz	x	x	12h	30 oz
cyprodinil		E-G	x	x	2d	4

Plum Full Bloom – Insects

Notes on insect management

- **Protect pollinators! Do not apply insecticides during bloom.**

Plum Petal Fall through Shuck Split – Diseases

Notes on disease management

Brown rot

- Failure to control plum curculio and/or brown marmorated stink bug may result in an increase in brown rot.
- When using coppers or captan post-bloom, drying conditions should be excellent to minimize the risk of phytotoxicity. Applications of captan from shuck split through early July can cause shot-holing of leaves and spotting of fruit of some European and Japanese plums.
- Rovral cannot be applied after petal fall.
- The last application of Bravo is at shuck split.

Table 5-5. Fungicides labeled for disease control from petal fall through shuck split[1]

Product and formulation Active ingredient	FRAC code[2]	brown rot	bacterial spot	black knot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	12-15.5 fl oz	x	x	4h	92.3 fl oz
azoxystrobin		F-E[r]	x	x	0d	15
Bravo Weather Stik	M3	3.1-4.1 pt	x	3-4 pt	12h	18.8 lb
chlorothalonil		G	G	G	shuck split	NA
Captan 80WDG	M	3.7 lb	x	x	24h	40 lb
captan		G	x	x	0d	NA
Cevya	3	5 oz	x	x	12h	15 fl oz
mefentrifluconazole		E	x	x	0d	5
Elevate 50 WDG	17	1-1.5 lb	x	x	12h	6 lb
fenhexamid		E-G	x	x	0d	NA
Elite 45DF	3	2 oz	x	x	12h	3 lb
tebuconazole		E	x	x	0d	NA
Flint Extra	11	2.5-3.8 fl oz	x	x	12h	15.2 fl oz
trifloxystrobin		E-G	x	x	1d	3
Fontelis (SC)	7	14-20 fl oz	x	x	12h	61 fl oz
penthiopyrad		E-G	x	x	0d	4
Indar 2F	3	6 fl oz	x	x	12h	48 fl oz
fenbuconazole		E[r]	x	x	0d	NA
Inspire Super (EW)	3+9	16-20 fl oz	x	x	12h	80 fl oz
difenoconazole + cyprodinil		E	x	x	2d	8
Kenja 400 SC	7	12.5 fl oz	x	x	12h	37.5 fl oz
isofetamid		E	x	x	1 day	3
Luna Experience (SC)	7+3	6-10 fl oz	x	x	12h	34 fl oz
fluopyram + tebuconazol		G-E	x	x	1d	NA
Luna Privilege	7	4-6.8 fl oz	x	x	12h	13.7 fl oz
fluopyram		E	x	x	0d	6

(Continued)

Table 5-5. Fungicides labeled for disease control from petal fall through shuck split *(continued)*

Product and formulation Active ingredient	FRAC code[2]	brown rot	bacterial spot	black knot	REI[3] PHI[4]	Max amt[5] Max app[6]
Luna Sensation (SC)	7+11	6-10 fl oz	x	x	12h	27.1 fl oz
fluopyram + trifloxystrobin		E	x	x	1d	4
Merivon XBF	7+11	4-6.7 fl oz	x	x	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		E	x	x	0d	4
Microthiol Disperss	M	10-20 lb	x	x	24h	NA
sulfur		F	x	x	0d	3
Miravis	7	3.4-5.1 fl oz	x	x	4 hr	20.4 fl oz
pydiflumetofen		E-G	x	x	0d	4
Ph-D	19	6.2 oz	x	x	0d	NA
polyoxin D		G	x	x	NA	NA
Pristine	7+11	10.5-14.5 oz	x	x	12h	72.5 oz
pyaclostrobin + boscalid		E-G[r]	x	x	0d	9
Quadris Top	11+3	12-14 fl oz	x	x	12h	56 fl oz
azoxystrobin + difenoconazole		E	x	x	0d	5
Quash	3	2.5-3.5 oz	x	x	12h	12 oz
metconazole		E-G	x	x	14d	3
Quilt Xcel	11+3	14 fl oz	x	x	12h	70 fl oz
azoxystrobin + propiconazole		E	x	x	0d	5
Rally 40WSP	3	2.5-6 oz	x	x	24h	2.75 lb
myclobutanil		G	x	x	1d	NA
Rovral 4F	2	1-2 pt	x	x	24h	4 pt
iprodione		E	x	x	N/A	NA
Scala (SC)	9	9-18 fl oz	x	x	12h	54 fl oz
pyrimethanil		E-G	x	x	2d	2
Tilt (EC)	3	4 fl oz	x	x	12h	20 fl oz
propiconazole		E	x	x	0d	5
Topguard EQ	3+11	6-8 oz	x	x	12h	NA
flutriafol + azoxystrobin		G	x	x	7d	4
Topguard Specialty Crop	3	13 fl oz	x	x	12h	56 fl oz
flutriafol		E	x	x	7d	4
Topsin M WSB	1	1-1.5 lb	x	1-1.5 lb	48h	4 lb
thiophanate-methyl		E[r]	x	E[r]	1d	NA
Vanguard WG (75WG)	9	5 oz	x	x	12h	30 oz
cyprodinil		E-G	x	x	2d	4

Plum Petal Fall through Second Cover – Insects

Notes on insect management

- **Codling moth:** Pheromone traps for codling moth should be deployed by petal fall with the first captures expected during the early cover sprays.
- **San Jose scale:** Insecticides are best applied when scale crawler nymphs are active.
  - Do not apply Movento until PF is complete.
- **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, See Borers of Peach, Cherry, and Plum, page 152.

Table 5-6. Insecticides labeled for insect management petal fall through second cover[1]

Product and formulation Active ingredient	IRAC code[2]	European red mite	plum curculio	Japanese beetle	San Jose scale	leaf-roller	oriental fruit moth	peach tree borers	peri-odical cicada	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	1 lb	x	x	x	x	x	x	x	12h	1 lb
bifenazate		G	x	x	x	x	x	x	x	3d	1
Actara (25WDG)	4A	x	4.5-5.5 oz	x	x	x	x	x	x	12h	11 oz
thiamethoxam		x	G	x	x	x	x	x	x	14d	NA
Admire Pro (4.6F)	4A	x	2.8 fl oz	1.4-2.8 fl oz	1.4-2.8 fl oz	x	x	x	x	12h	10.5/14 fl oz
imidacloprid		x	s	G	F	x	x	x	x	0-21d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	2.25-4.25 fl oz	x	x	x	x	x	x	x	12h	8.5 fl oz
abamectin		G	x	x	x	x	x	x	x	21d	2
Altacor (35WDG)	28	x	x	x	x	3-4.5 oz	3-4.5 oz	x	x	4h	9 oz
chlorantraniliprole		x	x	x	x	E	E	x	x	10d	NA
Apta (1.34SC)	21A	x	21-27 fl oz	x	x	21-27 fl oz	x	x	x	12h	53.5 fl oz
tolfenpyrad		x	G	x	x	G	x	x	x	14d	2
Asana XL (0.66EC) **(RUP)**	3A	x	4.8-14.5 fl oz	x	x	4.8-14.5 fl oz	4.8-14.5 fl oz	4.8-14.5 f oz	4.8-14.5 fl oz	12h	72.5 fl oz
esfenvalerate		x	G	x	x	E	E	G	E	14d	NA
Assail 30SG	4A	x	5-8 oz	5.3-8 oz	5.3-8 oz	x	5.3-8 oz	x	x	12h	32 oz
acetamiprid		x	E	F	F	x	E	x	x	7d	4
Avaunt (30WDG)	22	x	5-6 oz	x	x	x	6 oz	x	x	12h	24 oz
indoxacarb		x	G	x	x	x	F	x	x	14d	4
Baythroid XL (1EC) **(RUP)**	3A	x	2.4-2.8 fl oz	x	x	2.4-2.8 fl oz	2-2.4 fl oz	1.4-2 fl oz	2.4-2.8 fl oz	12h	5.6 fl oz
beta-cyfluthrin		x	G	x	x	u	E	G	E	7d	NA
Centaur WDG (70WDG)	16	x	x	x	34.5 oz	x	x	x	x	12h	69 oz
buprofezin		x	x	x	E	x	x	x	x	14d	2
Closer SC (2SC)	4C	x	x	x	5.7 fl oz	x	x	x	x	12h	17 fl oz
sulfoxaflor		x	x	x	s	x	x	x	x	7d	4
Danitol 2.4EC **(RUP)**	3A	10.3-21.3 fl oz	10.3-21.3 fl oz	10.3-21.3 fl oz	x	10.3-21.3 fl oz	10.3-21.3 fl oz	10.7-21.3 fl oz	x	24h	42.7 fl oz
fenpropathrin		F	G	E	x	u	E	G	x	3d	NA

(Continued)

Table 5-6. Insecticides labeled for insect management petal fall through second cover *(continued)*

Product and formulation Active ingredient	IRAC code[2]	European red mite	plum curculio	Japanese beetle	San Jose scale	leaf-roller	oriental fruit moth	peach tree borers	peri-odical cicada	REI[3] PHI[4]	Max amt[5] Max app[6]
Delegate WG (25WG)	5	x	6-7 oz	x	x	4.5-7 oz	6-7 oz	x	x	4h	28 oz
spinetoram		x	s	x	x	E	E	x	x	1d	4
Diazinon AG600 WBC **(RUP)**	1B	6.5-12.25 fl oz/100 gal	x	x	x	x	x	x	x	4d	102 fl oz
diazinon		u	x	x	x	x	x	x	x	21d	2
Dimilin 2L **(RUP)**	15	x	8-16 fl oz	x	x	8-16 fl oz	8-16 fl oz	x	x	12h	32 fl oz
diflubenzuron		x	u	x	x	u	u	x	x	14d	2
Entrust SC (2SC)	5	x	x	x	x	4-8 fl oz	4-8 fl oz	x	x	4h	29 fl oz
spinosad		x	x	x	x	u	F	x	x	1d	3
Envidor 2SC	23	16-18 fl oz	x	x	x	x	x	x	x	12h	18 fl oz
spirodiclofen		E	x	x	x	x	x	x	x	7d	1
Esteem 35WP	7C	x	x	x	4-5 oz	x	4-5 oz	x	x	12h	15 oz
pyriproxyfen		x	x	x	E	x	F	x	x	14d	3
Exirel (0.83SE)	28	x	13.5-20.5 fl oz	13.5-20.5 fl oz	x	10-20.5 fl oz	10-20.5 fl oz	x	x	12h	61.5 fl oz
cyantraniliprole		x	G	G	x	E	E	x	x	3d	3
Imidan 70W	1B	x	2.13-4.25 lb	2.13-4.25 lb	2.13-4.25 lb	2.13-4.25 lb	2.13-4.25 lb	x	x	7d	13 lb
phosmet		x	G	G	E	E	E	x	x	7d	NA
Intrepid 2F	18	x	x	x	x	8-16 fl oz	10-16 fl oz	x	x	4h	64 fl oz
methoxyfenozide		x	x	x	x	E	G	x	x	7d	NA
Magister SC (1.7SC)	21A	32-36 fl oz	x	x	x	x	x	x	x	12h	36 fl oz
fenazaquin		E	x	x	x	x	x	x	x	3d	1
Movento (2SC)	23	6-9 fl oz	x	x	6-9 fl oz	x	x	x	x	24h	15.3 fl oz
spirotetramat		s	x	x	G	x	x	x	x	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	x	1.2-4 fl oz	x	x	1.2-4 fl oz	1.2-4 fl oz	1.2-4 fl oz	x	12h	24 fl oz
zeta-cypermethrin		x	E	x	x	E	E	G	x	14d	NA
Nexter (75WP)	21	4.4-10.7 oz	x	x	x	x	x	x	x	12h	21.3 oz
pyridaben		G	x	x	x	x	x	x	x	7d	2
Oil (superior)	UN	1.5-2%	x	x	1.5-2%	x	x	x	x	4h	NA
mineral oil		E	x	x	G	x	x	x	x	0d	NA
Onager (1EC)	10A	12-24 oz	x	x	x	x	x	x	x	12h	24 fl oz
hexythiazox		E	x	x	x	x	x	x	x	7d	1

(Continued)

Table 5-6. Insecticides labeled for insect management petal fall through second cover *(continued)*

Product and formulation Active ingredient	IRAC code[2]	European red mite	plum curculio	Japanese beetle	San Jose scale	leaf-roller	oriental fruit moth	peach tree borers	peri-odical cicada	REI[3] PHI[4]	Max amt[5] Max app[6]
Portal XLO (0.4EC)	21A	2 pt	x	x	x	x	x	x	x	12h	4 pt
fenpyroximate		E	x	x	x	x	x	x	x	7d	2
Proaxis (0.5EC) **(RUP)**	3A	x	2.5-5.1 fl oz	2.5-5.1 fl oz	x	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		x	G	E	x	E	G	G	E	14d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	x	x	x	12h	NA
pyrethrins		u	i	F	u	u	x	x	x	0d	10
Rimon 0.83EC	15	x	x	x	x	20-50 fl oz	20-40 fl oz	20 fl oz	x	12h	150 fl oz
novaluron		x	x	x	x	E	E	u	x	8d	NA
Savey 50DF	10A	3-6 oz	x	x	x	x	x	x	x	12h	6 oz
hexythiazox		E	x	x	x	x	x	x	x	28d	1
Sevin XLR Plus (4F)	1A	x	2-3 qt	2-3 qt	4-5 qt	2-3 qt	2-3 qt	2-3 qt	2-3 qt	12h	14 qt
carbaryl		x	F	E	u	F	F	i	G	3d	3
Sivanto Prime (1.67SC)	4D	x	x	x	10.5-14 fl oz	x	x	x	x	4h	28 fl oz
flupyradifurone		x	x	x	G	x	x	x	x	14d	NA
Surround WP (95WP)	UN	x	25-50 lb	25-50 lb	x	25-50 lb	25-50 lb	25-50 lb	x	4h	NA
kaolin		x	F	F	x	u	u	s	x	0d	NA
Vendex 50WP **(RUP)**	12B	1-2 lb	x	x	x	x	x	x	x	2d	3 lb
fenbutatin-oxide		G	x	x	x	x	x	x	x	14d	2
Verdepryn 100SL (0.83SL)	28	x	5.5-11 fl oz	5.5-11 fl oz	x	5.5-11 fl oz	5.5-11 fl oz	x	x	4h	33 fl oz
cyclaniliprole		x	G	u	x	E	E	x	x	7d	3
Warrior II (2.08CS) **(RUP)**	3A	x	1.2-2.5 fl oz	1.2-2.5 fl oz	x	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		x	G	E	x	u	G	G	E	14d	NA
Zeal (72WP)	10B	2-3 oz	x	x	x	x	x	x	x	12h	3 oz
etoxazole		E	x	x	x	x	x	x	x	7d	1

Plum Cover Sprays – Diseases

7-10 days after shuck split

Notes on disease management

Bacterial spot

- Copper pesticides are not recommended after first cover, to reduce the risk of phytotoxicity.

Brown rot

- Although captan is still labeled for use for brown rot control, it is phytotoxic to some varieties of European, hybrid and Japanese plums. Symptoms of phytotoxicity include shot-holes of leaves and spotting of fruit, and may be mistaken for bacterial leaf spot.
- To prevent brown rot at harvest, continue sprays 21 days before harvest. Depending on rainfall, repeat applications every 5-10 days, if needed. Merivon, Luna Sensation and Pristine all have PHIs of 1 day or less.

Powdery mildew

- Stanley plums: **Do not apply Quash.** Do not apply Quilt Xcel to Stanley plums earlier than 21 days prior to harvest, which has been implicated in reduced size and shape issues.

Table 5-7. Fungicides labeled for disease control during cover[1]

Product and formulation Active ingredient	FRAC code[2]	brown rot	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	12-15.5 fl oz	12-15.5 fl oz	4h	92.3 fl oz
azoxystrobin		F-E[r]	F	0d	15
Captan 80WDG	M	3.7 lb	x	24h	40 lb
captan		G	x	0d	NA
Cevya	3	5 oz	3-5 fl oz	12h	15 fl oz
mefentrifluconazole		E	E	0d	5
Elevate 50 WDG	17	1-1.5 lb	x	12h	6 lb
fenhexamid		E-G	x	0d	NA
Elite 45DF	3	2 oz	x	12h	3 lb
tebuconazole		E	x	0d	NA
Flint Extra	11	2.5-3.8 fl oz	2.5-3.8 fl oz	12h	15.2 fl oz
trifloxystrobin		E-G	E	1d	3
Fontelis (SC)	7	14-20 fl oz	14-20 fl oz	12h	61 fl oz
penthiopyrad		E-G	F-G	0d	4
Indar 2F	3	6 fl oz	x	12h	48 fl oz
fenbuconazole		E[r]	E-G	0d	NA
Inspire Super (EW)	3+9	16-20 fl oz	16-20 fl oz	12h	80 fl oz
difenoconazole + cyprodinil		E	G-F	2d	8
Kenja 400 SC	7	12.5 fl oz	x	12h	37.5 fl oz
isofetamid		E	S	1 day	3
Luna Experience (SC)	7+3	6-10 fl oz	6-10 fl oz	12h	34 fl oz
fluopyram + tebuconazol		G-E	E	1d	NA
Luna Privilege	7	4-6.8 fl oz	4-6.8 fl oz	12h	13.7 fl oz
fluopyram		E	G	0d	6
Luna Sensation (SC)	7+11	6-10 fl oz	6-10 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		E	E-G	1d	4
Merivon XBF	7+11	4-6.7 fl oz	4-6.7 fl oz	12h	20.1 fl oz
fluxapyroxad + pyraclostrobin		E	E-G	0d	4

(Continued)

Table 5-7. Fungicides labeled for disease control during cover *(continued)*

Product and formulation Active ingredient	FRAC code[2]	brown rot	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Microthiol Disperss	M	10-20 lb	10-20 lb	24h	NA
sulfur		F	G	0d	3
Miravis	7	3.4-5.1 fl oz	3.4-5.1 fl oz	4 hr	20.4 fl oz
pydiflumetofen		E-G	E-G	0d	4
Ph-D	19	6.2 oz	6.2 oz	0d	NA
polyoxin D		G	G	NA	NA
Pristine	7+11	10.5-14.5 oz	10.5-14.5 oz	12h	72.5 oz
pyaclostrobin + boscalid		E-G[r]	E[r]	0d	9
Quadris Top	11+3	12-14 fl oz	12-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		E	G	0d	5
Quash	3	2.5-3.5 oz	3.5-4 oz	12h	12 oz
metconazole		E-G	E	14d	3
Quilt Xcel	11+3	14 fl oz	14 fl oz	12h	70 fl oz
azoxystrobin + propiconazole		E	G	0d	5
Quintec	13	x	7 fl oz	12h	28 fl oz
quinoxyfen		x	E	7d	4
Rally 40WSP	3	2.5-6 oz	2.5-6 oz	24h	2.75 lb
myclobutanil		G	E-G	1d	NA
Rovral 4F	2	1-2 pt	x	24h	4 pt
iprodione		E	x	N/A	NA
Scala (SC)	9	9-18 fl oz	x	12h	54 fl oz
pyrimethanil		E-G	x	2d	2
Tilt (EC)	3	4 fl oz	4 fl oz	12h	20 fl oz
propiconazole		E	G	0d	5
Topguard EQ	3+11	6-8 oz	6-8 oz	12h	NA
flutriafol + azoxystrobin		G	E	7d	4
Topguard Specialty Crop	3	14 oz	14 oz	12h	56 fl oz
flutriafol		G	E	7d	4

Plum Second and Additional Cover Sprays – Insects

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

Notes on insect management

- **Plum curculio** can stay active thorough second cover. Failure to control plum curculio may result in an increase in brown rot.
- **Peachtree borer:** Best controlled by a trunk drench at the time of peak moth flight in, usually in early August. See Borers of Peach, Cherry and Plum, page 152.
- **Japanese beetle:** Begin applications for Japanese beetle as soon as observed. Multiple applications may be needed.
- **Cherry fruit flies:** Adults emerge from late May to early July and lay their eggs in the fruits. Sprays need to target the adults before egg laying begins, generally 5 to 6 days after adults emerge.

Table 5-8. Insecticides labeled for summer covers[1]

Product and formulation Active ingredient	IRAC code[2]	European red mite	cherry fruit fly	Japanese beetle	leafroller	oriental fruit moth	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	1 lb	x	x	x	x	x	12h	1 lb
bifenazate		G	x	x	x	x	x	3d	1
Actara (25WDG)	4A	x	4.5-5.5 oz	x	x	x	x	12h	11 oz
thiamethoxam		x	G	x	x	x	x	14d	NA
Admire Pro (4.6F)	4A	x	2-2.8 fl oz	1.4-2.8 fl oz	x	x	x	12h	10.5/14 fl oz
imidacloprid		x	G	G	x	x	x	0-21d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	2.25-4.25 fl oz	x	x	x	x	x	12h	8.5 fl oz
abamectin		G	x	x	x	x	x	21d	2
Altacor (35WDG)	28	x	3-4.5 oz	x	3-4.5 oz	3-4.5 oz	x	4h	9 oz
chlorantraniliprole		x	G	x	E	E	x	10d	NA
Apta (1.34SC)	21A	x	14-27 fl oz	x	21-27 fl oz	x	21-27 fl oz	12h	53.5 fl oz
tolfenpyrad		x	F	x	G	x	s	14d	2
Asana XL (0.66EC) **(RUP)**	3A	x	4.8-14.5 fl oz	x	4.8-14.5 fl oz	4.8-14.5 fl oz	x	12h	72.5 fl oz
esfenvalerate		x	G	x	E	E	x	14d	NA
Assail 30SG	4A	x	5.3-8 oz	5.3-8 oz	x	5.3-8 oz	x	12h	32 oz
acetamiprid		x	G	F	x	E	x	7d	4
Avaunt (30WDG)	22	x	x	x	x	6 oz	x	12h	24 oz
indoxacarb		x	x	x	x	F	x	14d	4
Baythroid XL (1EC) **(RUP)**	3A	x	2.4-2.8 fl oz	x	2.4-2.8 fl oz	2-2.4 fl oz	x	12h	5.6 fl oz
beta-cyfluthrin		x	G	x	u	E	x	7d	NA
Danitol 2.4EC **(RUP)**	3A	10.3-21.3 fl oz	16-21.3 fl oz	10.3-21.3 fl oz	10.3-21.3 fl oz	10.3-21.3 fl oz	10.7-21.3 fl oz	24h	42.7 fl oz
fenpropathrin		F	G	E	u	E	E	3d	NA
Delegate WG (25WG)	5	x	x	x	4.5-7 oz	6-7 oz	4.5-7 oz	4h	28 oz
spinetoram		x	x	x	E	E	E	1d	4

(Continued)

Table 5-8. Insecticides labeled for summer covers *(continued)*

Product and formulation Active ingredient	IRAC code[2]	European red mite	cherry fruit fly	Japanese beetle	leafroller	oriental fruit moth	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Diazinon AG600 WBC **(RUP)**	1B	6.5-12.25 fl oz/100 gal	x	x	x	x	x	4d	102 fl oz
diazinon		u	x	x	x	x	x	21d	2
Dimilin 2L **(RUP)**	15	x	x	x	8-16 fl oz	8-16 fl oz	x	12h	32 fl oz
diflubenzuron		x	x	x	u	u	x	14d	2
Entrust SC (2SC)	5	x	4-8 fl oz	x	4-8 fl oz	4-8 fl oz	4-8 fl oz	4h	29 fl oz
spinosad		x	G	x	u	F	G	1d	3
Envidor 2SC	23	16-18 fl oz	x	x	x	x	x	12h	18 fl oz
spirodiclofen		E	x	x	x	x	x	7d	1
Esteem 35WP	7C	x	x	x	x	4-5 oz	x	12h	15 oz
pyriproxyfen		x	x	x	x	F	x	14d	3
Exirel (0.83SE)	28	x	10-17 fl oz	13.5-20.5 fl oz	10-20.5 fl oz	10-20.5 fl oz	13.5-20.5 fl oz	12h	61.5 fl oz
cyantraniliprole		x	E	G	E	E	G	3d	3
Imidan 70W	1B	x	x	2.1-4.25 lb	2.1-4.25 lb	2.1-4.25 lb	x	7d	13 lb
phosmet		x	x	G	E	E	x	7d	NA
Intrepid 2F	18	x	x	x	8-16 fl oz	10-16 fl oz	x	4h	64 fl oz
methoxyfenozide		x	x	x	E	G	x	7d	NA
Magister SC (1.7SC)	21A	32-36 fl oz	x	x	x	x	x	12h	36 fl oz
fenazaquin		E	x	x	x	x	x	3d	1
Movento (2SC)	23	6-9 fl oz	6-9 fl oz	x	x	x	6-9 fl oz	24h	15.3 fl oz
spirotetramat		s	s	x	x	x	s	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	x	1.28-4 fl oz	x	1.28-4 fl oz	1.28-4 fl oz	4 fl oz	12h	24 fl oz
zeta-cypermethrin		x	F	x	E	E	E	14d	NA
Nexter (75WP)	21	4.4-10.7 oz	x	x	x	x	x	12h	21.3 oz
pyridaben		G	x	x	x	x	x	7d	2
Oil (superior)	UN	see label	x	x	x	x	x	4h	NA
mineral oil		E	x	x	x	x	x	0d	NA
Onager (1EC)	10A	12-24 oz	x	x	x	x	x	12h	24 fl oz
hexythiazox		E	x	x	x	x	x	7d	1
Portal XLO (0.4EC)	21A	2 pt	x	x	x	x	x	12h	4 pt
fenpyroximate		E	x	x	x	x	x	7d	2
Proaxis (0.5EC) **(RUP)**	3A	x	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		x	G	E	E	G	x	14d	NA

(Continued)

Table 5-8. Insecticides labeled for summer covers *(continued)*

Product and formulation Active ingredient	IRAC code[2]	European red mite	cherry fruit fly	Japanese beetle	leafroller	oriental fruit moth	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Pyganic 5EC	3A	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	x	4.5-15.6 fl oz	12h	NA
pyrethrins		u	u	F	u	x	i	0d	10
Rimon 0.83EC	15	x	20-40 fl oz	x	20-50 fl oz	20-40 fl oz	x	12h	150 fl oz
novaluron		x	G	x	E	E	x	8d	NA
Savey 50DF	10A	3-6 oz	x	x	x	x	x	12h	6 oz
hexythiazox		E	x	x	x	x	x	28d	1
Sevin XLR Plus (4F)	1A	x	2-3 qt	2-3 qt	2-3 qt	2-3 qt	x	12h	14 qt
carbaryl		x	G	E	F	F	x	3d	3
Surround WP (95WP)	UN	x	25-50 lb	25-50 lb	25-50 lb	25-50 lb	x	4h	NA
kaolin		x	G	F	u	u	x	0d	NA
Vendex 50WP **(RUP)**	12B	1-2 lb	x	x	x	x	x	2d	3 lb
fenbutatin-oxide		G	x	x	x	x	x	14d	2
Verdepryn 100SL (0.83SL)	28	x	5.5-11 fl oz	5.5-11 fl oz	5.5-11 fl oz	5.5-11 fl oz	5.5-11 fl oz	4h	33 fl oz
cyclaniliprole		x	G	u	E	E	u	7d	3
Warrior II (2.08CS) **(RUP)**	3A	x	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		x	G	E	u	G	x	14d	NA
Zeal (72WP)	10B	2-3 oz	x	x	x	x	x	12h	3 oz
etoxazole		E	x	x	x	x	x	7d	1

Special Problems of Stone Fruit

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 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 spray 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 emergence can help you properly time insecticide applications, because insecticides target the hatching eggs laid by the newly emerged moths.

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 bud break, 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, nectarine and plum

Bacterial spot of stone fruit can be a serious problem in certain varieties, areas and years. The disease is fa-

vored by stormy, rainy weather from May through 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 been 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. These products are no longer labeled for plums.

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), https://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 27 for additional information on phosphorous acid, phosphonates and phosphites.

Mating disruption of oriental fruit moth

Mating disruption can succeed in blocks of at least 5 acres, or smaller blocks when perimeter or border sprays are used. There are many different types of dispensers available, see Mating Disruption for Codling Moth Control and Oriental Fruit Moth on pages 26-27 in the Apple chapter.

Periodical cicadas

See Periodical Cicadas in the Insect Management Notes section for apples, page 52.

6. GRAPE

Grape Insect Pests

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.

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			
							spotted-wing Drosophila	
							multi-colored Asian lady beetle	
							green June beetle	
							grape root borer	
climbing cutworm								
spider mites		spider mites						
grape scale			grape scale					
grape mealybug					grape mealybug			
		redbanded leafroller			red-banded leafroller			
			eight-spotted forester					
			grape cane girdler					
			grape cane gallmaker					
					grape rootworm			
							stink bug	
					spotted 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
Pathology Lead: J. Beckerman

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, and 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 in 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] For treated wine grapes, the REI is 5 days when conducting cane tying, turning, or girdling. The REI is 12 hours for all other activities in wine grapes.

[8] For table grapes, the REI for cane tying, turning, or girdling is 7 days.

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.

Table 6-1. Effectiveness of pesticides for control of grape diseases – delayed dormant through bud swell[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose	Phomopsis	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Sulforix	M	1-2 gal			48h	16 gal
lime-sulfur		E	E	s(E)	NA	8

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.

Table 6-2. Effectiveness of insecticides for control of grape insects – delayed dormant through bud swell[1]

Product and formulation Active ingredient	IRAC code[2]	climbing cutworm	grape flea beetle	mites: European red, spider mite	scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Admire Pro (4.6F)	4A	x	x	x	7-14 fl oz (soil)	12h	2.8/14 fl oz
imidacloprid		x	x	x	G	0/30d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	x	1.75-3.5 fl oz	x	12h/4d	7 fl oz
abamectin		x	x	G	x	28d	2
Altacor (35WDG)	28	3-4.5 oz	x	x	x	4h	9 oz
chlorantraniliprole		G	x	x	x	14d	4
Apollo SC (1SC)	10A	x	x	4-8 oz	x	12h/14d	NA
clofentezine		x	x	E	x	21d	1
Azera 0.21EC	3A	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	12h	NA
azadirachtin + pyrethrins		u	u	u	u	0d	10
Baythroid XL (1EC) **(RUP)**	3A	2.4-3.2 fl oz	2.4-3.2 fl oz	x	x	12h	12.8 fl oz
beta-cyfluthrin		E	G	x	x	3d	NA
Brigade 2EC **(RUP)**	3A	3.2-6.4 fl oz	x	6.4 fl oz	x	12h	7 fl oz
bifenthrin		G	x	u	x	30d	NA
Brigade WSB (10WP) **(RUP)**	3A	8-16 oz	x	16 oz	x	12h	16 oz
bifenthrin		G	x	u	x	30d	NA
B.t. (Agree, Dipel, etc.)	11A	x	x	x	x	4h	NA
Bacillus thuringiensis		F	x	x	x	0d	NA
Danitol 2.4EC **(RUP)**	3A	10.6-21.3 fl oz	5.3-10.6 fl oz	10.6-21.3 fl oz	x	24h	42.6 fl oz
fenpropathrin		G	E	G	x	21d	NA
Delegate WG (25WG)	5	3-5 oz	x	x	x	4h	19.5 oz
spinetoram		G	x	x	x	3d	5
Entrust SC (2SC)	5	4-8 fl oz	x	x	x	4h	23 fl oz
spinosad		G	x	x	x	3d	5
Envidor 2SC	23	x	x	16-34 fl oz	x	12h	34 fl oz
spirodiclofen		x	x	E	x	14d	1
Imidan 70W	1B	x	1.3-2.1 lb	x	x	14d	6.5 lb
phosmet		x	F	x	x	7/14d	NA

(Continued)

Table 6-2. Effectiveness of insecticides for control of grape insects – delayed dormant through bud swell[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	climbing cutworm	grape flea beetle	mites: European red, spider mite	scale	REI[3] PHI[4]	Max amt[5] Max app[6]
Kanemite 15SC	20B	x	x	21-31 fl oz	x	12h	62 fl oz
acequinocyl		x	x	F	x	7d	2
Magister SC (1.7SC)	21A	x	x	32-36 fl oz	x	12h	36 fl oz
fenazaquin		x	x	u	x	7d	1
Malathion 5EC	1B	x	x	3 pt	3 pt	72h	NA
malathion		x	x	u	u	3d	2
Movento (2SC)	23	x	x	6-8 fl oz	6-8 fl oz	24h	12.5 fl oz
spirotetramat		x	x	s	s	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	2-4 fl oz	x	x	x	12h	24 fl oz
zeta-cypermethrin		E	x	x	x	1d	NA
Nealta (1.67SC)	25	x	x	13.7 fl oz	x	12h	28 fl oz
cyflumetofen		x	x	G	x	14d	2
Nexter SC (3.75SC)	21A	x	x	7.5-17 fl oz	x	12h	NA
pyridaben		x	x	G	x	7d	2
Onager (1EC)	10A	x	x	12-24 oz	x	12h	24 oz
hexythiazox		x	x	E	x	7d	1
Portal XLO (0.4EC)	21A	x	x	2 pt	x	12h	2 pt
fenpyroximate		x	x	E	x	14d	2
Pyganic 5%EC	3A	x	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	12h	NA
pyrethrins		x	F	u	u	0d	10
Sevin XLR Plus (4F)	1A	2 qt	1-2 qt	x	1-2 qt	2d/6d	10 qt
carbaryl		E	E	x	u	7d	5
Vendex 50WP **(RUP)**	12B	x	x	1-2.5 lb	x	48h	4 lb
fenbutatin-oxide		x	x	F	x	28d	2
Verdepryn 100SL (0.83SL)	28	8.2-11 fl oz	x	x	x	4h	33 fl oz
cyclaniliprole		u	x	x	x	7d	3
Zeal (72WP)	10B	x	x	2-3 oz	x	12h	3 oz
etoxazole		x	x	E	x	14d	1

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 fungicide (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 180, for information about fungicide resistance development in powdery and downy mildews. See generic fungicides table for product with the same active ingredient, page 278.
- 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.

Table 6-3. Foundation fungicide program for early season control of grape diseases[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Aliette WDG	33	x	x	3-5 lb	x	x	12h	NA
aluminum tris		x	x	E	x	x	15d	3
Captan 80 WDG	M	1.25-2.5 lb	1.25-2.5 lb	1.25-2.5 lb	1.2-2.5 lb	1.2-2.5 lb	48h	15 lb
captan		s(G)	s(F)	G	E	i	0d	NA
Cuprofix Ultra 40D	M	x	1.25-3 lb	1.2-3 lb	1.2-3 lb	1.2-3 lb	48 h	50 lb
copper sulfate		x	F	F	F	F-i	NA	NA
Microthiol Disperss	M	x	x	x	3-10 lb	3-10 lb	24h	NA
sulfur		x	x	x	F	E	0d	NA
ProPhyt	33	x	x	2-4 pt	2-4 pt	x	4h	NA
potassium phosphite		x	x	G-E	G-E	x	0d	NA
Ridomil Gold Copper	4+M	x	x	5 lb (1 pack)	x	x	48h	8 lb
mefenoxam + copper hydroxide		x	x	E	x	x	42d	4
Ridomil Gold MZ WG	4+M	x	x	2.5 lb	x	x	48h	10 lb
mefenoxam + mancozeb		x	x	E	x	x	66d	4
Roper DF	M	x	1.5-4	1.5-4	1.5-4	x	24h	24 lb
mancozeb		x	E	E	E	x	66d	6
Sulforix	M	x	x	x	1-2 gal, 1 pt	1-2 gal, 1 pt	48h	NA
calcium polysulfide		x	x	x	G-E	i	NA	8
Ziram 76DF	M3	x	3-4 lb	3-4 lb	3-4 lb	x	48h	28 lb
ziram		x	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

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.

Table 6-4. Effectiveness of pesticides for control of grape diseases – bud break to pre-bloom[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	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	10-15.5 fl oz	4h	90 fl oz
azoxystrobin		x	E	E [r]	F	E [r]	14d	varies
Aliette WDG	33	x	x	3-5 lb	x	x	12h	NA
aluminum tris		x	x	E	x	x	15d	3
Aprovia (EC)	7	8.6-10.5 fl oz	8.6-10.5 fl oz	x	8.6-10.5 fl oz	8.6-10.5 fl oz	12h	32 fl oz
benzovindiflupyr		i	G-E	x	i	G-E	21d	3
Captan 80 WDG	M	1.25-2.5 lb	1.25-2.5 lb	1.25-2.5 lb	1.2-2.5 lb	1.2-2.5 lb	48h	15 lb
captan		s(G)	s(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	1.25-3 lb	1.2-3 lb	1.2-3 lb	1.2-3 lb	48 h	50 lb
copper sulfate		x	F	F	F	F-i	NA	NA
Endura (70WG)	7	x	x	x	x	4.5 oz	12h	24 oz
boscalid		x	x	x	x	E	14d	varies
Fervent 475SC	3+7	x	8.5 fl oz	x	8.5 fl oz	8.5 fl oz	12h	26 fl oz
isofetamid+tebuconazole		x	u	x	u	E	14d	NA
Flint Extra	11	x	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		x	E	s	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	x	x	x	x	20.5-24.4 fl oz	4h	NA
Banda de Lupinus albus doce (BLAD)		x	x	x	x	E	1d	5
Gatten	U13	x	x	x	x	6.4 fl oz	12h	1 lb
flutianil		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	NA
Kenja 400SC	7	20-22 fl oz	x	x	x	20-22 fl oz	12h	66 fl oz
isofetamid		G	x	x	x	F	14d	NA
Lifegard WG	M	x	4.5 oz	4.5 oz	4.5 oz	4.5 oz	4h	NA
Bacillus mycoides isolate J		x	x	F	x	F	0d	NA
Luna Experience (SC)	7+3	x	8-8.6 fl oz	x	8.6 fl oz	6-8.6 fl oz	12h/5d6	34 fl oz
fluopyram + tebuconazol		x	G	x	s	E	14d	NA
Luna Privilege (SC)	7	x	6-6.8 fl oz	x	x	3.2-6.8 fl oz	12h	14 fl oz
fluopyram		x	G	x	x	G	7d	2
Luna Sensation (SC)	7+11	x	5-7.6 fl oz	7.6 fl oz	5-7.6 fl oz	4-7.6 fl oz	12h	28 fl oz
fluopyram + trifloxystrobin		x	G	s	F-G	E	14d	6

(Continued)

Table 6-4. Effectiveness of pesticides for control of grape diseases – bud break to pre-bloom[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[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		E	G-E	s	G-E	E [r]	14d	6
Mettle 125ME	3	3-5 fl oz	3-5 fl oz	x	x	3-5 fl oz	12h/7d7	10 oz
tetraconazole		E	E	x	x	E [r]	14d	varies
Microthiol Disperss	M	x	x	x	3-10 lb	3-10 lb	24h	NA
sulfur		x	x	x	F	E	0d	NA
Miravis Prime	7+12	9.2-13.4 fl oz	9.2-13.4 fl oz	x	9.2-13.4 fl oz	9.2-13.4 fl oz	12h	37 fl oz
pydiflumetofen+fludioxonil		u	E	x	F-G	G-E	14d	2
OSO 5% SC	19	x	x	x	x	6.5-13 fl oz	4h	5 oz
polyoxin D		x	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/5d6	69 oz
pyraclostrobin + boscalid		E	E	E [r]	F	E	14d	varies
Procure 480SC	3	x	x	x	x	4-8 fl oz	24h	32 fl oz
triflumizole		x	x	x	x	E [r]	7d	4
ProPhyt	33	x	x	2-4 pt	2-4 pt	x	4h	NA
potassium phosphite		x	x	G-E	G-E	x	0d	NA
Quadris Top (SC)	3+11	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12h	56 fl oz
difenoconazole + azoxystrobin		E	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	3-5 oz	3-5 oz	x	x	3-5 oz	24h	2 lb
myclobutanil		E	E	x	x	E [r]	14d	NA
Ranman 400SC	21	x	x	E	x	x	12h	17 fl oz
cyazofamid		x	x	2.1-2.75 fl oz	x	x	30d	6
Reason 500SC	11	x	x	2.7 fl oz	x	x	12h	9 fl oz
fenamidone		x	x	G [r]	x	x	30d	NA
Revus	40	x	x	8 fl oz	x	x	4h	32 fl oz
mandipropamid		x	x	E	x	x	14d	NA
Revus Top	3+40	7 fl oz	7 fl oz	7 fl oz	7 fl oz	7 fl oz	12h	28 fl oz
difenoconazole + mandipropamid		E	E	E	E	E	14d	NA
Ridomil Gold Copper	4+M	x	x	5 lb (1 pack)	x	x	48h	8 lb
mefenoxam + copper hydroxide		x	x	E	x	x	42d	4
Ridomil Gold MZ WG	4+M	x	x	2.5 lb	x	x	48h	10 lb
mefenoxam + mancozeb		x	x	E	x	x	66d	4
Roper DF	M	x	1.5-4	1.5-4	1.5-4	x	24h	24 lb
mancozeb		x	E	E	E	x	66d	6
Sovran (50WG)	11	x	3.2-4.8 oz	4-6.4 oz	3.2-4.8 oz	3.2-4.8 oz	12h	26 oz
kresoxim-methyl		x	E	F [r]	F	E [r]	14d	4
Sulforix	M	x	x	x	1-2 gal, 1 pt	1-2 gal, 1 pt	48h	NA
calcium polysulfide		x	x	x	G-E	i	NA	8

(Continued)

Table 6-4. Effectiveness of pesticides for control of grape diseases – bud break to pre-bloom[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Tanos	11+27	x	x	8 oz	x	x	12h	72 oz
famoxadone + cymoxanil		x	x	G [r]	x	x	30d	9
Tebustar 45WSP	3	x	4 oz	x	x	4 oz	12h	2 lb
tebuconazole		x	E	x	x	E [r]	0d	NA
Topguard EQ	3+11	x	5-6 fl oz	8 fl oz	8 fl oz	5-6 fl oz	12h	34 fl oz
azoxystrobin+flutriafol		x	u	u	u	E	14d	6
Topsin M WSB	1	x	0.75-1.5 lb	x	0.75-1.5 lb	0.75-1.5 lb	2d	6 lb
thiophanate-methyl		x	F	x	G	E	7d	NA
Torino (SC)	U6	x	x	x	x	3.4-6.8 oz	4h	7 oz
cyflufenamid		x	x	x	x	E	3d	1 or 2
Vangard WG	9	x	x	x	x	10 oz	12h	30 oz
cyprodinil		x	x	x	x	s	7d	NA
Vivando 2.5F	U8	x	x	x	x	10.3-15.4 fl oz	12h	43 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	M3	x	3-4 lb	3-4 lb	3-4 lb	x	48h	28 lb
ziram		x	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 to 10-inch Shoots through Bloom – 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.
- **Rose chafers:** May be present any time between 4- and 10-inch shoot growth and bloom.
- **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.
- While all grapes do not benefit from insect pollination, protection of bees and other pollinators harvesting pollen from grape flowers is important. Avoid spraying insecticides that are toxic to pollinators during bloom.
- 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).
- Other insecticide formulations may be available. See generic insecticides table for product with the same active ingredient, pages 279-280.

Table 6-5. Effectiveness of insecticides for control of grape insects – bud break up to bloom[1]

Product and formulation Active ingredient	IRAC code[2]	climbing cutworm	grape cane girdler/ gallmaker	grape flea beetle	rose chafer	REI[3] PHI[4]	Max amt[5] Max app[6]
Altacor (35WDG)	28	3-4.5 oz	x	x	x	4h	9 oz
chlorantraniliprole		G	x	x	x	14d	4
Assail 30SG	4A	x	2.5-5.3 oz	x	2.5-5.3 oz	12h	10.6 oz
acetamiprid		x	u	x	E	3d	2
Azera 0.21EC	3A	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	12h	NA
azadirachtin + pyrethrins		u	u	u	u	0d	10
Baythroid XL (1EC) **(RUP)**	3A	2.4 -3.2 fl oz	2.4 -3.2 fl oz	2.4 -3.2 fl oz	x	12h	12.8 fl oz
beta-cyfluthrin		E	G	G	x	3d	NA
Brigade 2EC **(RUP)**	3A	3.2-6.4 fl oz	x	x	x	12h	7 fl oz
bifenthrin		G	x	x	x	30d	NA
Brigade WSB (10WP) **(RUP)**	3A	8-16 oz	x	x	x	12h	16 oz
bifenthrin		G	x	x	x	30d	NA
Danitol 2.4EC **(RUP)**	3A	10.6-21.3 fl oz	10.6-21.3 fl oz	5.3 to 10.6 fl oz	10.6-21.3 fl oz	24h	42.6 fl oz
fenpropathrin		G	u	E	E	21d	NA
Delegate WG (25WG)	5	3-5 oz	x	x	x	4h	19.5 oz
spinetoram		G	x	x	x	3d	5
Entrust SC (2SC)	5	4-8 fl oz	x	x	x	4h	23 fl oz
spinosad		G	x	x	x	3d	5
Imidan 70W	1B	x	1.3-2.1 lb	1.3-2.1 lb	1.3-2.1 lb	14d	6.5 lb
phosmet		x	u	F	G	7/14d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	2-4 fl oz	x	x	x	12h	24 fl oz
zeta-cypermethrin		E	x	x	x	1d	NA
Pyganic 5%EC	3A	x	x	4.5-15.6 fl oz	x	12h	NA
pyrethrins		x	x	F	x	0d	10
Sevin XLR Plus (4F)	1A	2 qt	x	1-2 qt	1-2 qt	2d/6d	10 qt
carbaryl		E	x	E	E	7d	5
Surround WP (95WP)	UN	x	x	x	25-50 lb	4h	NA
kaolin		x	x	x	F	0	NA
Verdepryn 100SL (0.83SL)	28	8.2-11 fl oz	x	x	x	4h	33 fl oz
cyclaniliprole		u	x	x	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 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.
- Although fruit of the most commonly planted varieties become resistant to powdery and downy mildews as they mature, 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.
- **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 179.
- 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.

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 180, for information about fungicide resistance development in powdery and downy mildews. See generic fungicides table for product with the same active ingredient, page 278.

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.

Table 6-6. Effectiveness of pesticides for control of grape diseases – pre-bloom through shatter[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	Botrytis bunch rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	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	10-15.5 fl oz	10-15.5 fl oz	4h	90 fl oz
azoxystrobin		x	E	s	E [r]	F	E [r]	14d	varies
Aliette WDG	33	x	x	x	3-5 lb	x	x	12h	NA
aluminum tris		x	x	x	E	x	x	15d	3
Aprovia (EC)	7	8.6-10.5 fl oz	8.6-10.5 fl oz	x	x	8.6-10.5 fl oz	8.6-10.5 fl oz	12h	32 fl oz
benzovindiflupyr		i	G-E	x	x	i	G-E	21d	3
Captan 80 WDG	M	1.25-2.5 lb	1.25-2.5 lb	2.5 lb	1.25-2.5 lb	1.2-2.5 lb	1.2-2.5 lb	48h	15 lb
captan		s(G)	s(F)	F	G	E	i	0d	NA
Cevya	3	x	4 fl oz	x	x	3-4 fl oz	3-4 fl oz	12h	8 fl oz
mefentrifluconazole		x	E	x	x	G	G-E	14d	2

(Continued)

Table 6-6. Effectiveness of pesticides for control of grape diseases – pre-bloom through shatter[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	Botrytis bunch rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Cuprofix Ultra 40D	M	x	1.25-3 lb	x	1.2-3 lb	1.2-3 lb	1.2-3 lb	48 h	50 lb
copper sulfate		x	F	x	F	F	F-i	x	
Elevate 50 WDG	17	x	x	1 lb	x	x	1 lb	12h	3 lb
fenhexamid		x	x	E	x	x	s	0d	3
Endura (70WG)	7	x	x	8 oz	x	x	4.5 oz	12h	24 oz
boscalid		x	x	G	x	x	E	14d	varies
Fervent 475SC	3+7	x	8.5 fl oz	8.5 fl oz	x	8.5 fl oz	8.5 fl oz	12h	26 fl oz
isofetamid+tebuconazole		x	u	s	x	u	E	14d	NA
Flint Extra	11	x	3.5-3.8 fl oz	3.8 fl oz	3.8 fl oz	3.5-3.8 fl oz	3-3.5 fl oz	12h	23 fl oz
trifloxystrobin		x	E	G	s	F	E	14d	6
Forum	40	x	x	x	6 oz	x	x	12h	24 oz
dimethomorph		x	x	x	E	x	x	14d	4
Fracture	M	x	x	24.4-36.6 fl oz	x	x	20.5-24.4 fl oz	4h	NA
Banda de Lupinus albus doce (BLAD)		x	x	E	x	x	E	1d	5
Gatten	U13	x	x	x	x	x	6.4 fl oz	12h	1 lb
flutianil		x	x	x	x	x	G-E	14d	4
Inspire Super (EW)	3+9	16-20 fl oz	16-20 fl oz	16-20 fl oz	x	x	16-20 fl oz	12h	80 fl oz
difenoconazole + cyprodinil		E	E	E	x	x	G	14d	NA
Intuity (SC)	11	x	x	6 fl oz	x	x	6 fl oz	12h	18 fl oz
mandestrobin		x	x	G-E	x	x	s	10d	3
Kenja 400SC	7	20-22 fl oz	x	20-22 fl oz	x	x	20-22 fl oz	12h	66 fl oz
isofetamid		G	x	F	x	x	F	14d	NA
Lifegard WG	M	x	4.5 oz	x	4.5 oz	4.5 oz	4.5 oz	4h	NA
Bacillus mycoides isolate J		x	x	x	F	x	F	0d	NA
Luna Experience (SC)	7+3	x	8-8.6 fl oz	8-8.6 fl oz	x	8.6 fl oz	6-8.6 fl oz	12h/ 5d6	34 fl oz
fluopyram + tebuconazol		x	G	E	x	s	E	14d	NA
Luna Privilege (SC)	7	x	6-6.8 fl oz	6-6.8 fl oz	x	x	3.2-6.8 fl oz	12h	14 fl oz
fluopyram		x	G	E	x	x	G	7d	2
Luna Sensation (SC)	7+11	x	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	28 fl oz
fluopyram + trifloxystrobin		x	G	G-E	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	4-5.5 fl oz	12h	33 fl oz
fluxapyroxad + pyraclostrobin		E	G-E	s	s	G-E	E [r]	14d	6
Mettle 125ME	3	3-5 fl oz	3-5 fl oz	x	x	x	3-5 fl oz	12h/7d7	10 oz
tetraconazole		E	E	x	x	x	E [r]	14d	varies

(Continued)

Table 6-6. Effectiveness of pesticides for control of grape diseases – pre-bloom through shatter[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	Botrytis bunch rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Microthiol Disperss	M	x	x	x	x	3-10 lb	3-10 lb	24h	NA
sulfur		x	x	x	x	F	E	0d	NA
Miravis Prime	7+12	9.2-13.4 fl oz	9.2-13.4 fl oz	10.3-13.4 fl oz	x	9.2-13.4 fl oz	9.2-13.4 fl oz	12h	37 fl oz
pydiflumetofen+fludioxonil		u	E	G-E	x	F-G	G-E	14d	2
OSO 5% SC	19	x	x	6.5-13 fl oz	x	x	6.5-13 fl oz	4h	5 oz
polyoxin D		x	x	G	x	x	G	0d	6
Pristine	11+7	8-12.5 oz	8-12.5 oz	8-23 oz	8-12.5 oz	8-12.5 oz	8-12.5 oz	12h/ 5d6	69 oz
pyraclostrobin + boscalid		E	E	G	E [r]	F	E	14d	varies
Procure 480SC	3	x	x	x	x	x	4-8 fl oz	24h	32 fl oz
triflumizole		x	x	s	x	x	E [r]	7d	4
ProPhyt	33	x	x	x	2-4 pt	2-4 pt	x	4h	NA
potassium phosphite		x	x	x	G-E	G-E	x	0d	NA
Quadris Top (SC)	3+11	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12h	56 fl oz
difenoconazole + azoxystrobin		E	E	s	F	F	E	14d	NA
Quintec (2.08F)	13	x	x	x	x	x	4-6.6 fl oz	12h	33 fl oz
quinoxyfen		x	x	x	x	x	E	21d	5
Rally 40WSP	3	3-5 oz	3-5 oz	x	x	x	3-5 oz	24h	2 lb
myclobutanil		E	E	x	x	x	E[r]	14d	NA
Ranman 400SC	21	x	x	x	2.1-2.75 fl oz	x	x	12h	17 fl oz
cyazofamid		x	x	x	E	x	x	30d	6
Reason 500SC	11	x	x	x	2.7 fl oz	x	x	12h	9 fl oz
fenamidone		x	x	x	G[r]	x	x	30d	NA
Revus	40	x	x	x	8 fl oz	x	x	4h	32 fl oz
mandipropamid		x	x	x	E	x	x	14d	NA
Revus Top	3+40	7 fl oz	7 fl oz	x	7 fl oz	7 fl oz	7 fl oz	12h	28 fl oz
difenoconazole + mandipropamid		E	E	x	E	E	E	14d	NA
Ridomil Gold Copper	4+M	x	x	x	5 lb (1 pack)	x	x	48h	8 lb
mefenoxam + copper hydroxide		x	x	x	E	x	x	42d	4
Ridomil Gold MZ WG	4+M	x	x	x	2.5 lb	x	x	48h	10 lb
mefenoxam + mancozeb		x	x	x	E	x	x	66d	4
Roper DF	M	x	1.5-4	1.5-4	1.5-4	1.5-4	x	24h	24 lb
mancozeb		x	E	i	E	E	x	66d	6
Rovral 4 F	2	x	x	1-2 pt	x	x	x	48h	2 or 8 pt
iprodione		x	x	G	x	x	x	7d	1 or 4

(Continued)

Table 6-6. Effectiveness of pesticides for control of grape diseases – pre-bloom through shatter[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	Botrytis bunch rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Scala SC	9	x	x	18 fl oz	x	x	x	12h	36 fl oz
pyrimethanil		x	x	G	x	x	x	7d	NA
Sovran (50WG)	11	x	3.2-4.8 oz	3.2-6.4 oz	4-6.4 oz	3.2-4.8 oz	3.2-4.8 oz	12h	26 oz
kresoxim-methyl		x	E	s	F [r]	F	E [r]	14d	4
Sulforix	M	x	x	x	x	1-2 gal, 1 pt	1-2 gal, 1 pt	48h	NA
calcium polysulfide		x	x	x	x	G-E	i	NA	8
Switch 62.5 WG	9+12	x	x	11-14 oz	x	x	x	12h	56 oz
cyprodinil + fludioxonil		x	x	G	x	x	x	7d	NA
Tanos	11+27	x	x	x	8 oz	x	x	12h	72 oz
famoxadone + cymoxanil		x	x	x	G [r]	x	x	30d	9
Tebustar 45WSP	3	x	4 oz	x	x	x	4 oz	12h	2 lb
tebuconazole		x	E	x	x	x	E [r]	0d	NA
Topguard EQ	3+11	x	5-6 fl oz	8 fl oz	8 fl oz	8 fl oz	5-6 fl oz	12h	34 fl oz
azoxystrobin + flutriafol		x	u	s	u	u	E	14d	6
Topsin M WSB	1	x	0.75-1.5 lb	x	x	0.75-1.5 lb	0.75-1.5 lb	2d	6 lb
thiophanate-methyl		x	F	x	x	G	E	7d	NA
Torino (SC)	U6	x	x	x	x	x	3.4-6.8 oz	4h	7 oz
cyflufenamid		x	x	x	x	x	E	3d	1 or 2
Vangard WG	9	x	x	10 oz	x	x	10 oz	12h	30 oz
cyprodinil		x	x	G-E	x	x	s	7d	NA
Vivando 2.5F	U8	x	x	x	x	x	10.3-15.4 fl oz	12h	43 fl oz
metrafenone		x	x	x	x	x	E	14d	3
Zampro	45+40	x	x	x	11-14 fl oz	x	x	12h	56 fl oz
ametoctradin + dimethomorph		x	x	x	E	x	x	14d	NA
Ziram 76DF	M3	x	3-4 lb	3-4 lb	3-4 lb	3-4 lb	x	48h	28 lb
ziram		x	E	s	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 through Veraison (berry coloring) – 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 187-189.

Table 6-7. Effectiveness of insecticides for control of grape insects – shatter[1]

Product and formulation Active ingredient	IRAC code[2]	grape berry-moth	grape phylloxera	Japanese beetle	leafhopper	red-banded leafroller	rose chafer	spider mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	x	1.5-3.5 oz	1.5-3.5 oz	x	x	x	12h	7 oz
thiamethoxam		x	x	G	G	x	x	x	5d	NA
Admire Pro (4.6F)	4A	x	7-14 fl oz (soil)	x	7-14 fl oz (soil); 1-1.4 fl oz (foliar)	x	x	x	12h	2.8/14 fl oz
imidacloprid		x	G	x	E	x	x	x	0/30d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	x	x	1.75-3.5 fl oz	x	x	1.75-3.5 fl oz	12h/ 4d	7 fl oz
abamectin		x	x	x	F	x	x	G	28d	2
Altacor (35WDG)	28	2-4.5 oz	x	3-4.5 oz	x	x	x	x	4h	9 oz
chlorantraniliprole		E	x	G	x	x	x	x	14d	4
Apollo SC (1SC)	10A	x	x	x	x	x	x	4-8 oz	12h/ 14d	NA
clofentezine		x	x	x	x	x	x	E	21d	1
Assail 30SG	4A	2.5-5.3 oz	2.5-5.3 oz	2.5-5.3 oz	2.5-5.3 oz	x	2.5-5.3 oz	x	12h	10.6 oz
acetamiprid		u	G	G	E	x	E	x	3d	2
Avaunt (30WDG)	22	5-6 oz	x	3.5-6 oz	5-6 oz	x	x	x	12h	12 oz
indoxacarb		G	x	G	s	x	x	x	7d	2
Azera 0.21EC	3A	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	12h	NA
azadirachtin + pyrethrins		u	u	u	u	u	u	u	0d	10
Baythroid XL (1EC) **(RUP)**	3A	2.4 -3.2 fl oz	x	x	1.6 -3.2 fl oz	x	x	x	12h	12.8 fl oz
beta-cyfluthrin		E	x	x	G	x	x	x	3d	NA
BeetleGONE! ag	11	x	x	1-17.5 lb	x	x	x	x	4h	NA
B.t. galleriae		x	x	G	x	x	x	x	0d	NA
Belay (2.13SC)	4A	6 fl oz (foliar)	6-12 fl oz (soil)	2-4 fl oz (foliar)	6-12 fl oz (soil); 2-4 fl oz (foliar)	x	x	x	12h	12 fl oz
clothianidin		F	s	F	E	x	x	x	0/30d	1
Brigade 2EC **(RUP)**	3A	3.2-6.4 fl oz	x	3.2-6.4 fl oz	3.2-6.4 fl oz	x	x	6.4 fl oz	12h	7 fl oz
bifenthrin		G	x	G	G	x	x	u	30d	NA
Brigade WSB (10WP) **(RUP)**	3A	8-16 oz	x	8-16 oz	8-16 oz	x	x	16 oz	12h	16 oz
bifenthrin		G	x	G	G	x	x	u	30d	NA
B.t. (Agree, Dipel, etc.)	11A	1-2 lb	x	x	x	1-2 lb	x	x	4h	NA
Bacillus thuringiensis		F	x	x	x	F	x	x	0d	NA
Closer SC (2SC)	4C	x	x	x	2.75-5.75 fl oz	x	x	x	12h	17 fl oz
sulfoxaflor		x	x	x	E	x	x	x	7d	4

(Continued)

Table 6-7. Effectiveness of insecticides for control of grape insects – shatter[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	grape berry-moth	grape phylloxera	Japanese beetle	leafhopper	red-banded leafroller	rose chafer	spider mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Danitol 2.4EC **(RUP)**	3A	10.6-21.3 fl oz	10.6-21.3 fl oz	10.6-21.3 fl oz	5.3-10.6 fl oz	10.6-21.3 fl oz	10.6-21.3 fl oz	10.6-21.3 fl oz	24h	42.6 fl oz
fenpropathrin		E	E	E	G	u	E	G	21d	NA
Delegate WG (25WG)	5	3-5 oz	x	x	x	3-5 oz	x	x	4h	19.5 oz
spinetoram		E	x	x	x	E	x	x	3d	5
Dibrom 8E **(RUP)**	1B	x	x	x	0.5-0.6 pt	x	x	x	48h	6 pt
naled		x	x	x	u	x	x	x	10d	NA
Entrust SC (2SC)	5	4-8 fl oz	x	x	x	4-8 fl oz	x	x	4h	23 fl oz
spinosad		G	x	x	x	G	x	x	3d	5
Envidor 2SC	23	x	x	x	x	x	x	16-34 fl oz	12h	34 fl oz
spirodiclofen		x	x	x	x	x	x	E	14d	1
Imidan 70W	1B	1.3-2.1 lb	x	1.3-2.1 lb	1.3-2.1 lb	1.3-2.1 lb	1.3-2.1 lb	x	14d	6.5 lb
phosmet		G	x	G	G	G	G	x	7/14d	NA
Intrepid 2F	18	8-16 fl .oz	x	x	x	8-16 fl oz	x	x	4h	48 fl oz
methoxyfenozide		E	x	x	x	G	x	x	30d	NA
Kanemite 15SC	20B	x	x	x	x	x	x	21-31 fl oz	12h	62 fl oz
acequinocyl		x	x	x	x	x	x	F	7d	2
Magister SC (1.7SC)	21A	x	x	x	32-36 fl oz	x	x	32-36 fl oz	12h	36 fl oz
fenazaquin		x	x	x	u	x	x	u	7d	1
Malathion 5EC	1B	x	x	3 pt	3 pt	x	x	3 pt	72h	NA
malathion		x	x	G	G	x	x	u	3d	2
Movento (2SC)	23	x	6-8 fl oz	x	x	x	x	6-8 fl oz	24h	12.5 fl oz
spirotetramat		x	E	x	x	x	x	s	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	4 fl oz	x	4 fl oz	4 fl oz	x	x	x	12h	24 fl oz
zeta-cypermethrin		E	x	E	E	x	x	x	1d	NA
Nealta (1.67SC)	25	x	x	x	x	x	x	13.7 fl oz	12h	28 fl oz
cyflumetofen		x	x	x	x	x	x	G	14d	2
Nexter SC (3.75SC)	21A	x	x	x	7.5-17 fl oz	x	x	7.5-17 fl oz	12h	NA
pyridaben		x	x	x	G	x	x	G	7d	2
Onager (1EC)	10A	x	x	x	x	x	x	12-24 oz	12h	24 oz
hexythiazox		x	x	x	x	x	x	E	7d	1
Platinum (2SC)	4A	x	8-17 fl oz	8-17 fl oz	8-17 fl oz	x	x	x	12h	17 fl oz
thiamethoxam		x	G	F	G	x	x	x	60d	NA
Portal XLO (0.4EC)	21A	x	x	x	1-2 pt	x	x	2 pt	12h	2 pt
fenpyroximate		x	x	x	F	x	x	E	14d	2

(Continued)

Table 6-7. Effectiveness of insecticides for control of grape insects – shatter[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	grape berry-moth	grape phylloxera	Japanese beetle	leafhopper	red-banded leafroller	rose chafer	spider mite	REI[3] PHI[4]	Max amt[5] Max app[6]
PQZ (1.87SC)	9B	x	x	x	3.2 fl oz	x	x	x	12h	4.8 fl oz
pyrifluquinazon		x	x	x	G	x	x	x	3d	2
Pyganic 5%EC	3A	x	x	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	x	4.5-15.6 fl oz	12h	NA
pyrethrins		x	x	F	u	u	x	u	0d	10
Sevin XLR Plus (4F)	1A	2 qt	x	1-2 qt	1-2 qt	2 qt	1-2 qt	x	2d/6d	10 qt
carbaryl		G	x	E	G	G	E	x	7d	5
Sivanto Prime (1.67SC)	4D	x	x	x	7-14 fl oz	x	x	x	4h	28 fl oz
flupyradifurone		x	x	x	G	x	x	x	0/30d	NA
Surround WP (95WP)	UN	x	x	25-50 lb	25-50 lb	x	25-50 lb	x	4h	NA
kaolin		x	x	F	F	x	F	x	0	NA
Transform WG	4C	x	x	x	1.5-2.75 oz	x	x	x	24h	8.5 oz
sulfoxaflor		x	x	x	E	x	x	x	7d	4
Vendex 50WP **(RUP)**	12B	x	x	x	x	x	x	1-2.5 lb	48h	4 lb
fenbutatin-oxide		x	x	x	x	x	x	F	28d	2
Venom (70SG)	4A	1-3 oz (foliar)	5-7.5 oz (soil)	x	1-3 oz (foliar)	x	x	x	12h	12 oz
dinotefuran		F	s	x	G	x	x	x	1/28d	NA
Verdepryn 100SL (0.83SL)	28	8.2-11 fl oz	x	8.2-11 fl oz	x	8.2-11 fl oz	x	x	4h	33 fl oz
cyclaniliprole		E	x	u	x	u	x	x	7d	3
Zeal (72WP)	10B	x	x	x	x	x	x	2-3 oz	12h	3 oz
etoxazole		x	x	x	x	x	x	E	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

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, 11, 21, 40).
- See Fungicide Resistance Management, page 180, for information about fungicide resistance development in powdery and downy mildews. See Generic Fungicides table for product(s) with the same active ingredient, page 278.

Table 6-8. Effectiveness of pesticides for control of grape diseases – shatter to veraison[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	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	10-15.5 fl oz	4h	90 fl oz
azoxystrobin		x	E	E [r]	F	E [r]	14d	varies
Aliette WDG	33	x	x	3-5 lb	x	x	12h	NA
aluminum tris		x	x	E	x	x	15d	3
Aprovia (EC)	7	8.6-10.5 fl oz	8.6-10.5 fl oz	x	8.6-10.5 fl oz	8.6-10.5 fl oz	12h	32 fl oz
benzovindiflupyr		i	G-E	x	i	G-E	21d	3
Captan 80 WDG	M	1.25-2.5 lb	1.25-2.5 lb	1.25-2.5 lb	1.2-2.5 lb	1.2-2.5 lb	48h	15 lb
captan		s(G)	s(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	1.25-3 lb	1.2-3 lb	1.2-3 lb	1.2-3 lb	48 h	50 lb
copper sulfate		x	F	F	F	F-i	x	NA
Endura (70WG)	7	x	x	x	x	4.5 oz	12h	24 oz
boscalid		x	x	x	x	E	14d	varies
Fervent 475SC	3+7	x	8.5 fl oz	x	8.5 fl oz	8.5 fl oz	12h	26 fl oz
isofetamid+tebuconazole		x	u	x	u	E	14d	NA
Flint Extra	11	x	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		x	E	s	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	x	x	x	x	20.5-24.4 fl oz	4h	NA
Banda de Lupinus albus doce (BLAD)		x	x	x	x	F	1d	5
Gatten	U13	x	x	x	x	6.4 fl oz	12h	1 lb
flutianil		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	NA
Kenja 400SC	7	20-22 fl oz	x	x	x	20-22 fl oz	12h	66 fl oz
isofetamid		G	x	x	x	F	14d	NA
Lifegard WG	M	x	4.5 oz	4.5 oz	4.5 oz	4.5 oz	4h	NA
Bacillus mycoides isolate J		x	x	F	x	F	0d	NA
Luna Experience (SC)	7+3	x	8-8.6 fl oz	x	8.6 fl oz	6-8.6 fl oz	12h/5d6	34 fl oz
fluopyram + tebuconazol		x	G	x	s	E	14d	NA
Luna Privilege (SC)	7	x	6-6.8 fl oz	x	x	3.2-6.8 fl oz	12h	14 fl oz
fluopyram		x	G	x	x	G	7d	2
Luna Sensation (SC)	7+11	x	5-7.6 fl oz	7.6 fl oz	5-7.6 fl oz	4-7.6 fl oz	12h	28 fl oz
fluopyram + trifloxystrobin		x	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		E	G-E	s	G-E	E [r]	14d	6

(Continued)

Table 6-8. Effectiveness of pesticides for control of grape diseases – shatter to veraison[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Mettle 125ME	3	3-5 fl oz	3-5 fl oz	x	x	3-5 fl oz	12h/7d7	10 oz
tetraconazole		E	E	x	x	E [r]	14d	varies
Microthiol Disperss	M	x	x	x	3-10 lb	3-10 lb	24h	NA
sulfur		x	x	x	F	E	0d	NA
Miravis Prime	7+12	9.2-13.4 fl oz	9.2-13.4 fl oz	x	9.2-13.4 fl oz	9.2-13.4 fl oz	12h	37 fl oz
pydiflumetofen+fludioxonil		u	E	x	F-G	G-E	14d	2
OSO 5% SC	19	x	x	x	x	6.5-13 fl oz	4h	5 oz
polyoxin D		x	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/5d6	69 oz
pyraclostrobin + boscalid		E	E	E [r]	F	E	14d	varies
Procure 480SC	3	x	x	x	x	4-8 fl oz	24h	32 fl oz
triflumizole		x	x	x	x	E [r]	7d	4
ProPhyt	33	x	x	2-4 pt	2-4 pt	x	4h	NA
potassium phosphite		x	x	G-E	G-E	x	0d	NA
Quadris Top (SC)	3+11	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12h	56 fl oz
difenoconazole + azoxystrobin		E	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	3-5 oz	3-5 oz	x	x	3-5 oz	24h	2 lb
myclobutanil		E	E	x	x	E[r]	14d	NA
Ranman 400SC	21	x	x	2.1-2.75 fl oz	x	x	12h	17 fl oz
cyazofamid		x	x	E	x	x	30d	6
Reason 500SC	11	x	x	2.7 fl oz	x	x	12h	9 fl oz
fenamidone		x	x	G[r]	x	x	30d	NA
Revus	40	x	x	8 fl oz	x	x	4h	32 fl oz
mandipropamid		x	x	E	x	x	14d	NA
Revus Top	3+40	7 fl oz	7 fl oz	7 fl oz	7 fl oz	7 fl oz	12h	28 fl oz
difenoconazole + mandipropamid		E	E	E	E	E	14d	NA
Ridomil Gold Copper	4+M	x	x	5 lb (1 pack)	x	x	48h	8 lb
mefenoxam + copper hydroxide		x	x	E	x	x	42d	4
Ridomil Gold MZ WG	4+M	x	x	2.5 lb	x	x	48h	10 lb
mefenoxam + mancozeb		x	x	E	x	x	66d	4
Sovran (50WG)	11	x	3.2-4.8 oz	4-6.4 oz	3.2-4.8 oz	3.2-4.8 oz	12h	26 oz
kresoxim-methyl		x	E	F [r]	F	E [r]	14d	4
Sulforix	M	x	x	x	1-2 gal, 1 pt	1-2 gal, 1 pt	48h	NA
calcium polysulfide		x	x	x	G-E	i	NA	8
Switch 62.5 WG	9+12	x	x	x	x	x	12h	56 oz
cyprodinil + fludioxonil		x	x	x	x	x	7d	NA

(Continued)

Table 6-8. Effectiveness of pesticides for control of grape diseases – shatter to veraison[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	black rot	downy mildew	Phomopsis blight	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Tanos	11+27	x	x	8 oz	x	x	12h	72 oz
famoxadone + cymoxanil		x	x	G [r]	x	x	30d	9
Tebustar 45WSP	3	x	4 oz	x	x	4 oz	12h	2 lb
tebuconazole		x	E	x	x	E [r]	0d	NA
Topguard EQ	3+11	x	5-6 fl oz	8 fl oz	8 fl oz	5-6 fl oz	12h	34 fl oz
azoxystrobin+flutriafol		x	u	u	u	E	14d	6
Topsin M WSB	1	x	0.75-1.5 lb	x	0.75-1.5 lb	0.75-1.5 lb	2d	6 lb
thiophanate-methyl		x	F	x	G	E	7d	NA
Torino (SC)	U6	x	x	x	x	3.4-6.8 oz	4h	7 oz
cyflufenamid		x	x	x	x	E	3d	1 or 2
Vangard WG	9	x	x	x	x	10 oz	12h	30 oz
cyprodinil		x	x	x	x	s	7d	NA
Vivando 2.5F	U8	x	x	x	x	10.3-15.4 fl oz	12h	43 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	M3	x	3-4 lb	3-4 lb	3-4 lb	x	48h	28 lb
ziram		x	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 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.
- **Multi-colored Asian lady beetle:** Scout vineyards several days before harvest to determine the abundance of multi-colored 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 Multi-colored Asian Lady Beetle section on page 181.
- **RESIDUE REMINDER:** Wettable powder formulations may leave visible residues on fruit at harvest.
- Pay close attention to the PHI on products.

Table 6-9. Effectiveness of pesticides for control of grape insect pests – veraison to harvest[1]

Product and formulation Active ingredient	IRAC code[2]	grape berry moth	grape june beetle	Japanese beetle	leafhopper	multi-colored Asian lady beetle	spider mite	spotted-wing Drosophila	stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	x	1.5-3.5 oz	1.5-3.5 oz	x	x	x	4 oz	12h	7 oz
thiamethoxam		x	x	G	G	x	x	x	G	5d	NA
Admire Pro (4.6F)	4A	x	x	x	7-14 fl oz (soil); 1-1.4 fl oz (foliar)	x	x	x	x	12h	2.8/14 fl oz
imidacloprid		x	x	x	E	x	x	x	x	0/ 30d	NA

(Continued)

Table 6-9. Effectiveness of pesticides for control of grape insect pests – veraison to harvest[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	grape berry moth	grape june beetle	Japanese beetle	leafhopper	multi-colored Asian lady beetle	spider mite	spotted-wing Drosophila	stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Agri-Mek SC (0.7SC) **(RUP)**	6	x	x	x	1.75-3.5 fl oz	x	1.75-3.5 fl oz	x	x	12h/ 4d	7 fl oz
abamectin		x	x	x	F	x	G	x	x	28d	2
Altacor (35WDG)	28	2-4.5 oz	x	3-4.5 oz	x	x	x	x	x	4h	9 oz
chlorantraniliprole		E	x	G	x	x	x	x	x	14d	4
Apollo SC (1SC)	10A	x	x	x	x	x	4-8 oz	x	x	12h/ 14d	NA
clofentezine		x	x	x	x	x	E	x	x	21d	1
Assail 30SG	4A	2.5-5.3 oz	x	2.5-5.3 oz	2.5-5.3 oz	x	x	x	x	12h	10.6 oz
acetamiprid		u	x	G	E	x	x	x	x	3d	2
Avaunt (30WDG)	22	5-6 oz	x	3.5-6 oz	5-6 oz	x	x	x	x	12h	12 oz
indoxacarb		G	G	G	s	x	x	x	x	7d	2
Azera 0.21EC	3A	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	16-56 fl oz	12h	NA
azadirachtin + pyrethrins		u	u	u	u	u	u	u	u	0d	10
Baythroid XL (1EC) **(RUP)**	3A	2.4-3.2 fl oz	x	x	1.6 -3.2 fl oz	x	x	2.4-3.2 fl oz	x	12h	12.8 fl oz
beta-cyfluthrin		E	x	x	G	x	x	E	x	3d	NA
BeetleGONE! ag	11	x	x	1-17.5 lb	x	x	x	x	x	4h	NA
B.t. galleriae		x	x	G	x	x	x	x	x	0d	NA
Belay (2.13SC)	4A	6 fl oz (foliar)	x	2-4 fl oz (foliar)	6-12 fl oz(-soil); 2-4 fl oz (foliar)	2-4 fl oz (foliar)	x	x	x	12h	12 fl oz
clothianidin		F	x	F	E	E	x	x	x	0/ 30d	1
Brigade 2EC **(RUP)**	3A	3.2-6.4 fl oz	x	3.2-6.4 fl oz	3.2-6.4 fl oz	x	6.4 fl oz	x	x	12h	7 fl oz
bifenthrin		G	x	G	G	x	u	x	x	30d	NA
Brigade WSB (10WP) **(RUP)**	3A	8-16 oz	x	8-16 oz	8-16 oz	x	16 oz	x	x	12h	16 oz
bifenthrin		G	x	G	G	x	u	x	x	30d	NA
B.t. (Agree, Dipel, etc.)	11A	1-2 lb	x	x	x	x	x	x	x	4h	NA
Bacillus thuringiensis		u	x	x	x	x	x	x	x	0d	NA
Closer SC (2SC)	4C	x	x	x	2.75-5.75 fl oz	x	x	x	x	12h	17 fl oz
sulfoxaflor		x	x	x	E	x	x	x	x	7d	4
Danitol 2.4EC **(RUP)**	3A	10.6-21.3 fl oz	x	10.6-21.3 fl oz	5.3-10.6 fl oz	x	10.6-21.3 fl oz	10.6-21.3 fl oz	10.6-21.3 fl oz	24h	42.6 fl oz
fenpropathrin		E	x	E	G	x	G	E	G	21d	NA
Delegate WG (25WG)	5	3-5 oz	x	x	x	x	x	x	x	4h	19.5 oz
spinetoram		E	x	x	x	x	x	E	x	3d	5

(Continued)

Table 6-9. Effectiveness of pesticides for control of grape insect pests – veraison to harvest[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	grape berry moth	grape june beetle	Japanese beetle	leafhopper	multi-colored Asian lady beetle	spider mite	spotted-wing Drosophila	stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Dibrom 8E **(RUP)**	1B	x	x	x	0.5-0.6 pt	x	x	0.5-0.6 pt	x	48h	6 pt
naled		x	x	x	u	x	x	u	x	10d	NA
Entrust SC (2SC)	5	4-8 fl oz	x	x	x	x	x	x	x	4h	23 fl oz
spinosad		G	x	x	x	x	x	G	x	3d	5
Envidor 2SC	23	x	x	x	x	x	16-34 fl oz	x	x	12h	34 fl oz
spirodiclofen		x	x	x	x	x	E	x	x	14d	1
Imidan 70W	1B	1.3-2.1 lb	x	1.3-2.1 lb	1.3-2.1 lb	x	x	1.3-2.1 lb	x	14d	6.5 lb
phosmet		G	x	G	G	x	x	G	x	7/ 14d	NA
Intrepid 2F	18	8-16 fl .oz	x	x	x	x	x	x	x	4h	48 fl oz
methoxyfenozide		E	x	x	x	x	x	x	x	30d	NA
Kanemite 15SC	20B	x	x	x	x	x	21-31 fl oz	x	x	12h	62 fl oz
acequinocyl		x	x	x	x	x	F	x	x	7d	2
Magister SC (1.7SC)	21A	x	x	x	32-36 fl oz	x	32-36 fl oz	x	x	12h	36 fl oz
fenazaquin		x	x	x	u	x	u	x	x	7d	1
Malathion 5EC	1B	x	x	3 pt	3 pt	x	3 pt	3 pt	x	72h	NA
malathion		x	x	G	G	x	u	G	x	3d	2
Movento (2SC)	23	x	x	x	x	x	6-8 fl oz	x	x	24h	12.5 fl oz
spirotetramat		x	x	x	x	x	s	x	x	7d	NA
Mustang Maxx (0.83EC) **(RUP)**	3A	4 fl oz	x	4 fl oz	4 fl oz	2-4 fl oz	x	x	x	12h	24 fl oz
zeta-cypermethrin		E	x	E	E	G	x	E	x	1d	NA
Nealta (1.67SC)	25	x	x	x	x	x	13.7 fl oz	x	x	12h	28 fl oz
cyflumetofen		x	x	x	x	x	G	x	x	14d	2
Nexter SC (3.75SC)	21A	x	x	x	7.5-17 fl oz	x	7.5-17 fl oz	x	x	12h	NA
pyridaben		x	x	x	G	x	G	x	x	7d	2
Onager (1EC)	10A	x	x	x	x	x	12-24 oz	x	x	12h	24 oz
hexythiazox		x	x	x	x	x	E	x	x	7d	1
Portal XLO (0.4EC)	21A	x	x	x	1-2 pt	x	2 pt	x	x	12h	2 pt
fenpyroximate		x	x	x	F	x	E	x	x	14d	2
PQZ (1.87SC)	9B	x	x	x	3.2 fl oz	x	x	x	x	12h	4.8 fl oz
pyrifluquinazon		x	x	x	G	x	x	x	x	3d	2

(Continued)

Table 6-9. Effectiveness of pesticides for control of grape insect pests – veraison to harvest[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	grape berry moth	grape june beetle	Japanese beetle	leafhopper	multi-colored Asian lady beetle	spider mite	spotted-wing Drosophila	stink bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Pyganic 5%EC	3A	x	x	4.5-15.6 fl oz	4.5-15.6 fl oz	x	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	12h	NA
pyrethrins		x	x	F	u	G	u	F	u	0d	10
Sevin XLR Plus (4F)	1A	2 qt	2 qt	1-2 qt	1-2 qt	x	x	x	x	2d/ 6d	10 qt
carbaryl		G	E	E	G	x	x	x	x	7d	5
Sivanto Prime (1.67SC)	4D	x	x	x	7-14 fl oz	x	x	x	x	4h	28 fl oz
flupyradifurone		x	x	x	G	x	x	x	x	0/ 30d	NA
Surround WP (95WP)	UN	x	25-50 lb	25-50 lb	25-50 lb	x	x	x	x	4h	NA
kaolin		x	u	F	F	x	x	x	x	0	NA
Transform WG	4C	x	x	x	1.5-2.75 oz	x	x	x	x	24h	8.5 oz
sulfoxaflor		x	x	x	E	x	x	x	x	7d	4
Vendex 50WP **(RUP)**	12B	x	x	x	x	x	1-2.5 lb	x	x	48h	4 lb
fenbutatin-oxide		x	x	x	x	x	F	x	x	28d	2
Venom (70SG)	4A	1-3 oz (foliar)	x	x	1-3 oz (foliar)	1-3 oz (foliar)	x	x	x	12h	12 oz
dinotefuran		F	x	x	G	G	x	x	x	1/ 28d	NA
Verdepryn 100SL (0.83SL)	28	8.2-11 fl oz	x	8.2-11 fl oz	x	x	x	8.2-11 fl oz	8.2-11 fl oz	4h	33 fl oz
cyclaniliprole		E	x	u	x	x	x	E	s	7d	3
Zeal (72WP)	10B	x	x	x	x	x	2-3 oz	x	x	12h	3 oz
etoxazole		x	x	x	x	x	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

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 179. Same as for Grape Bloom, pages 163-166.
- **Sour rot complex:** Mix Oxidate or Blight Ban 506 with an insecticide (for Drosophila control). See discussion on page 179.
- **Black rot:** Sprays for black rot should not be needed at this time

Table 6-10. Effectiveness of pesticides for control of grape diseases – veraison to harvest[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	anthracnose fruit rot	black rot	Botrytis bunch rot	downy mildew	Phomopsis blight	powdery mildew	bitter rot	ripe rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	x	x	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	x	x	4h	90 fl oz
azoxystrobin		x	x	E	s	E [r]	F	E [r]	x	x	14d	varies
Aliette WDG	33	x	x	x	x	3-5 lb	x	x	x	x	12h	NA
aluminum tris		x	x	x	E	x	x	x	x	x	15d	3
Captan 80 WDG	M	1.25-2.5 lb	1.25-2.5 lb	1.25-2.5 lb	2.5 lb	1.25-2.5 lb	1.2-2.5 lb	1.2-2.5 lb	x	x	48h	15 lb
captan		s(G)	s(F)	F	G	E	i	s(G)	x	x	0d	NA
Cevya	3	x	x	4 fl oz	x	x	3-4 fl oz	3-4 fl oz	x	x	12h	8 fl oz
mefentrifluconazole		x	x	E	x	x	G	G-E	x	x	14d	2
Cuprofix Ultra 40D	M	x	x	1.25-3 lb	x	1.2-3 lb	1.2-3 lb	1.2-3 lb	x	x	48 h	50 lb
copper sulfate		x	x	F	x	F	F	F-i	x	x	x	NA
Elevate 50 WDG	17	x	x	x	1 lb	x	x	1 lb	x	x	12h	3 lb
fenhexamid		x	x	x	E	x	x	s	x	x	0d	3
Endura (70WG)	7	x	x	x	8 oz	x	x	4.5 oz	x	x	12h	24 oz
boscalid		x	x	x	G	x	x	E	x	x	14d	varies
Fervent 475SC	3+7	x	x	8.5 fl oz	8.5 fl oz	x	8.5 fl oz	8.5 fl oz	x	x	12h	26 fl oz
isofetamid+tebuconazole		x	x	u	s	x	u	E	x	x	14d	NA
Flint Extra	11	x	x	3.5-3.8 fl oz	3.8 fl oz	3.8 fl oz	3.5-3.8 fl oz	3-3.5 fl oz	x	x	12h	23 fl oz
trifloxystrobin		x	x	E	G	s	F	E	x	x	14d	6
Forum	40	x	x	x	x	6 oz	x	x	x	x	12h	24 oz
dimethomorph		x	x	x	x	E	x	x	x	x	14d	4
Fracture	M	x	x	x	24.4-36.6 fl oz	x	x	20.5-24.4 fl oz	x	x	4h	NA
Banda de Lupinus albus doce (BLAD)		x	x	x	E	x	x	E	x	x	1d	5
Gatten	U13	x	x	x	x	x	x	6.4 fl oz	x	x	12h	1 lb
flutianil		x	x	x	x	x	x	G-E	x	x	14d	4
Inspire Super (EW)	3+9	16-20 fl oz	16-20 fl oz	16-20 fl oz	16-20 fl oz	x	x	16-20 fl oz	x	x	12h	80 fl oz
difenoconazole + cyprodinil		E	E	E	x	x	x	G	x	x	14d	NA
Intuity (SC)	11	x	x	x	6 fl oz	x	x	6 fl oz	x	x	12h	18 fl oz
mandestrobin		x	x	x	G-E	x	x	s	x	x	10d	3
Kenja 400SC	7	20-22 fl oz	20-22 fl oz	x	20-22 fl oz	x	x	20-22 fl oz	x	20-22 fl oz	12h	66 fl oz
isofetamid		G	G	x	F	x	x	F	x	u	14d	NA

(Continued)

Table 6-10. Effectiveness of pesticides for control of grape diseases – veraison to harvest[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	anthracnose fruit rot	black rot	Botrytis bunch rot	downy mildew	Phomopsis blight	powdery mildew	bitter rot	ripe rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Lifegard WG	M	x	x	x	x	4.5 oz	x	4.5 oz	x	x	4h	NA
Bacillus mycoides isolate J		x	x	x	x	F	x	F	x	x	0d	NA
Luna Experience (SC)	7+3	x	x	8-8.6 fl oz	8-8.6 fl oz	x	8.6 fl oz	6-8.6 fl oz	x	x	12h/ 5d6	34 fl oz
fluopyram + tebuconazol		x	x	G	E	x	s	E	x	x	14d	NA
Luna Privilege (SC)	7	x	x	6-6.8 fl oz	6-6.8 fl oz	x	x	3.2-6.8 fl oz	x	x	12h	14 fl oz
fluopyram		x	x	G	E	x	x	G	x	x	7d	2
Luna Sensation (SC)	7+11	x	x	5-7.6 fl oz	5-7.6 fl oz	7.6 fl oz	5-7.6 fl oz	4-7.6 fl oz	x	x	12h	28 fl oz
fluopyram + trifloxystrobin		x	x	G	G-E	s	F-G	E	x	x	14d	6
Merivon (2.09SC)	7+11	4 to 5.5 fl oz	4 to 5.5 fl oz	4 to 5.5 fl oz	4 to 5.5 fl oz	4 to 5.5 fl oz	4 to 5.5 fl oz	4-5.5 fl oz	x	4-5.5 fl oz	12h	33 fl oz
fluxapyroxad + pyraclostrobin		E	G-E	E	s	s[r]	G-E	E [r]	x	s(G)	14d	6
Mettle 125ME	3	3-5 fl oz	3-5 fl oz	3-5	x	x	x	3-5 fl oz	x	x	12h/ 7d7	10 oz
tetraconazole		E	E	u	x	x	x	E [r]	x	x	14d	varies
Microthiol Disperss	M	x	x	x	x	x	3-10 lb	3-10 lb	x	x	24h	NA
sulfur		x	x	x	x	F	E	x	x	x	0d	NA
Miravis Prime	7+12	9.2-13.4 fl oz	9.2-13.4 fl oz	9.2-13.4 fl oz	10.3-13.4 fl oz	x	9.2-13.4 fl oz	9.2-13.4 fl oz	x	x	12h	37 fl oz
pydiflumetofen+fludioxonil		u	E	G-E	F-G	x	G-E	F-G	x	x	14d	2
OSO 5% SC	19	x	x	x	6.5-13 fl oz	x	x	6.5-13 fl oz	x	x	4h	5 oz
polyoxin D		x	x	x	G	x	x	G	x	x	0d	6
Pristine	11+7	8-12.5 oz	8-12.5 oz	8-12.5 oz	8-23 oz	8-12.5 oz	8-12.5 oz	8-12.5 oz	x	x	12h/ 5d6	69 oz
pyraclostrobin + boscalid		E	E	G	E [r]	F	E	u	x	x	14d	varies
Procure 480SC	3	x	x	x	x	x	x	4-8 fl oz	x	x	24h	32 fl oz
triflumizole		x	x	s	x	x	E [r]	x	x	x	7d	4
ProPhyt	33	x	x	x	x	2-4 pt.	2-4 pt	x	x	x	4h	NA
potassium phosphite		x	x	x	G-E	G-E	x	x	x	x	0d	NA
Quadris Top (SC)	3+11	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	12-14 fl oz	x	x	12h	56 fl oz
difenoconazole + azoxystrobin		E	E	s	F	s[r]	E	G	x	x	14d	NA
Rally 40WSP	3	3-5 oz	3-5 oz	3-5 oz	x	x	x	3-5 oz	x	x	24h	2 lb
myclobutanil		E	E	x	x	x	E[r]	x	x	x	14d	NA

(Continued)

Table 6-10. Effectiveness of pesticides for control of grape diseases – veraison to harvest[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose foliar	anthracnose fruit rot	black rot	Botrytis bunch rot	downy mildew	Phomopsis blight	powdery mildew	bitter rot	ripe rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Revus	40	x	x	x	x	8 fl oz	x	x	x	x	4h	32 fl oz
mandipropamid		x	x	x	E	x	x	x	x	x	14d	NA
Revus Top	3+40	7 fl oz	7 fl oz	7 fl oz	x	7 fl oz	7 fl oz	7 fl oz	x	x	12h	28 fl oz
difenoconazole + mandipropamid		E	E	E	x	E	E	F	x	x	14d	NA
Scala SC	9	x	x	x	18 fl oz	x	x	x	x	x	12h	36 fl oz
pyrimethanil		x	x	x	G	x	x	x	x	x	7d	NA
Sovran (50WG)	11	x	x	3.2-4.8 oz	3.2-6.4 oz	4-6.4 oz	3.2-4.8 oz	3.2-4.8 oz	x	x	12h	26 oz
kresoxim-methyl		x	x	s	E-F [r]	E-F [r]	E	E-F [r]	x	x	14d	4
Sulforix	M	x	x	x	x	1-2 gal, 1 pt	1-2 gal, 1 pt	1 pt/ 100 g	x	x	48h	NA
calcium polysulfide		x	x	x	x	G-E	i	F-G	x	x	48h	8
Switch 62.5 WG	9+12	x	x	x	11-14 oz	x	x	x	x	x	12h	56 oz
cyprodinil + fludioxonil		x	x	x	G	x	x	x	x	x	7d	NA
Tebustar 45WSP	3	x	x	4 oz	x	x	x	4 oz	x	x	12h	2 lb
tebuconazole		x	x	E	x	x	x	E [r]	x	x	0d	NA
Topguard EQ	3+11	x	x	5-6 fl oz	8 fl oz	8 fl oz	8 fl oz	5-6 fl oz	x	x	12h	34 fl oz
azoxystrobin+flutriafol		x	x	u	s	u	u	E	x	x	14d	6
Topsin M WSB	1	x	x	0.75-1.5 lb	x	x	0.75-1.5 lb	0.75-1.5 lb	0.75-1.5 lb	x	2d	6 lb
thiophanate-methyl		x	x	F	x	x	G	E	G	x	7d	NA
Torino (SC)	U6	x	x	x	x	x	x	3.4-6.8 oz	x	x	4h	7 oz
cyflufenamid		x	x	x	x	x	x	E	x	x	3d	1 or 2
Vangard WG	9	x	x	x	10 oz	x	x	10 oz	x	x	12h	30 oz
cyprodinil		x	x	x	G-E	x	x	s	x	x	7d	NA
Vivando 2.5F	U8	x	x	x	x	x	x	10.3-15.4 fl oz	x	x	12h	43 fl oz
metrafenone		x	x	x	x	x	x	E	x	x	14d	3
Zampro	45+40	x	x	x	x	11-14 fl oz	x	x	x	x	12h	56 fl oz
ametoctradin + dimethomorph		x	x	x	x	E	x	x	x	x	14d	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 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 denature 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: https://www.canr.msu.edu/ipm/Invasive_species/spotted_wing_drosophila/index

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 preharvest intervals for the products you choose to apply.

Multi-colored Asian lady beetle

The multi-colored 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

This insect can be a serious pest in southern parts of our region. There are no insecticides currently labeled for use against this pest in grapes, but it can be managed with the biocontrol tactic of nematodes. Research on the behavioral tactic of pheromone mating disruption has looked promising, but no mating disruption product is currently registered for control of this pest on grapes.

Spotted lanternfly

The spotted lanternfly is an invasive planthopper that is currently spreading 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.

Table 6-12. 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	++	+++	+++

(Continued)

Table 6-12. 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]
Lemberger	+++	+++	+++	+	?	+++	+++	?	No	?	++	?
Leon Millot	+	++	+++	+	+	+	?	+	Yes	++	+	?
Marquette	++	+	+	+++	+++	?	+	+++	No	++	+++	+
Marquis	+	+++	+	+	+++	?	?	+++	?	?	+	?
Mars	+	+	+	+	+	?	+	++	?	?	+	+
Merlot	++	+++	+++	++	+	+++	+++	++	No	++	?	?
Moore's Diamond	+++	+	+++	++	?	++	?	?	No	?	?	?
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.

Table 6-13. 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	0.8 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)

Table 6-13. 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)

Table 6-13. 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.

[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

Table 6-14. Effectiveness of insecticides for control of grape insects[1]

		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	12 oz
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	16 oz
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)

Table 6-14. 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
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 pt
fenpyroximate																		14d	2
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

(Continued)

Table 6-14. 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]**
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	E	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.

[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. BLUEBERRY

Blueberry Spray Schedule

Entomology Lead: C. Welty
Pathology Lead: N. Gauthier and J. Beckerman

How to read the spray schedule tables

Every blueberry 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.

Blueberry Delayed Dormant – Diseases

Apply after buds begin to break.

- Orondis Gold and Ridomil Gold SL are labeled for control of Phytophthora root rot of high bush blueberries; Ridomil Gold is labeled for highbush and low bush blueberry types. Apply to established plantings before the plants start growth in the spring. Apply to new plantings at time of planting.
- Sulforix should not be applied within 14 days of an oil spray.
  - Orondis Gold contains mefenoxam (FRAC 4), the active ingredient of Ridomil Gold (FRAC 4). Use only one of these products for control of Phytophthora and alternate with a FRAC 33.
- Ziram 76DF should be applied at loose bud and again 7 days later for Phomopsis cane blight.

Table 7-1. Dormant to delayed dormant fungicide applications[1]

Product and formulation Active ingredient	FRAC code[2]	Phomopsis cane blight	Phytophthora root rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Aliette WDG	33	5 lb	0.5 lb	12h	20 lb
aluminum tris		s	G	0.5d	4
Orondis Gold	49+4	x	20-55 oz	48 h	110 fl oz
oxathiapipralin+ mefenoxam		x	E	1 d	2
ProPhyt	33	x	4 pt	4h	NA
potassium phosphite		x	G	0d	NA
Ridomil Gold SL	4	x	3.6 pt	48h	7.2 pt
mefenoxam		x	E	0d	NA
Sulforix	M	1-2 gal/100 gal	x	48h	8 gal
calcium polysulfide		u	x	NA	4
Ziram 76DF	M3	3 lb	x	48h	NA
ziram		G	x	30d	NA

Blueberry Green Tip – Diseases

- Apply when leaf buds swell and are showing 1/16-1/4 inch green tip.
- For control of **mummy berry**: Scout for fallen mummies producing tiny, trumpet-like "mushrooms," particularly in wet areas. "Mushrooms" produce spores for 1-4 weeks, with the longer durations occurring under cooler conditions.
- Freezing temperatures may result in injury and increase the susceptibility of young leaves and shoots to Botryosphaeria infection. A spray within 24 hours of a frost event may improve efficacy of fungicides used.
- Tank mixes that include captan or Bravo with oils or EC formulated pesticides can cause phytotoxicity.
- The second application of Ridomil may be applied during periods of high disease pressure and wet conditions.

Table 7-2. Green tip fungicide application[1]

Product and formulation Active ingredient	FRAC code[2]	Botryosphaeria canker	mummy berry	Phomopsis cane blight	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	4h	46 fl oz
azoxystrobin		u	F	F	0d	NA
Aliette WDG	33	x	5 lb	0.5 lb	12h	20 lb
aluminum tris		x	s	G	0.5d	4
Bravo Weather Stik	M3	x	3-4 pt	3-4 pt	12h	12 pt
chlorothalonil		x	E	s	42d	NA
Captan 80WG	M 5	x	1.25-3 lb	1.25-3 lb	48h	43.75 lb
captan		x	s[E]	F	0d	NA
Fontelis	7	x	2.5-3 fl oz	x	12h	72 fl oz
penthiopyrad		x	E	x	0d	NA
Indar 2F	3	x	6 fl oz	6 fl oz	12h	24 fl oz
fenbuconazole		x	E	G	30d	4
Inspire Super	3+9	x	16-20 fl oz	x	12h	80 fl oz
difenoconazole + cyprodinil		x	E	x	7d	NA

(Continued)

Table 7-2. Green tip fungicide application[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	Botryosphaeria canker	mummy berry	Phomopsis cane blight	REI[3] PHI[4]	Max amt[5] Max app[6]
Kocide 3000	M	x	1.75 lb-3.5 lb	1.75 lb-3.5 lb	48h	28 lb
copper hydroxide		x	F	s	0d	NA
Luna Privilege	7	x	4.8-6.8 fl oz	4.8-6.8 fl oz	12h	13.7
fluopyram		x	E	U	0d	NA
Luna Tranquility (SC)	7+9	x	13.6-27 fl oz	27 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		x	E-G	s	0d	NA
Merivon	7+11	x	4-11 fl oz	4-11 fl oz	12h	33 fl oz
pyraclostrobin + fluxopyroxad		x	G	G	0	3
Miravis Prime	7+12	x	9-13.4 fl oz	9-13.4 fl oz	12h	26.8 fl oz
pydiflumetofen+fludioxonil		x	G	G	0d	NA
Omega 500F	29	x	20 fl oz	20 fl oz	12h	120 fl oz
fluazinam		x	F	u	30d	NA
Orondis Gold	49+4	x	x	20-55 oz	48h	110 fl oz
oxathiapipralin+ mefenoxam		x	x	E	1d	2
Pristine (38WG)	11+7	x	18.5-23 oz	18.5-23 oz	24h	92 oz
pyraclostrobin + boscalid		x	F	G	0d	4
ProPhyt	33	x	x	4 pt	4h	NA
potassium phosphite		x	x	G	0d	NA
Quadris Top	11+3	x	12-14 fl oz	2-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		x	G	s	7d	4
Quash SC	3	2.5 oz	2.5 oz	2.5 oz	12h	7.5 oz
metconazole		u	E	E	7d	3
Quilt Xcel	11+3	14-21 fl oz	14-21 fl oz	14-21 fl oz	12h	63 fl oz
azoxystrobin + propiconazole		u	F	G	30d	NA
Ridomil Gold SL	4	x	x	3.6 pt	48h	7.2 pt
mefenoxam		x	x	E	0d	NA
Sulforix	M	1-2 gal/100 gal	x	1-2 gal/100 gal	48h	8 gal
calcium polysulfide		u	x	G	NA	4
Switch 62.5WG	9+12	x	11-14 oz	11-14 oz	12h	56 oz
cyprodinil + fludioxonil		x	F	F	0d	NA
Tilt	3	x	6 fl oz	6 fl oz	12h	30 fl oz
propiconazole		x	G-F	G	30d	5
Ziram 76DF	M3	x	3 lb	3 lb	48h	NA
ziram		x	G	G	30d	NA

Blueberry Pink Bud Stage through Petal Fall – Diseases

Make applications as needed when flower petals show pink, at 25% bloom, and every 7-10 days when blooms are open through petal fall.

- **Mummy berry** management: Pre-bloom fungicide sprays should begin at green tip and continue sprays until all blooms have fallen.
- For early harvest berries: Be aware of the preharvest intervals (PHI) of Bravo, Indar2F, Quilt. Tilt, Ziram and generic counterparts.

Table 7-3. Fungicide applications from pink bud through petal fall[1]

Product and formulation Active ingredient	FRAC code[2]	Alternaria fruit rot	anthracnose fruit rot	Botryosphaeria canker	Botrytis blight	mummy berry	Phomopsis cane blight	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	4h	46 fl oz
azoxystrobin		G	G-E	u	s (P)	F	F	0d	see label
Bravo Weather Stik	M3	3-4 pt	3-4 pt	x	3-4 pt	3-4 pt	3-4 pt	12h	12 pt
chlorothalonil		u	s[G]	x	s	E	s	42d	NA
Captan 80WG	M 5	1.25-3 lb	1.25-3 lb	x	1.25-3 lb	1.25-3 lb	1.25-3 lb	48h	43.75 lb
captan		F	G	x	F	s[E]	F	0d	NA
Elevate 50WDG	17	x	x	x	1.5 lb	1.5 lb	x	12h	6 lb
fenhexamid		x	x	x	E	F	x	0d	NA
Fontelis	7	x	x	x	16-24 fl oz	24 fl oz	16-24 fl oz	12h	72 fl oz
penthiopyrad		x	x	x	E	E	E	0d	NA
Indar 2F	3	6 fl oz	6 fl oz	x	6 fl oz	6 fl oz	6 fl oz	12h	24 fl oz
fenbuconazole		F	u	x	E	E	s	30d	4
Inspire Super	3+9	16-20 fl oz	16-20 fl oz	x	16-20 fl oz	16-20 fl oz	x	12h	80 fl oz
difenoconazole + cyprodinil		u	u	x	G-F	x	x	7d	NA
Kenja 400SC	7	x	13.5-15.5 fl oz	x	13.5-15.5 fl oz	x	x	12h	54 fl oz
Isofetamid		x	u	x	E	x	x	7d	NA
Kocide 3000	M	1-2.25 lb	1-2.25 lb	x	1-2.25 lb	1.75 lb-3.5 lb	1.75 lb-3.5 lb	48h	28 lb
copper hydroxide		F-P	F	x	F-P	F-P	s	0d	NA
Luna Privilege	7	6.8 fl oz	4.8-6.8 fl oz	x	4.8-6.8 fl oz	4.8-6.8 fl oz	4.8-6.8 fl oz	12h	13.7 fl oz
fluopyram		E	u	x	E	E	u	0d	NA
Luna Tranquility (SC)	7+9	13.6-27 fl oz	13.6-27 fl oz	x	13.6-27 fl oz	13.6-27 fl oz	13.6-27 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		G-F	s	x	E	E-G	u	0d	NA
Merivon	7+11	4-11 fl oz	4-11 fl oz	x	4-11 fl oz	4-11 fl oz	4-11 fl oz	12h	33 fl oz
pyraclostrobin + fluxopyroxad		u	E	x	s	G	G	0d	3
Miravis Prime	7+12	9-13.4 fl oz	13.4 fl oz	x	9-13.4 fl oz	9-13.4 fl oz	9-13.4 fl oz	12h	26.8 fl oz
pydiflumetofen+fludioxonil		G	G	x	G	G	G	0d	NA
Omega 500F	29	20 fl oz	20 fl oz	x	20 fl oz	20 fl oz	20 fl oz	12h	120 fl oz
fluazinam		F	G	x	u	F	u	30d	NA
PhD	19	6.2 oz	6.2 oz	x	6.2 oz	6.2 oz	6.2 oz	4h	4.2 oz
polyoxin D		P	P	x	G	G	G-F	0d	6

(Continued)

Table 7-3. Fungicide applications from pink bud through petal fall[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	Alternaria fruit rot	anthrac-nose fruit rot	Botryos-phaeria canker	Botrytis blight	mummy berry	Phomopsis cane blight	REI[3] PHI[4]	Max amt[5] Max app[6]
Pristine (38WG)	11+7	18.5-23 oz	18.5-23 oz	x	18.5-23 oz	18.5-23 oz	18.5-23 oz	24h	92 oz
pyraclostrobin + boscalid		G	E	x	G	F	G	0d	4
Proline 480C	3	5.7 fl oz	5.7 fl oz	x	5.7 fl oz	5.7 fl oz	5.7 fl oz	12h	11.4 oz
prothioconazole		F	u	x	E	E	E-G	7d	2
ProPhyt	33	4 pt	4 pt	x	x	4 pt	x	4h	NA
potassium phosphite		u	F	x	x	F	x	0d	NA
Quadris Top	11+3	12-14 fl oz	12-14 fl oz	x	x	12-14 fl oz	2-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		G	F	x	x	G	s	7d	4
Quash SC	3	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	2.5 oz	12h	7.5 oz
metconazole		u	G	u	F	E	E	7d	3
Quilt Xcel	11+3	x	14-21 fl oz	14-21 fl oz	x	14-21 fl oz	14-21 fl oz	12h	63 fl oz
azoxystrobin + propiconazole		x	G	u	x	F	G	30d	NA
Sulforix	M	x	x	x	x	1-2 gal/100 gal	1-2 gal/100 gal	48h	8 gal
calcium polysulfide		x	x	x	x	G-F	u	NA	4
Switch 62.5WG	9+12	11-14 oz	11-14 oz	x	11-14 oz	11-14 oz	11-14 oz	12h	56 oz
cyprodinil + fludioxonil		E	G	x	G	F	F	0d	NA
Tilt	3	x	x	x	x	6 fl oz	6 fl oz	12h	30 fl oz
propiconazole		x	x	x	x	G	s[G]	30d	5
Ziram 76DF	M3	3 lb	3 lb	x	3 lb	3 lb	3 lb	48h	NA
ziram		F	G	x	F	G	G	30d	NA

Blueberry Pink Bud Stage through Petal Fall – Insects

- **Cherry fruitworm** control by conventional insecticides (other than Esteem and Intrepid) starts at petal fall and are re-applied 10 days later.
- Cherry fruitworm control with Esteem: Apply when egg laying begins and again at petal fall.
- Cherry fruitworm control with Intrepid: 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.

Table 7-4. Recommended insecticides from pink bud through petal fall[1]

Product and formulation Active ingredient	IRAC code[2]	cherry fruitworm and cranberry fruitworm	REI[3] PHI[4]	Max amt[5] Max app[6]
Apta (1.34SC)	21A	27 fl oz	12h	81 fl oz
tolfenpyrad		G	3d	3
Asana XL (0.66EC) **(RUP)**	3A	4.8-9.6 fl oz	12h	38.4 fl oz
esfenvalerate		G	14d	NA
Assail 30SG	4A	4.5-5.3 oz	12h	26.7 oz
acetamiprid		G	1d	5
Avaunt eVo (30WDG)	22	3.5-6 oz	12h	24 oz
indoxacarb		G	7d	4

(Continued)

Table 7-4. Recommended insecticides from pink bud through petal fall[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	cherry fruitworm and cranberry fruitworm	REI[3] PHI[4]	Max amt[5] Max app[6]
*B.t. kurstak*i (DiPel DF, Javelin WG, etc.)	11	0.5-2 lb	4h	NA
Bacillus thuringiensis kurstaki		G	0d	NA
Brigade 2EC **(RUP)**	3A	2.1-6.4 fl oz	12h	32 fl oz
bifenthrin		G	1d	NA
Brigade WSB (10WP) **(RUP)**	3A	5.3-16 oz	12h	80 oz
bifenthrin		G	1d	NA
Danitol 2.4EC **(RUP)**	3A	10.6-16 oz	24h	32 fl oz
fenpropathrin		E	3d	2
Delegate WG (25WG)	5	3-6 oz	4h	19.5 oz
spinetoram		G	3d	6
Diazinon AG600 WBC **(RUP)**	1B	12.75 fl oz	120h	25.5 fl oz
diazinon		u	7d	2
Entrust SC (2SC)	5	4-6 fl oz	4h	29 fl oz
spinosad		F	1d	6
Esteem 35WP	7C	5 oz	12h	10 oz
pyriproxyfen		E	7d	2
Exirel (0.83SE)	28	10-13.5 fl oz	12h	61.5 fl oz
cyantraniliprole		G	3d	NA
Grandevo WDG	UN	1-3 lb	4h	NA
Chromobacterium subtsugae		E	0d	NA
Imidan 70W	1B	1.33 lb	24-72h	7.13 lb
phosmet		E	3d	5
Intrepid 2F	18	10-16 fl oz	4h	48 fl oz
methoxyfenozide		F	7d	3
Knack (0.86EC)	7C	16 fl oz	12h	32 fl oz
pyriproxyfen		E	7d	2
Lannate LV (2.4WSL) **(RUP)**	1A	1.5-3 pt	48h	12 pt
methomyl		u	3d	4
Malathion 8F	1B	1.25 pt	12h	NA
malathion		u	1d	3
Neemix 4.5 (0.39L), AzaDirect	UN	4-16 fl oz	4h	NA
azadirachtin		u	0d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	12h	NA
pyrethrins		u	0d	10
Rimon 0.83EC	15	20-30 fl oz	12h	90 fl oz
novaluron		G	8d	NA
Sevin XLR Plus (4F)	1A	1.5-2 qt	12h	10 qt
carbaryl		G	7d	5
Verdepryn 100SL (0.83SL)	28	8.2-11 fl oz	4h	33 fl oz
cyclaniliprole		G	1d	3

Blueberry Summer Cover – Diseases

Apply first cover about 7-10 days after petal fall, and second cover about 10 days later.

Disease management notes

- Pre- and post-harvest rots can be greatly reduced by timely harvests and proper handing, followed by rapid, post-harvest cooling. Fungicides alone are not sufficient to control these diseases. Do not harvest or handle wet fruit.
- Do not use an adjuvant with Fontelis after petal fall.
- Applications of Abound, Quash and Quilt for control of other diseases may aid in the control Botryosphaeria (bot) canker
- Be aware of the preharvest intervals (PHI) of Bravo; Indar2F, Quilt. Tilt, Ziram and generic counterparts.

Table 7-5. Fungicide applications for summer cover[1]

Product and formulation Active ingredient	FRAC code[2]	Alternaria fruit rot	anthracnose fruit rot	Phomopsis cane blight	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	4h	46 fl oz
azoxystrobin		G	G-E	F	0d	varies
Aliette WDG	33	5 lb	5 lb	5 lb	12h	20 lb
aluminum tris		u	u	3-4 pt	0.5d	4
Bravo Weather Stik	M3	3-4 pt	3-4 pt	3-4 pt	12h	12 pt
chlorothalonil		u	s	s	42d	NA
Captan 80WG	M 5	1.25-3 lb	1.25-3 lb	1.25-3 lb	48h	43.75 lb
captan		F	G	F	0d	NA
Fontelis	7	x	x	24 fl oz	12h	72 fl oz
penthiopyrad		x	x	E	0d	NA
Indar 2F	3	6 fl oz	6 fl oz	6 fl oz	12h	24 fl oz
fenbuconazole		F	u	G	30d	4
Inspire Super	3+9	16-20 fl oz	16-20 fl oz	x	12h	80 fl oz
difenoconazole + cyprodinil		u	u	x	7d	NA
Kenja 400SC	7	x	13.5-15.5 fl oz	x	12h	54 fl oz
Isofetamid		x	u	x	7d	NA
Kocide 3000	M	1-2.25 lb	1-2.25 lb	1.75 lb-3.5 lb	48h	28 lb
copper hydroxide		F-P	F	s	0d	varies
Luna Privilege	7	6.8 fl oz	x	x	12h	13.7
fluopyram		E	x	x	0d	NA
Luna Tranquility (SC)	7+9	13.6-27 fl oz	13.6-27 fl oz	13.6-27 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		G-F	G-F	u	0d	NA
Merivon	7+11	4-11 fl oz	4-11 fl oz	4-11 fl oz	12h	33 fl oz
pyraclostrobin + fluxopyroxad		u	E	G	0d	3
Miravis Prime	7+12	9-13.4 fl oz	13.4 fl oz	9-13.4 fl oz	12h	26.8 fl oz
pydiflumetofen+fludioxonil		G	G	G	0d	NA
Omega 500F	29	20 fl oz	20 fl oz	20 fl oz	12h	120 fl oz
fluazinam		F	G	u	30d	NA
PhD	19	6.2 oz	6.2 oz	6.2 oz	4h	4.2 oz
polyoxin D		P	P	G-F	0d	6
Pristine (38WG)	11+7	18.5-23 oz	18.5-23 oz	18.5-23 oz	24h	92 oz
pyraclostrobin + boscalid		G	E	G	0d	4

(Continued)

Table 7-5. Fungicide applications for summer cover[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	Alternaria fruit rot	anthracnose fruit rot	Phomopsis cane blight	REI[3] PHI[4]	Max amt[5] Max app[6]
Proline 480C	3	5.7 fl oz	5.7 fl oz	5.7 fl oz	12h	11.4 oz
prothioconazole		F	u	E-G	7d	2
ProPhyt	33	4 pt	4 pt	x	4h	NA
potassium phosphite		F-P	F	x	0d	NA
Quadris Top	11+3	12-14 fl oz	12-14 fl oz	2-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		G	F	u	7d	4
Quash SC	3	2.5 oz	2.5 oz	2.5 oz	12h	7.5 oz
metconazole		u	G	E	7d	3
Quilt Xcel	11+3	x	14-21 fl oz	14-21 fl oz	12h	63 fl oz
azoxystrobin + propiconazole		x	G	G	30d	NA
Switch 62.5WG	9+12	11-14 oz	11-14 oz	11-14 oz	12h	56 oz
cyprodinil + fludioxonil		E	G	F	0d	NA
Tilt	3	x	x	6 fl oz	12h	30 fl oz
propiconazole		x	x	G	30d	5
Ziram 76DF	M3	3 lb	3 lb	3 lb	48h	NA
ziram		F	G	G	30d	NA

Blueberry First and Second Cover – Insects

- Control cranberry fruitworm 10 and 20 days after petalfall.
- Plum curculio adults and larvae have not been observed to damage blueberries in most southern portions of the region.
- 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. Blueberry maggot is not a common pest in the southern portion of the region.

Table 7-6. Insect management recommendations for first-second cover[1]

Product and formulation Active ingredient	IRAC code[2]	cherry fruitworm/ cranberry fruitworm	plum curculio	REI[3] PHI[4]	Max amt[5] Max app[6]
Apta (1.34SC)	21A	27 fl oz	27 fl oz	12h	81 fl oz
tolfenpyrad		G	G	3d	3
Asana XL (0.66EC) **(RUP)**	3A	4.8-9.6 fl oz	x	12h	38.4 fl oz
esfenvalerate		G	x	14d	NA
Assail 30SG	4A	4.5-5.3 oz	x	12h	26.7 oz
acetamiprid		G	x	1d	5
Avaunt eVo (30WDG)	22	3.5-6 oz	6 oz	12h	24 oz
indoxacarb		G	E	7d	4
B.t. kurstaki (DiPel DF, Javelin WG, etc.)	11	0.5-2 lb	x	4h	NA
Bacillus thuringiensis kurstaki		G	x	0d	NA
Brigade 2EC **(RUP)**	3A	2.1-6.4 fl oz	2.1-6.4 fl oz	12h	32 fl oz
bifenthrin		G	G	1d	NA

(Continued)

Table 7-6. Insect management recommendations for first-second cover[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	cherry fruitworm/ cranberry fruitworm	plum curculio	REI[3] PHI[4]	Max amt[5] Max app[6]
Brigade WSB (10WP) **(RUP)**	3A	5.3-16 oz	5.3-16 oz	12h	80 oz
bifenthrin		G	G	1d	NA
Danitol 2.4EC **(RUP)**	3A	10.6-16 oz	10.6-16 oz	24h	32 fl oz
fenpropathrin		E	G	3d	2
Delegate WG (25WG)	5	3-6 oz	x	4h	19.5 oz
spinetoram		G	x	3d	6
Diazinon AG600 WBC **(RUP)**	1B	12.75 fl oz	x	120h	25.5 fl oz
diazinon		u	x	7d	2
Entrust SC (2SC)	5	4-6 fl oz	x	4h	29 fl oz
spinosad		F	x	1d	6
Esteem 35WP	7C	5 oz	x	12h	10 oz
pyriproxyfen		E	x	7d	2
Exirel (0.83SE)	28	10-13.5 fl oz	13.5-20.5 fl oz	12h	61.5 fl oz
cyantraniliprole		G	G	3d	NA
Grandevo WDG	UN	1-3 lb	x	4h	NA
Chromobacterium subtsugae		E	x	0d	NA
Imidan 70W	1B	1.3 lb	1.3 lb	24-72h	7.1 lb
phosmet		E	E	3d	5
Intrepid 2F	18	10-16 fl oz	x	4h	48 fl oz
methoxyfenozide		F	x	7d	3
Knack (0.86EC)	7C	16 fl oz	x	12h	32 fl oz
pyriproxyfen		E	x	7d	2
Lannate LV (2.4WSL) **(RUP)**	1A	1.5-3 pt	x	48h	12 pt
methomyl		u	x	3d	4
Malathion 8F	1B	1.25 pt	1.25 pt	12h	NA
malathion		u	F	1d	3
Neemix 4.5 (0.39L), AzaDirect	UN	4-16 fl oz	x	4h	NA
azadirachtin		u	x	0d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	x	12h	NA
pyrethrins		u	x	0d	10
Rimon 0.83EC	15	20-30 fl oz	x	12h	90 fl oz
novaluron		G	x	8d	NA
Sevin XLR Plus (4F)	1A	1.5-2 qt	x	12h	10 qt
carbaryl		G	x	7d	5
Verdepryn 100SL (0.83SL)	28	8.2-11 fl oz	8.2-11 fl oz	4h	33 fl oz
cyclaniliprole		G	G	1d	3

Blueberry Third and Additional Covers – Insects

Apply about 10 days after previous cover and repeat as needed. Be sure to check PHIs.

- Pre- and post-harvest rots can be greatly reduced by timely harvests and proper handing, followed by rapid, post-harvest cooling. Fungicides alone are not sufficient to control these diseases. Do not harvest or handle wet fruit.
- Sprays for blueberry maggot should begin as soon as the adults are observed in traps, and continue until harvest.

Table 7-7. Insect management at third and summer covers[1]

Product and formulation Active ingredient	IRAC code[2]	blueberry maggot	brown marmorated stink bug	Japanese beetle	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Admire Pro (4.6F)	4A	2.1-2.8 fl oz	x	2.1-2.8 fl oz	x	12h	14 fl oz
imidacloprid		F	x	F	x	3 or 7d	5
Altacor (35WDG)	28	x	x	3-4.5 oz	x	4h	9 oz
chlorantraniliprole		x	x	i	x	1d	NA
Apta (1.34SC)	21A	27 fl oz	x	x	x	12h	81 fl oz
tolfenpyrad		F	x	x	x	3d	3
Asana XL (0.66EC) **(RUP)**	3A	9.6 fl oz	x	4.8-9.6 fl oz	x	12h	38.4 fl oz
esfenvalerate		G	x	G	x	14d	NA
Assail 30SG	4A	4.5-5.3 oz	x	4.5-5.3 oz	x	12h	26.7 oz
acetamiprid		G	x	u	x	1d	5
Aza-Direct	UN	x	1-3.5 pt	1-3.5 pt	x	4h	NA
azadirachtin		x	F	F	x	0d	NA
Beetle GONE! Ag	UN	x	x	1-17.5 lb	x	4h	NA
Bacillus thuringiensis galleriae		x	x	u	x	0d	NA
Brigade 2EC **(RUP)**	3A	2.1-6.4 fl oz	x	2.1-6.4 fl oz	x	12h	32 fl oz
bifenthrin		G	x	E	x	1d	NA
Brigade WSB (10WP) **(RUP)**	3A	5.3-16 oz	x	x	x	12h	80 oz
bifenthrin		G	x	x	x	1d	NA
Danitol 2.4EC **(RUP)**	3A	10.6-16 fl oz	10.6-16 fl oz	10.6-16 oz	10.6-16 oz	24h	32 fl oz
fenpropathrin		G	G	G	E	3d	2
Delegate WG (25WG)	5	3-6 oz	x	x	3-6 oz	4h	19.5 oz
spinetoram		F	x	x	E	3d	6
Diazinon AG600 WBC **(RUP)**	1B	12.75 fl oz	x	x	x	120h	25.5 fl oz
diazinon		G	x	x	x	7d	2
Entrust SC (2SC)	5	x	x	x	4-6 fl oz	4h	29 fl oz
spinosad		x	x	x	G	1d	6
Exirel (0.83SE)	28	13.5-20 fl oz	x	x	13.5-20.5 fl oz	12h	61.5 fl oz
cyantraniliprole		F	x	x	E	3d	NA
Grandevo WDG	UN	x	2-3 lb	2-3 lb	2-3 lb	4h	NA
Chromobacterium subtsugae		x	u	s	G	0d	NA
Imidan 70W	1B	1.3 lb	x	1.3 lb	1.3 lb	24-72h	7.1 lb
phosmet		E	x	G	E	3d	5

(Continued)

Table 7-7. Insect management at third and summer covers[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	blueberry maggot	brown marmorated stink bug	Japanese beetle	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Lannate LV (2.4WSL) **(RUP)**	1A	0.75-1.5 pt	1.5-3 pt	x	1.5-3 pt	48h	12 pt
methomyl		G	G	x	E	3d	4
Malathion 8F	1B	1.25 pt	x	1.25 pt	x	12h	NA
malathion		G	x	F	x	1d	3
Mustang Maxx (0.83EC) **(RUP)**	3A	x	x	x	4 fl oz	12h	24 fl oz
zeta-cypermethrin		x	x	x	E	1d	NA
Platinum 75SG	4A	x	x	1.66-4 oz	x	12h	4 oz
thiamethoxam		x	x	u	x	75d	NA
Pyganic 5EC	3A	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	4.5-15.6 fl oz	12h	NA
pyrethrins		F	u	u	F	0d	10
Rimon 0.83EC	15	20-30 fl oz	x	x	20-30 fl oz	12h	90 fl oz
novaluron		G	x	x	u	8d	NA
Sevin XLR Plus (4F)	1A	1.5-2 qt	x	1-2 qt	x	12h	10 qt
carbaryl		G	x	G	x	7d	5
Sivanto Prime (1.67SC)	4D	12-14 fl oz	x	x	x	4h	28 fl oz
flupyradifurone		G	x	x	x	3d	NA
Verdepryn 100SL (0.83SL)	28	8.2-11 fl oz	8.2-11 fl oz	8.2-11 fl oz	8.2-11 fl oz	4h	33 fl oz
cyclaniliprole		G	s	u	E	1d	3

Blueberry Post-harvest – Diseases

Table 7-8. Post-harvest disease management recommendations[1]

Product and formulation Active ingredient	FRAC code[2]	Phomopsis cane blight	Phytophthora root rot	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	4h	46 fl oz
azoxystrobin		F	u	x	0d	NA
Aliette WDG	33	5 lb	5 lb	x	12h	20 lb
aluminum tris		s	G	x	0.5d	4
Bravo Weather Stik	M3	3-4 pt	x	3-4 pt	12h	12 pt
chlorothalonil		s	x	s	42d	NA
Captan 80WG	M 5	1.25-3 lb	x	1.25-3 lb	48h	43.75 lb
captan		s	x	G	0d	NA
Indar 2F	3	6 fl oz	x	6 fl oz	12h	24 fl oz
fenbuconazole		G	x	E	30d	4
Inspire Super	3+9	x	x	16-20 fl oz	12h	80 fl oz
difenoconazole + cyprodinil		x	x	u	7d	NA
Kenja 400SC	7	x	x	13.5-15.5 fl oz	12h	54 fl oz
Isofetamid		x	x	G	7d	NA

(Continued)

Table 7-8. Post-harvest disease management recommendations[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	Phomopsis cane blight	Phytophthora root rot	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Kocide 3000	M	1.75 lb-3.5 lb	x	x	48h	28 lb
copper hydroxide		s	x	x	0d	varies
Luna Privilege	7	x	x	4.8-6.8 fl oz	12h	13.7 fl oz
fluopyram		x	x	E	0d	NA
Luna Tranquility (SC)	7+9	13.6-27 fl oz	x	13.6-27 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		u	x	E	0d	NA
Merivon	7+11	4-11 fl oz	x	4-11 fl oz	12h	33 fl oz
pyraclostrobin + fluxopyroxad		G	x	E	0d	3
Mettle 125ME	3	x	x	3-5 fl oz	12h	20 fl oz
tetraconazole		x	x	E	0d	5
Miravis Prime	7+12	9-13.4 fl oz	x	9-13.4 fl oz	12 h	26.8 fl oz
pydiflumetofen+fludioxonil		G	x	u	0d	NA
Omega 500F	29	20 fl oz	x	20 fl oz	12h	120 fl oz
fluazinam		u	x	G	30d	NA
Orondis Gold	49+4	x	20-55 oz	x	48h	110 fl oz
oxathiapipralin+ mefenoxam		x	E	x	1d	2
PhD	19	6.2 oz	x	6.2 oz	4h	4.2 oz
polyoxin D		G-F	x	s	0d	6
Pristine (38WG)	11+7	18.5-23 oz	x	18.5-23 oz	24h	92 oz
pyraclostrobin + boscalid		G	x	E	0d	4
Procure 480SC	3	x	x	4-8 fl oz	12h	32 oz
triflumizole		x	x	E	0d	8
Proline 480C	3	5.7 fl oz	x	5.7 fl oz	12h	11.4 oz
prothioconazole		E-G	x	G	7d	2
Prolivo 300 SC	50	x	x	4-5 fl oz	4h	16 fl oz
pyriofenone		x	x	E	0d	NA
ProPhyt	33	x	4 pt	4 pt	4h	NA
potassium phosphite		x	G	G	0d	NA
Quadris Top	11+3	2-14 fl oz	x	12-14 fl oz	12h	56 fl oz
azoxystrobin + difenoconazole		s	x	G	d	4
Quash SC	3	2.5 oz	x	2.5 oz	12h	7.5 oz
metconazole		E	x	E	7d	3
Quilt Xcel	11+3	14-21 fl oz	x	14-21 fl oz	12h	63 fl oz
azoxystrobin + propiconazole		G	x	E	30d	NA
Ridomil Gold SL	4	x	3.6 pt	x	48h	3.6 pt
mefenoxam		x	E	x	0d	NA
Sulforix	M	1-2 gal/100 gal	x	x	48h	8 gal
calcium polysulfide		u	x	x	NA	4
Switch 62.5WG	9+12	11-14 oz	x	x	12h	56 oz
cyprodinil + fludioxonil		F	x	x	0d	NA

(Continued)

Table 7-8. Post-harvest disease management recommendations[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	Phomopsis cane blight	Phytophthora root rot	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Tilt	3	x	x	6 fl oz	12h	30 fl oz
propiconazole		x	x	E	30d	5
Torino	U6	x	x	3.4 oz	4 h	6.8 oz
cyflufenamid		x	x	E	0d	2
Ziram 76DF	M3	3 lb	x	3 lb	48h	NA
ziram		G	x	u	30d	NA

Special Comments on Blueberry Schedule

Spotted lanternfly

The spotted lanternfly is an invasive planthopper that is spreading 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.

For more on blueberry production

For additional information on blueberry production and management, the University of Kentucky has published the Midwest Blueberry Production Guide, available at: http://www2.ca.uky.edu/agcomm/pubs/ID/ID210/ID210.pdf

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	Botrytis 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)	11	F	E	F	u	F	F	u	G	4h	46 fl oz
azoxystrobin										0d	NA
Aftershock	11	u	G	F	u	u	u	u	G	12 h	22.8 fl oz
fluoxastrobin										1d	NA
Aliette WDG	33	G	G	u	u	E	G	G	G	12h	20 lb
aluminum tris (0-ethyl phosphonate)										0.5d	4
Aprovia	7	u	u	u	u	u	u	i	u	12 h	10.5 oz
benzovindiflupyr										1 yr	NA
Bravo Weather Stik	M3	u	G	E-G	u	E	E	i	G	12h	12 pt
chlorothalonil										42d	NA
Captan 50WP	M 5	F	G	F	F	[E]	F	u	G	48h	70 lb
captan										0d	NA
CaptEvate 68WDG	M+17	F	F	E	u	E-G	F	i	u	48h	21 lb
captan + fenhexamid										30d	NA
Elevate 50WG	M+17	u	u	E	u	F	F	i	u	12h	6 lb
fenhexamid										0d	NA

(Continued)

Effectiveness of Pesticides for Blueberry Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Alternaria fruit rot	anthracnose fruit rot	Botrytis blight	Fusicoccum canker	mummy berry	Phomopsis cane blight	Phytophthora root rot	powdery Mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
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
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 0d	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

(Continued)

Effectiveness of Pesticides for Blueberry Diseases[1] *(continued)*

Product and formulation Active ingredient	FRAC Code[2]	Alternaria fruit rot	anthracnose fruit rot	Botrytis blight	Fusicoccum canker	mummy berry	Phomopsis cane blight	Phytophthora root rot	powdery Mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
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
Switch 62.5WG cyprodinil + fludioxonil	9+12	E	G	G	u	F	F	i	i	12h 0d	56 oz NA
Tilt propiconazole	3	u	u	u	u	G-F	G	i	E	12h 30d	30 fl oz 5
Torino cyflufenamid	U6	u	u	u	u	u	u	i	E	4 h 0d	6.8 oz 2
Ziram 76DF ziram	M3	F	G	G	F	G	G	u	u	48h 30d	NA 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.

[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) thiamethoxam	4A	x	x	x	G	x	x	12h 3d	12 oz NA
Admire Pro (4.6F) imidacloprid	4A	F	x	x	F	x	x	12h 3 or 7d	14 fl oz 5
Altacor (35WDG) chlorantraniliprole	28	x	x	E	i	x	x	4h 1d	9 oz NA
Apta (1.34SC) tolfenpyrad	21A	F	x	u	x	G	x	12h 3d	81 fl oz 3
Asana XL (0.66EC) **(RUP)** esfenvalerate	3A	G	x	G	G	x	x	12h 14d	38.4 fl oz NA
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	120 hr/5d 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

(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]
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
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 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.
[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.

8. RASPBERRY AND BLACKBERRY

Raspberry and Blackberry Spray Schedule

Entomology Leads: N. Joshi, R. Bessin
Pathology Leads: J. Beckerman

How to read the spray schedule tables

Every raspberry and blackberry 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.

Raspberry and Blackberry Delayed Dormant – Diseases

- 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.
- Begin applications for control of Phytophthora when tips of buds show green. Other phosphorous acid products include ProPhyt, Phostrol, Fosphite, K-phite, and Rampart.
- Ridomil Gold GR is for use at planting. Do not top-dress with granules.
- Copper products are available in various formulations. Read labels carefully.

Table 8-1. Fungicides for disease management at dormant to delayed dormant[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose	cane blight/ spur blight	Phytophthora root rot	REI[3] PHI[4]	Max amt[5] Max app[6]
Aliette WDG	33	x	x	5 lb	12h	N/A
aluminum tris		x	x	E	60d	4
Badge SC	M	1-2.25 pt	1-2.25 pt	x	48h	35.2 pt
copper sulfate + oxychloride		F	F	u	0d	N/A
Cuproxat FL	M	2.5-6 pt	2.5-5 pt	x	12h	varies
tribasic copper sulfate		F	F	x	0d	N/A
Cabrio EG (20EG)	11	14 oz	14 oz	x	12h	56 oz
pyraclostrobin		E	E	u	0d	N/A
Kocide 3000	M	1.75 lb or 0.75 lb	1.75 lb or 0.75 lb	x	48h	28.6 lb

(Continued)

Table 8-1. Fungicides for disease management at dormant to delayed dormant[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	anthracnose	cane blight/ spur blight	Phytophthora root rot	REI[3] PHI[4]	Max amt[5] Max app[6]
copper hydroxide		u	F	x	0d	N/A
Nordox 75G	M	1.25-2.5 lb	x	x	24h	24 lb
cuprous oxide		F	F	u	0d	N/A
Orondis Gold	49+4	x	x	13.7 - 110 fl oz	48 h	220 fl oz
oxathiapiprolin+ mefenoxam		0	x	E	1d	varies
ProPhyte	33	x	x	4 pt	4h	2
phosphorous acid		x	x	E	0d	8 pt
Ridomil Gold SL	4	x	x	0.25 pt/1000 sq ft	48h	3.6 pt
mefenoxam		u	u	E	45d	1
Sulforix	M	3 gal/100 gal	3 gal/100 gal	x	48h	N/A
calcium polysulfide		E	G	u	0d	varies

Raspberry and Blackberry Delayed Dormant – Insects

- 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.
- See Rednecked Cane Borer (page 218-219) about pruning to remove last year's galls.

Table 8-2. Insecticides for disease management at dormant to delayed dormant[1]

Product and formulation Active ingredient	IRAC code[3]	raspberry crown borer	REI[3] PHI[4]	Max amt[5] Max app[6]
Altacor (35WG)	28	3-4.5 oz	4h	9 oz
chlorantraniliprole		G	3d	NA
Brigade WSB (10WP) **(RUP)**	3A	16 oz	12h	32 oz
bifenthrin		E	3d	NA
Hero (1.24EC) **(RUP)**	3A	10.3 fl oz	12h	27.4 fl oz
bifenthrin + zeta-permethrin		u	3d	2

Raspberry and Blackberry Pre-bloom

Apply when flowers show white.

Delayed pre-bloom disease management notes

- 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.

Table 8-3. Fungicides for disease management at pre-bloom[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose	cane blight/spur blight	raspberry leaf spot/Septoria leaf spot	rusts (orange and late leaf)	powdery mildew	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	10-15.5 fl oz	6-15.5 fl oz	4h	92.3 fl oz
azoxystrobin		E	E	E	E	E	0d	9
Cabrio EG (20EG)	11	14 oz	14 oz	14 oz	15 oz	14 oz	12h	56 oz
pyraclostrobin		E	E	E	s(E)	E	0d	N/A
Captan 80WDG	M4	2.5 lb	2.5 lb	2.5 lb	x	x	48h	12.5 lb
captan		G	G	s	x	x	3d	N/A
Captec 4L	M4	0.75-1 qt/100 gal	0.75-1 qts/100 gal	x	x	x	72h	35 qt
captan		G	G	x	x	x	3d	N/A
CaptEvate 68WDG	M+17	3.5 lb	3.5 lb	x	x	x	48h	21 lb
captan + fenhexamid		G	G	x	x	x	30d	N/A
Fontelis	7	x	14-24 fl oz	x	14-24 fl oz	14-24 fl oz	12h	72 fl oz
penthiopyrad		x	u	x	u	s(G)	0d	N/A
JMS Stylet Oil	M	x	x	x	3-6 qt	3-6 qt	4h	N/A
mineral oil		x	x	x	F	F	NL	N/A
Kocide 3000	M	0.75 lb	0.75 lb	x	0.75 lb	x	48h	28.6 lb
copper hydroxide		u	F	x	u	x	0d	N/A
Luna Privilege	7	x	x	4.8-6.4 fl oz	x	4.8-6.4 fl oz	12 h	13.7 fl oz
fluopyram		x	x	G	x	E	0d	N/A
Luna Tranquility (SC)	7+9	x	x	16-27 fl oz	x	13.6-27 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		x	x	u	x	G	0d	N/A
Merivon	7+11	4-11 fl oz	4-11 fl oz	4-11 fl oz	8-11 fl oz	4-11 fl oz	12 h	33 fl oz
pyraclostrobin + fluxopyroxad		u	E	E	s	G	0	3
Pristine 38WG	11+7	18.5-23 oz	18.5-23 oz	x	18.5-23 oz	18.5-23 oz	12h	92 oz
pyraclostrobin + boscalid		E	E	E	s	E	0d	4
Prolivo 300SC	U8	x	x	x	x	4-5 fl oz	4h	16 fl oz
pyriofenone		x	x	x	x	E	0d	N/A
Quilt Xcel	11+3	14-21 fl oz	14-21 fl oz	14-21 fl oz	14-21 fl oz	14-21 fl oz	12h	63 fl oz
azoxystrobin + propiconazole		G	G	G	G	G	30d	3
Rally 40WSP	3	x	x	x	1.25-3 oz	1.25-3 oz	24h	10 oz
myclobutanil		x	x	x	E	E	0d	N/A
Sulfur 80WDG	M	x	x	x	x	6-15 lb	24h	varies
sulfur		x	x	x	x	u	0d	N/A
Switch 62.5WG	9+12	11-14 oz	x	x	x	x	12h	56 oz
cyprodinil + fludioxonil		u	x	x	x	x	0d	2
Tanos (DW)	11+27	x	8-10 oz	8-10 oz	x	x	12h	72 oz
famoxadone + cymoxanil		s	G	G	x	x	0d	N/A
Tilt (EC)	3	x	6 fl oz	x	6 fl oz	6 fl oz	12h	30 fl oz
propiconazole		x	u	x	E	E	30d	5

Raspberry and Blackberry Pre-bloom – Insects

Table 8-4. Insecticides for disease management at pre-bloom[1]

Product and formulation Active ingredient	IRAC code[2]	leafroller	raspberry fruitworm	raspberry sawfly	rose chafer	strawberry clipper	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	x	x	x	x	3 oz	12h	6 oz
thiamethoxam		x	x	x	x	G	3d	NA
Agree WG (Dipel, etc.)	11	1-2 lb	x	x	x	x	4h	NA
B. thuringiensis		F	x	x	x	x	0d	NA
Altacor (35WG)	28	3-4.5 oz	x	x	x	x	4h	9 oz
chlorantraniliprole		E	x	x	x	x	3d	NA
Asana XL (0.66EC) **(RUP)**	3A	4.8-9.6 fl oz	x	x	x	x	12h	28.8 fl oz
esfenvalerate		E	x	x	x	x	7d	NA
Assail 30SG	4A	x	4.5-5.3 oz	x	x	x	12h	26.7 oz
acetamiprid		x	u	x	x	x	1d	5
Brigade WSB (10WP) **(RUP)**	3A	8-16 oz	x	x	x	x	12h	32 oz
bifenthrin		E	x	x	x	x	3d	NA
Confirm 2F	18	16 fl oz	x	x	x	x	4h	64 fl oz
tebufenozide		E	x	x	x	x	14d	NA
Danitol 2.4EC **(RUP)**	3A	10.6-16 fl oz	x	x	x	x	24h	32 fl oz
fenpropathrin		E	x	x	x	x	3d	NA
Delegate WG (25WG)	5	3-6 oz	3-6 oz	3-6 oz	x	x	4h	19.5 oz
spinetoram		E	E	G	x	x	1d	6
Entrust SC (2SC)	5	4-6 fl oz	4-6 fl oz	4-6 fl oz	x	x	4h	29 fl oz
spinosad		G	G	G	x	x	1d	6
Hero (1.24EC) **(RUP)**	3A	4 to 10.3 fl oz	x	x	x	x	12h	27.4 fl oz
bifenthrin + zeta-permethrin		G	x	x	x	x	3d	2
Intrepid 2F	18	10 to 16 fl oz	x	x	x	x	4h	48 fl oz
methoxyfenozide		G	x	x	x	x	3d	3
Malathion 5EC	1B	x	x	x	3 pt	x	12h	9.6 pt
malathion		x	x	x	G	x	1d	3
Mustang Maxx (0.83EC) **(RUP)**	3A	4 fl oz	x	x	x	x	12h	24 fl oz
zeta-cypermethrin		E	x	x	x	x	1d	6
Neemix 4.5 (0.39L)	UN	7-16 fl oz	x	x	7-16 fl oz	x	4h	NA
azadirachtin		u	x	x	u	x	0d	NA
Pyganic 5EC	3A	4.5-15.61 fl oz	4.5-15.61 fl oz	4.5-15.61 fl oz	4.5-15.61 fl oz	4.5-15.61 fl oz	12h	NA
pyrethrins		F	F	i	F	u	0d	10
Sevin XLR Plus (4F)	1A	1-2 qt	2 qt	2 qt	1-2 qt	1-2 qt	12h	10 qt
carbaryl		G	i	G	G	G	7d	NA
Surround WP (95WP)	UN	25-50 lb	x	x	25-50 lb	x	4h	NA
kaolin		u	x	x	u	x	0d	NA

Raspberry and Blackberry First Bloom through Petal Fall

Apply when first flowers open through when petals fall.

- For best management of Botrytis, plan on making three 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.

Table 8-5. Fungicides labeled for disease management from bloom through petal fall[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	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	x	10-15.5 fl oz	6-15.5 fl oz	4h	92.3 fl oz
azoxystrobin		E	E	E	x	E	E	0d	9
Cabrio EG (20EG)	11	14 oz	14 oz	14 oz	14 oz	14 oz	14 oz	12h	56 oz
pyraclostrobin		E	E	E	s	s	E	0d	NA
Captan 80WDG	M4	2.5 lb	2.5 lb	2.5 lb	2.5 lb	x	x	48h	12.5 lb
captan		G	G	s	G	x	x	3d	NA
Captec 4L	M4	0.75-1 qt/100 gal	2.5 lb	2.5 lb	0.75-1 qt/100 gal	x	x	72h	35 qt
captan		G	G	F	G	x	x	3d	NA
CaptEvate 68WDG	M+17	3.5 lb	3.5 lb	x	3.5 lb	x	x	48h	21 lb
captan + fenhexamid		G	G	x	E	x	x	30d	NA
Elevate 50WDG	17	x	x	x	1.5 lb	x	x	12h	6 lb
fenhexamid		x	x	x	E	x	x	0d	NA
Fontelis	7	x	x	x	1-2 pt	x	x	12h	72 fl oz
penthiopyrad		x	x	x	E	x	x	0d	NA
JMS Stylet Oil	M	x	x	x	x	3-6 qt	3-6 qt	4h	NA
mineral oil		x	x	x	x	F	F	NL	NA
Kenja 400SC	7	x	x	x	13.5-15.5 fl oz	x	13.5-15.5 fl oz	12h	54 fl oz
Isofetamid		u	x	x	E	x	E	0d	NA
Luna Privilege	7	x	4.8-6.4 fl oz	4.8-6.4 fl oz	4.8-6.4 fl oz	x	4.8-6.4 fl oz	12 h	13.7 fl oz
fluopyram		x	F	G	E	x	E	0d	NA
Luna Tranquility (SC)	7+9	x	x	16-27 fl oz	16-27 fl oz	x	13.6-27 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		G	u	u	u	u	G	0d	NA
Merivon	7+11	4-11 fl oz	4-11 fl oz	4-11 fl oz	8-11 fl oz	4-11 fl oz	4-11 fl oz	12 h	33 fl oz
pyraclostrobin + fluxopyroxad		E	E	E	s	s	G	0	3
OSO 5%SC	19	6.5-13 fl oz	x	x	6.5-13 fl oz	6.5-13 fl oz	6.5-13 fl oz	4h	78 fl oz
polyoxin D		u	x	x	E	u	G	0d	6
Pristine 38WG	11+7	18.5-23 oz	18.5-23 oz	x	18.5-23 oz	18.5-23 oz	18.5-23 oz	12h	92 oz
pyraclostrobin + boscalid		E	E	x	E	s	E	0d	4
Prolivo 300SC	U8	x	x	x	x	x	4-5 fl oz	4h	16 fl oz
pyriofenone		x	x	x	x	x	E	0d	NA

(Continued)

Table 8-5. Fungicides labeled for disease management from bloom through petal fall[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	REI[3] PHI[4]	Max amt[5] Max app[6]
Quilt Xcel	11+3	14-21 fl oz	14-21 fl oz	14-21 fl oz	x	14-21 fl oz	14-21 fl oz	12h	63 fl oz
azoxystrobin + propiconazole		G	G	G	x	G	G	30d	3
Rally 40WSP	3	x	x	1.25-3 oz	x	1.25-3 oz	1.25-3 oz	24h	10 oz
myclobutanil		x	x	G	x	E	E	0d	NA
Rovral 4F	2	x	x	x	1-2 pt	x	x	24h	8 pt
iprodione		x	x	x	E	x	x	0d	4
Sulfur 80WDG	M	x	x	x	x	x	6-15 lb	24h	varies
sulfur		x	x	x	x	x	F	0d	NA
Switch 62.5WG	9+12	4.8-6.4 fl oz	4.8-6.4 fl oz	x	4.8-6.4 fl oz	x	x	12h	56 oz
cyprodinil + fludioxonil		G	G	x	E	x	x	0d	2
Tanos (DW)	11+27	x	8-10 oz	8-10 oz	x	x	x	12h	72 oz
famoxadone + cymoxanil		x	G	G	x	x	x	0d	NA
Tilt (EC)	3	x	6 fl oz	x	x	6 fl oz	6 fl oz	12h	30 fl oz
propiconazole		x	u	x	x	E	E	30d	5

Raspberry and Blackberry First Bloom through Petal Fall – Insects

Save the bees! Do not apply insecticides during bloom to protect bees and pollinators.

Raspberry and Blackberry Post-bloom through Harvest – Diseases

Disease management notes

- Fungicide applications for botrytis control at this time can help reduce the incidence of postharvest rot.

Table 8-6. Fungicides for disease management at post-bloom through harvest[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	Phytoph-thora root rot	REI[3] PHI[4]	Max amt[4] Max app[5]
Abound (SC)	11	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	x	10-15.5 fl oz	6-15.5 fl oz	x	4h	92.3 fl oz
azoxystrobin		E	E	E	x	E	E	x	0d	9
Aliette WDG	33	x	x	x	x	x	x	5 lb	12h	4
aluminum tris		x	x	x	x	x	x	E	60d	NA
Badge SC	M	1-2.25 pt	1-2.25 pt	x	x	x	x	x	48h	35.2 pt
copper sulfate + oxychloride		F	F	x	x	x	x	x	0d	NA
Cuproxat FL	M	2.5-6 pt	2.5-5 pt	2.5-5 pt	x	2.5-5 pt	x	x	12h	varies
tribasic copper sulfate		F	F	F	x	F	x	x	0d	NA
Cabrio EG (20EG)	11	14 oz	14 oz	14 oz	14 oz	14 oz	14 oz	x	12h	56 oz
pyraclostrobin		E	E	E	s	s	E	u	0d	NA

(Continued)

Table 8-6. Fungicides for disease management at post-bloom through harvest[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	Phytoph-thora root rot	REI[3] PHI[4]	Max amt[4] Max app[5]
Captan 80WDG	M4	2.5 lb	2.5 lb	2.5 lb	2.5 lb	x	x	x	48h	12.5 lb
captan		G	G	s	G	x	x	x	3d	NA
Captec 4L	M4	0.75-1 qt/100 gal	0.75-1 qt/100 gal	x	0.75-1 qt/100 gal	x	x	x	72h	35 qt.
captan		G	G	x	G	x	x	x	3d	NA
CaptEvate 68WDG	M+17	3.5 lb	3.5 lb	x	3.5 lb	x	x	x	48h	21 lb
captan + fenhexamid		G	G	x	E	x	x	x	30d	NA
Elevate 50WDG	17	x	x	x	1.5 lb	x	x	x	12h	6 lb
fenhexamid		x	x	x	E	x	x	x	0d	NA
Fontelis	7	x	x	x	1-2 pt	x	x	x	12h	72 fl oz
penthiopyrad		x	x	x	E	x	x	x	0d	NA
JMS Stylet Oil	M	x	x	x	x	3-6 qt	3-6 qt	x	4h	NA
mineral oil		x	x	x	x	F	F	x	NL	NA
Kenja 400SC	7	x	x	x	13.5-15.5 fl oz	x	13.5-15.5 fl oz	x	12h	54 fl oz
Isofetamid		x	x	x	E	x	E	x	0d	NA
Kocide 3000	M	x	0.75 lb	0.75 lb	0.75 lb	0.75 lb	0.75 lb	x	48h	28.6 lb
copper hydroxide		x	F	u	u	u	u	x	0d	NA
Luna Privilege	7	x	x	4.8-6.4 fl oz	4.8-6.4 fl oz	4.8-6.4 fl oz	4.8-6.4 fl oz	x	12 h	13.7 fl oz
fluopyram		x	x	G	E	u	E	x	0d	NA
Luna Tranquility (SC)	7+9	x	x	16-27 fl oz	16-27 fl oz	x	13.6-27 fl oz	x	12h	54.7 fl oz
fluopyram + pyrimethanil		x	x	u	u	x	G	x	0d	NA
Merivon	7+11	4-11 fl oz	4-11 fl oz	4-11 fl oz	8-11 fl oz	4-11 fl oz	4-11 fl oz	x	12 h	33 fl oz
pyraclostrobin + fluxopyroxad		E	E	E	S	s	G	x	0	3
Nordox 75G	M	1.25-2.5 lb	x	x	x	1.25-2.5 lb	x	x	24h	24 lb
cuprous oxide		F	x	x	x	u	x	x	0d	NA
Orondis Gold	49+4	x	x	x	x	x	x	13.7-110 fl oz	48 h	220 fl oz
oxathiapiprolin + mefenoxam		x	x	x	x	x	x	E	1d	2
OSO 5%SC	19	6.5-13 fl oz	x	x	6.5-13 fl oz	6.5-13 fl oz	6.5-13 fl oz	x	4h	78 fl oz
polyoxin D		u	x	x	E	u	G	x	0d	6
Pristine 38WG	11+7	18.5-23 oz	18.5-23 oz	x	18.5-23 oz	18.5-23 oz	18.5-23 oz	x	12h	92 oz
pyraclostrobin + boscalid		E	E	x	E	S	E	x	0d	4

(Continued)

Table 8-6. Fungicides for disease management at post-bloom through harvest[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	Phytoph-thora root rot	REI[3] PHI[4]	Max amt[4] Max app[5]
Prolivo 300SC	U8	x	x	x	x	x	4-5 fl oz	x	4h	16 fl oz
pyriofenone		x	x	x	x	x	E	x	0d	NA
ProPhyte	33	x	x	x	x	x	x	4 pt	4h	varies
phosphorous acid		x	x	x	x	x	x	E	0d	4
Quilt Xcel	11+3	14-21 fl oz	14-21 fl oz	14-21 fl oz	x	14-21 fl oz	14-21 fl oz	x	12h	63 fl oz
azoxystrobin + propiconazole		G	G	G	x	G	G	x	30d	3
Rally 40WSP	3	x	x	x	x	1.25-3 oz	1.25-3 oz	x	24h	10 oz
myclobutanil		x	x	x	x	E	E	x	0d	NA
Ridomil Gold SL	4	x	x	x	x	x	x	3.6 pt	48h	3.6 pt
mefenoxam		x	x	x	x	x	x	E	45d	1
Rovral 4F	2	x	x	x	2 pt	x	x	x	24h	8 pt
iprodione		x	x	x	E	x	x	x	0d	4
Sulfur 80-WDG	M	x	x	x	x	x	6-15 lb	x	24h	varies
sulfur		x	x	x	x	x	F	x	0d	NA
Switch 62.5WG	9+12	11-14 oz	x	x	x	x	x	x	12h	56 oz
cyprodinil + fludioxonil		u	x	x	x	x	x	x	0d	2
Tanos (DW)	11+27	8-10 oz	8-10 oz	8-10 oz	x	x	x	x	12h	72 oz
famoxadone + cymoxanil		s	G	G	x	x	x	x	0d	NA
Tilt (EC)	3	x	6 fl oz	x	x	6 fl oz	6 fl oz	x	12h	30 fl oz
propiconazole		x	u	x	x	E	E	x	30d	5

Raspberry and Blackberry Post-bloom through Harvest – Insects

Check the insecticide label for toxicity to bees and timing of application before selecting insecticide compounds for the Japanese beetle and other insect pests if growing fall-bearing varieties.

Table 8-7. Insecticides labeled for management at post-bloom through harvest[1]

Product and formulation Active ingredient	IRAC code[2]	broad mite	green June Japanese beetle	plant bugs	rednecked cane borer	sap beetle	stink bug	spotted-wing Drosophila	thrips	two-spotted spider mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	x	x	x	x	x	x	x	x	0.75-1 lb	12h	2 lb
bifenazate		x	x	x	x	x	x	x	x	G	1d	2
Actara (25WDG)	4A	x	3 oz	3 oz	x	x	3 oz	x	x	x	12h	6 oz
thiamethoxam		x	G	G	x	x	G	x	x	x	3d	NA

(Continued)

Table 8-7. Insecticides labeled for management at post-bloom through harvest[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	broad mite	green June Japanese beetle	plant bugs	rednecked cane borer	sap beetle	stink bug	spotted-wing Drosophila	thrips	two-spotted spider mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Admire Pro (4.6F)	4A	x	x	x	10.5-14 fl oz	x	x	x	7-14 fl oz	x	12h	14 fl oz
imidacloprid		x	x	x	G	x	x	x	F	x	7d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	3.5 fl oz	x	x	x	x	x	x	x	1.75-3.5 fl oz	12h	10.25 fl oz
abamectin		E	x	x	x	x	x	x	x	E	7d	NA
Assail 30SG	4A	x	4.5-5.3 oz	4.5-5.3 oz	x	4.5-5.3 oz	x	x	4.5-5.3 oz	x	12h	26.7 oz
acetamiprid		x	G	G	x	G	x	x	u	x	1d	5
BeetleGone!	11	x	1-17.5 lb	x	x	x	x	x	x	x	4h	NA
B. thuringiensis		x	u	x	x	x	x	x	x	x	0d	NA
Brigade WSB (10WP) **(RUP)**	3A	x	x	x	x	x	x	8-16 oz	x	16 oz	12h	32 oz
bifenthrin		x	x	x	x	x	x	E	x	F	3d	NA
Danitol 2.4EC **(RUP)**	3A	x	10.6-16 fl oz	10.6-16 fl oz	x	x	10.6-16 fl oz	10.6-16 fl oz	x	16 fl oz	24h	32 fl oz
fenpropathrin		x	E	E	x	x	E	E	x	F	3d	NA
Delegate WG (25WG)	5	x	x	x	x	x	x	3-6 oz	3-6 oz	x	4h	19.5 oz
spinetoram		x	x	x	x	x	x	E	E	x	1d	6
Entrust SC (2SC)	5	x	x	x	x	x	x	4-6 fl oz	x	x	4h	29 fl oz
spinosad		x	x	x	x	x	x	G	x	x	1d	6
Hero (1.24EC) **(RUP)**	3A	x	x	x	x	x	x	x	x	10.3 fl oz	12h	27.4 fl oz
bifenthrin + zeta-permethrin		x	x	x	x	x	x	x	x	F	3d	2
Kanemite 15SC	20B	x	x	x	x	x	x	x	x	31 fl oz	12h	62 fl oz
acequinocyl		x	x	x	x	x	x	x	x	G	1d	2
M-Pede	UN	0.25 -4%	x	x	x	x	x	x	x	x	12h	NA
potassium salts of fatty acids		E	x	x	x	x	x	x	x	x	0d	NA
Magister (1.7SC)	21A	x	x	x	x	x	x	x	x	32-36 fl oz	12h	36 fl oz
fenazaquin		x	x	x	x	x	x	x	x	u	7d	1
Malathion 5EC	1B	x	3 pt	x	x	x	x	x	3 pt	x	12h	9.6 pt
malathion		x	G	x	x	x	x	x	G	x	1d	3
Mustang Maxx (0.83EC) **(RUP)**	3A	x	4 fl oz	x	x	x	x	4 fl oz	x	x	12h	24 fl oz
zeta-cypermethrin		x	E	x	x	x	x	E	x	x	1d	6
Neemix 4.5 (0.39L)	UN	x	7-16 fl oz	x	x	x	x	x	7-16 fl oz	x	4h	NA
azadirachtin		x	u	x	x	x	x	x	u	x	0d	NA

(Continued)

Table 8-7. Insecticides labeled for management at post-bloom through harvest[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	broad mite	green June Japanese beetle	plant bugs	rednecked cane borer	sap beetle	stink bug	spotted-wing Drosophila	thrips	two-spotted spider mite	REI[3] PHI[4]	Max amt[5] Max app[6]
Pyganic 5EC	3A	x	4.5-15.61 fl oz	4.5-15.61 fl oz	x	x	4.5-15.61 fl oz	4.5-15.61 fl oz	4.5-15.61 fl oz	x	12h	NA
pyrethrins		x	i	F	x	x	i	F	i	x	0d	10
Savey 50DF	10A	x	x	x	x	x	x	x	x	4-6 oz	12h	6 oz
hexythiazox		x	x	x	x	x	x	x	x	E	3d	1
Sevin XLR Plus (4F)	1A	x	1-2 qt	1.5-2 qt	x	x	x	x	x	x	12h	10 qt
carbaryl		x	G	G	x	x	i	x	x	x	7d	NA
Surround WP (95WP)	UN	x	25-50 lb	x	x	x	x	x	25-50 lb	x	4h	NA
kaolin		x	u	x	x	x	x	x	u	x	0d	NA
Zeal (72WP)	10B	x	x	x	x	x	x	x	x	2-3 oz	12h	3 oz
etoxazole		x	x	x	x	x	x	x	x	E	0d	1

Raspberry and Blackberry Post-harvest – Diseases

Disease management notes

- Apply fall spray of any fungicide after old canes are removed.
- When applying any fungicide after harvest, take into account maximum rate allowed.
- For best control of Phytophthora, the last fall application of Aliette should be made at least 30 days prior to leaf drop.

Table 8-8. Fungicides for disease management at post-harvest[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	REI[3] PHI[4]	Max amt[5] Max amt[6]
Abound (SC)	11	6-15.5 fl oz	6-15.5 fl oz	6-15.5 fl oz	x	10-15.5 fl oz	6-15.5 fl oz	4h	92.3 fl oz
azoxystrobin		E	E	E	G	E	E	0d	9
Cabrio EG (20EG)	11	14 oz	14 oz	14 oz	14 oz	14 oz	14 oz	12h	56 oz
pyraclostrobin		E	E	E	s	s	E	0d	NA
Captan 80WDG	M4	2.5 lb	2.5 lb	x	2.5 lb	x	x	48h	12.5 lb
captan		G	G	s	G	x	x	3d	NA
Captec 4L	M4	0.75-1 qt/100 gal	0.75-1 qt/100 gal	x	0.75-1 qt/100 gal	x	x	72h	35 qt
captan		G	G	x	G	x	x	3d	NA
CaptEvate 68WDG	M+17	3.5 lb	3.5 lb	x	3.5 lb	x	x	48h	21 lb.
captan + fenhexamid		G	G	x	E	G	x	30d	NA
Elevate 50WDG	17	x	x	x	1.5 lb	x	x	12h	6 lb.
fenhexamid		x	x	x	E	x	x	0d	NA

(Continued)

Table 8-8. Fungicides for disease management at post-harvest[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	REI[3] PHI[4]	Max amt[5] Max amt[6]
Fontelis	7	x	x	x	1-2 pts	x	x	12h	72 fl oz
penthiopyrad		x	x	x	E	x	G	0d	NA
JMS Stylet Oil	M	x	x	x	x	3-6 qt	3-6 qt	4h	NA
mineral oil		x	x	x	x	F	F	NL	NA
Kenja 400SC	7	x	x	x	13.5-15.5 fl oz	x	13.5-15.5 fl oz	12h	54 fl oz
Isofetamid		u	x	x	G	u	E	0d	NA
Luna Privilege	7	x	4.8-6.4 fl oz	4.8-6.4 fl oz	4.8-6.4 fl oz	x	4.8-6.4 fl oz	12 h	13.7 fl oz
fluopyram		x	F	G	E	x	E	0d	NA
Luna Tranquility (SC)	7+9	x	x	16-27 fl oz	16-27 fl oz	x	13.6-27 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		x	x	u	E	x	G	0d	NA
OSO 5%SC	19	6.5-13 fl oz	x	x	6.5-13 fl oz	6.5-13 fl oz	6.5-13 fl oz	4h	78 fl oz
polyoxin D		u	x	x	F-G	u	G	0d	6
Pristine 38WG	11+7	18.5-23 oz	18.5-23 oz	x	18.5-23 oz	18.5-23 oz	18.5-23 oz	12h	92 oz
pyraclostrobin + boscalid		E	E	E	E[r]	S	E	0d	4
Prolivo 300SC	U8	x	x	x	x	x	4-5 fl oz	4h	16 fl oz
pyriofenone		x	x	x	x	x	E	0d	NA
Quilt Xcel	11+3	14-21 fl oz	14-21 fl oz	14-21 fl oz	x	14-21 fl oz	14-21 fl oz	12h	63 fl oz
azoxystrobin + propiconazole		G	G	G	G	G	G	30d	3
Rally 40WSP	3	x	x	x	x	1.25-3 oz	1.25-3 oz	24h	10 oz
myclobutanil		x	x	x	x	E	E	0d	NA
Rovral 4F	2	x	x	x	2 pt	x	x	24h	8 pt.
iprodione		x	x	x	E[r]	x	x	0d	4
Sulfur 80WDG	M	x	x	x	x	x	6-15 lb	24h	varies
sulfur		x	x	x	x	x	u	0d	NA
Switch 62.5WG	9+12	11-14 oz	x	x	11-14 oz	x	x	12h	56 oz
cyprodinil + fludioxonil		u	x	x	G	x	x	0d	2
Tanos (DW)	11+27	x	8-10 oz	8-10 oz	x	x	x	12h	72 oz
famoxadone + cymoxanil		x	G	G	x	x	x	0d	NA
Tilt (EC)	3	x	6 fl oz	x	x	6 fl oz	6 fl oz	12h	30 fl oz
propiconazole		x	u	x	x	E	E	30d	5

Raspberry and Blackberry Post-harvest – Insects

Insect management notes

- Apply insecticides for **borer** control during October and November.

Table 8-9. Insecticides labeled for management at post-harvest[1]

Product and formulation Active ingredient	IRAC code[2]	raspberry crown borer	REI[3] PHI[4]	Max amt[5] Max app[6]
Altacor (35WG)	28	3-4.5 oz	4h	9 oz
chlorantraniliprole		G	3d	NA
Brigade WSB (10WP) **(RUP)**	3A	16 oz	12h	32 oz
bifenthrin		E	3d	NA
Hero (1.24EC) **(RUP)**	3A	10.3 fl oz	12h	27.4 fl oz
bifenthrin + zeta-permethrin		u	3d	2

Special Comments on Raspberry and Blackberry Schedule

Spotted-wing Drosophila

See page 181 (under Grapes).

Broad mite

The broad mite damages 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. 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. 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.

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.

For more information about broad mites, including photos, see Managing Broad Mite in Southeastern Caneberry Plantings at: https://smallfruits.org/2021/04/managing-broad-mite-in-southeastern-caneberry-plantings

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.

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.

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, etc.), Quilt Xcel, and Cover XL are labeled for control on blackberry; however, chemical control of this disease under heavy disease 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 water mold Peronospora sparsa. 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. 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	thrips	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
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 + zeta-permethrin	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

(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	thrips	two-spotted spider mite	REI[3] PHI[4]	Max amt[5] Max app[6]
M-Pede	UN	E	x	x	x	x	x	x	x	x	x	x	x	x	x	x	12h	NA
potassium salts of fatty acids																	0d	NA
Malathion	1B	x	G	x	x	x	x	x	x	G	x	x	x	G	G	x	12h	9 pt
malathion																	1d	3
Mustang Maxx (0.83EC) **(RUP)**	3A	x	E	E	x	x	x	x	x	x	x	E	x	E	x	x	12h	24 fl oz
zeta-cypermethrin																	1d	6
Neemix 4.5 (0.39L)	UN	x	u	u	x	x	x	x	x	u	x	x	x	x	u	x	4h	NA
azadirachtin																	0d	NA
Pyganic 5EC; 1.4EC	3A	x	i	F	F	x	F	i	x	F	x	i	x	F	i	x	12h	NA
pyrethrins																	0d	NA
Savey 50DF	10A	x	x	x	x	x	x	x	x	x	x	x	x	x	x	E	12h	6 oz
hexythiazox																	3d	1
Sevin XLR Plus (4F)	1A	x	G	G	G	x	i	G	x	G	x	i	x	G	x	x	12h	10 qt
carbaryl																	7d	NA
Surround WP (95WP)	UN	x	u	u	x	x	x	x	x	u	x	x	x	x	u	x	4h	NA
kaolin																	0d	NA
Zeal (72WP)	10B	x	x	x	x	x	x	x	x	x	x	x	x	x	x	E	12h	3 oz
etoxazole																	0d	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.

[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	NA 4
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.

[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.

[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.

9. STRAWBERRY

Strawberry Spray Schedule

Section Editors:
Entomology: C. Guedot and R. Bessin
Plant Pathology: J. Beckerman and M. Heller-Haas
Horticulture: E. Wahle

How to read the spray schedule tables

Every strawberry 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.

Strawberry Pre-plant – Diseases

- Recent research on the role of dips in disease management have shown inconsistent results. The information is included but not necessarily recommended. Starting with disease-free plants and plugs are essential for successful strawberry production and these treatments will not rescue infected plants.
- Wash excess soil from roots prior to dipping. Dip or expose plants for label recommended time. Drain transplants after dip, and plant as quickly as possible. Do not reuse solution and dispose of solution as per local regulations.
- When dipping with Abound and Switch, submerge plants for 2-5 min; when using, Aliette and Rampart, dip for 15-30 min.
- Labeled rates of Aliette differ between dips and foliar application.

Table 9-1. Fungicide application at planting[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose crown	red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	5-8 fl oz	5-8 fl oz	4h	61.5 fl oz
azoxystrobin		G[r]	E	0d	NA
Aliette WDG	33	x	2.5 lb/100 gal	12h	30 lb
aluminum tris		x	E	1d	NA
Phostrol	33	x	2.5–5 pt/100 gal	4h	NA
phosphorous acid		x	E	NA	NA
Prophyte	33	x	2 pt/100 gal	4h	varies
phosphorous acid		x	x	NA	4
Switch 62.5WG	9+12	5-8 oz /100 gal	x	12h	56 oz
cyprodinil + fludioxonil		G	x	0d	NA

Strawberry Early Spring (Pre-bloom) – Diseases

Apply when new leaves are expanding and blossom buds are visible.

Disease management notes

- 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.

Table 9-2. Strawberry prebloom disease management recommendations[1]

Product and formulation Active ingredient	FRAC code[2]	angular leaf spot	anthracnose crown	leaf blight Phomopsis	leaf scorch (Diplocarpon)	leaf spot (Mycosphaerella)	powdery mildew	red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	x	5-8 fl oz	x	x	x	6-15.5 fl oz	x	4h	NA
azoxystrobin		x	G[r]	x	x	x	G	x	4h	NA
Actiguard 50WG	21	0.5-0.75 oz	x	x	x	x	x	x	12h	6 oz
Acibenzolar-S-methyl:		s	x	x	x	x	x	x	0d	NA
Aftershock/Evito 480SC	11	x	2-5.7 fl oz	x	x	x	2-5.7 fl oz	x	12h	22.8 fl oz
fluoxastrobin		x	G	x	x	x	G	x	1d	4
Aliette WDG	33	x	x	x	x	x	x	2.5-5 lb	12h	30 lb
aluminum tris		x	x	x	x	x	x	E	1d	NA
Badge SC	M	1-2.25 pt	x	1 – 2.25 pt	2-2.25 pt	x	1-2.25 pt	x	48h	28.9 pt
copper sulfate + oxychloride		F	x	F	F	x	F	x	0d	NA
Cabrio EG (20EG)	11	x	12-14 oz	x	x	12-14 oz	12-14 oz	12-14 oz	12h	70 oz
pyraclostrobin		x	E	x	x	G	E	E	0d	NA

(Continued)

Table 9-2. Strawberry prebloom disease management recommendations[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	angular leaf spot	anthracnose crown	leaf blight Phomopsis	leaf scorch (Diplocarpon)	leaf spot (Mycosphaerella)	powdery mildew	red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Captan (80WDG)	M	x	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	x	x	24h	30 lb
captan		x	E	G	G	G	x	x	0d	NA
Cuprofix Ultra 40 disperss	M	1.2-2.5 lb	x	1.2-2.5 lb	1.2-2.5 lb	1.2-2.5 lb	x	x	12h	20.5 lb
copper sulfate		F	x	F	F	F	x	x	0d	NA
Cuproxat FL	M	2.5-5 pt	x	2.5-5 pt	2.5-5 pt	2.5-5 pt	x	x	48 h	NA
tribasic copper sulfate		F	x	F	F	F	x	x	NA	NA
Elevate 50WDG	17	x	x	x	x	x	x	x	4h	6 lb
fenhexamid		x	x	x	x	x	x	x	0d	NA
Flint Extra	11	x	2.5-3 fl oz	2.5-3 fl oz	x	x	2.5-3 fl oz	x	12h	18 fl oz
trifloxystrobin		x	G	G	x	x	G	x	0d	6
Fontelis (SC)	7	x	16-24 oz	x	x	x	16-24 oz	x	12h	72 fl oz
penthiopyrad		x	G	x	x	x	E	x	0d	NA
Intuity (SC)	11	x	x	x	x	x	6 fl oz	x	12h	12 fl oz
mandestrobin		x	x	x	x	x	s(E)	x	0d	2
Kenja 400SC	7	x	13.5-15.5 fl oz	x	x	x	x	x	12h	54 fl oz
isofetamid		x	i	x	x	x	x	x	0d	NA
Kocide 3000	M	0.75-1.25 lb	x	0.75-1.25 lb	0.75-1.25 lb	0.75-1.25 lb	x	x	48h	27.3 lb
copper hydroxide		F	x	F	F	F	x	x	0d	NA
Luna Privilege	7	x	3.2-6.8 fl oz	x	x	3.2-6.8 fl oz	3.2-6.8 fl oz	x	12 h	13.7 fl oz
fluopyram		x	G	x	x	G	G	x	NL	2
Luna Sensation (SC)	7+11	x	4-7.6 fl oz	x	x	4-7.6 fl oz	4-7.6 fl oz	E	12h	27.1 fl oz
fluopyram + trifloxystrobin		x	E	x	x	G	E	4-7.6 fl oz	0d	NA
Luna Tranquility (SC)	7+9	x	x	16-27 fl oz	x	16-27 fl oz	16-27 fl oz	x	12h	54.7 fl oz
fluopyram + pyrimethanil		x	x	G	x	G	E	x	1d	NA
Merivon	7+11	x	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	x	12h	33 fl oz
pyraclostrobin + fluxopyroxad		x	E	E	G	E	F	x	0d	3
Mettle 125ME	3	x	x	3-5 oz	3-5 oz	3-5 oz	3-5 oz	x	12h	20 fl oz
tetraconazole		x	x	E	G	G	E	x	0d	4
Miravis Prime	7+12	x	9.1-13.4 oz	9.1-13.4 oz	x	x	9.1-13.4 oz	x	12 h	27.2 oz
pydiflumetofen + fludioxonil		x	E	G	x	x	G	x	0 d	4
Nordox 75G	M	x	x	1.25-2.5 lb	1.25-2.5 lb	1.25-2.5 lb	x	x	12h	NA
cuprous oxide		x	x	F	F	F	x	x	NA	NA
Orondis Gold 200	49+4	x	x	x	x	x	x	20-62 fl oz	48 h	124 fl oz
oxathiapiprolin + mefenoxam		x	x	x	x	x	x	E	28d	2

(Continued)

Table 9-2. Strawberry prebloom disease management recommendations[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	angular leaf spot	anthracnose crown	leaf blight Phomopsis	leaf scorch (Diplocarpon)	leaf spot (Mycosphaerella)	powdery mildew	red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
PhD	19	x	6.2 oz	x	x	x	6.2 oz	x	4h	NA
polyoxin D		x	G	x	x	x	G	x	0d	NA
Prophyte	33	x	x	x	x	x	x	2 pt/100 gal	4h	4 pt
phosphorous acid		x	x	x	x	x	x	G	NA	varies
Phostrol	33	x	x	x	x	x	x	G	4 h	NA
phosphorous acid		x	x	x	x	x	x	2.5-5 pt/100 gal	NA	NA
Protocol (L)	1+3	x	1.3 pt	x	x	1.3 pt	1.3 pt	x	24h	5.3 pt
thiophanate-methyl + propiconazole		x	G[r]	x	x	G[r]	G[r]	x	1d	NA
Pristine	11+7	x	18.5-23 oz	18.5-23 oz	x	18.5-23 oz	18.5-23 oz	18.5-23 oz	12h	115 oz
pyraclostrobin + boscalid		x	G	G	x	G	E	E	0d	5
ProBlad Verde	M12	x	x	x	x	x	20.5-24.4 fl oz	x	4 h	NA
Banda de Lupinus alba doce		x	x	x	x	x	F	x	1d	5
Procure 480SC	3	x	x	x	x	x	4-8 fl oz	x	12h	32 fl oz
triflumizole		x	x	x	x	x	G	x	1d	NA
Quadris Top (SC)	3+11	x	12-14 fl oz	x	x	12-14 fl oz	12-14 fl oz	x	12h	56 fl oz
difenoconazole + azoxystrobin		x	G	x	x	G	G	x	0d	4
Quilt Xcel (SE)	11+3	x	14 fl oz	x	x	14 fl oz	15 fl oz	x	12h	56 fl oz
azoxystrobin + propiconazole		x	G	x	x	G	E	x	0d	4
Quintec 28F	13	x	x	x	x	x	4-6 fl oz	x	24h	24 fl oz
quinoxyfen		x	x	x	x	x	E	x	1d	4
Rally 40WSP	3	x	x	2.5-5 oz	x	2.5-5 oz	2.5-5 oz	x	24h	30 oz
myclobutanil		x	x	F	x	G	E	x	0d	NA
Ridomil Gold SL	4	x	x	x	x	x	x	E[r]	48h	1.5 lb
mefenoxam		x	x	x	x	x	x	1 pt	0d	3
Rovral 4F	2	x	2 pt	2 pt	x	2 pt	x	x	24h	NA
iprodione		x	u	u	x	u	x	x	0d	1
Switch 62.5WG	9+12	x	11-14 oz	x	x	11-14 oz	x	x	12h	56 oz
cyprodinil + fludioxonil		x	G	x	x	F	x	x	0d	NA
Thiram (65WP), Thiram Granuflow	M	x	4.4 lb	x	x	x	4.4 lb	x	24h	NA
thiram		x	F	x	x	x	G	x	1d	5

(Continued)

Table 9-2. Strawberry prebloom disease management recommendations[1] *(continued)*

Product and formulation Active ingredient	FRAC code[2]	angular leaf spot	anthracnose crown	leaf blight Phomopsis	leaf scorch (Diplocarpon)	leaf spot (Mycosphaerella)	powdery mildew	red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Tilt (EC)	3	x	x	x	x	4 fl oz	5 fl oz	x	12h	16 fl oz
propiconazole		x	x	x	x	G	G	x	0d	NA
Topguard EQ (SC)	3+11	x	5-8 oz	x	x	x	5-8 oz	5-8 oz	12h	32 fl oz
azoxystrobin + flutriafol		x	G	x	x	x	E	u	0d	4
Topsin-M WSB	1	x	0.75-1 lb	0.75-1 lb	x	0.75-1 lb	0.75-1 lb	x	24h	4 lb
thiophanate-methyl		x	G	i	x	G	i[r]	x	1d	NA
Torino (SC)	U6	x	x	x	x	x	3.4 fl oz	x	4h	7.2 oz
cyflufenamid		x	x	x	x	x	E	x	3d	2

Strawberry Pre-bloom – Insects

- Do not apply insecticides during bloom to protect bees and other pollinators.
- 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 row-yard 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.
- For **Eastern flower thrips**: Sample when first blossom buds begin to open. Threshold is 2-10 thrips per blossom. Treat before widespread bloom draws pollinators.
- For **spittle bug, tarnished plant bug**: If a problem, apply when buds first become visible, and make a second application just before the first bloom opens.
- Admire Pro cannot be applied within 10 days prior to bloom or when bees are foraging.
- Diazinon AG600 allows for one foliar and one soil application per year.

Table 9-3. Insect pest recommendations for pre-bloom through bloom[1]

Product and formulation Active ingredient	IRAC code[2]	clipper	cyclamen mite	eastern flower thrips	spider mite	spittlebug	tarnished plant bug	thrips	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	x	x	x	0.75-1 lb	x	x	x	12h	NA
bifenazate		x	x	x	E	x	x	x	1d	1
Actara (25WDG)	4A	x	x	x	x	x	4 oz	x	12h	12 oz
thiamethoxam		x	x	x	x	x	s	x	3d	NA
Admire Pro (4.6F)	4A	x	x	x	x	1.3 fl oz	x	x	12h	3.9/14 fl oz
imidacloprid		x	x	x	x	G	x	x	7 or 14d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	3.5 oz	x	3.5 oz	x	x	x	12h	14 fl oz
abamectin		x	G	x	E	x	x	x	3d	NA
Apta (1.34SC)	21A	x	x	27 fl oz	x	x	27 fl oz	27 fl oz	12h	81 fl oz
tolfenpyrad		x	x	x	u	x	u	u	1d	3

(Continued)

Table 9-3. Insect pest recommendations for pre-bloom through bloom[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	clipper	cyclamen mite	eastern flower thrips	spider mite	spittlebug	tarnished plant bug	thrips	REI[3] PHI[4]	Max amt[5] Max app[6]
Assail 30SG	4A	x	x	4-6.9 oz	x	1.9-6.9 oz	1.9-6.9 oz	4-6.9 oz	12h	13.8 oz
acetamiprid		x	x	G	x	G	G	E	1d	2
Beleaf 50SG	29	x	x	x	x	x	2.8 oz	x	12h	8.4 oz
flonicamid		x	x	x	x	x	E	x	0d	2
Brigade WSB (10WP) **(RUP)**	3A	6.4-32 oz	x	x	16-32 oz	6.4-32 oz	6.4-32 oz	x	12h	80 oz
bifenthrin		E	x	x	F	E	E	x	0d	NA
Closer SC	4C	x	x	4.5 fl oz	x	x	2.7–4.5 oz	x	12h	17 oz
sulfoxaflor		x	x	s	x	x	u	x	1d	4
Danitol 2.4EC **(RUP)**	3A	16-21.3 fl oz	16-21.3 fl oz	x	16-21.3 fl oz	10.6 fl oz	10.6 fl oz	x	24h	See label
fenpropathrin		E	u	x	F	u	u	x	3d	See label
Diazinon AG600 WBC **(RUP)**	1B	x	25.5 oz	x	12.75 fl oz /100 g	x	x	x	3d	25.5 fl oz
diazinon		x	G	x	F	x	x	x	5d	1
Dibrom 8E **(RUP)**	1B	x	x	1 pt	1 pt	1 pt	1 pt	x	2d	5 pt
naled		x	x	u	u	u	u	x	1d	5
Entrust SC (2SC)	5	x	x	4-6 fl oz	x	x	x	4-6 fl oz	4h	18 fl oz
spinosad		x	x	G	x	x	x	x	1d	3
Exirel (0.83SE)	28	x	x	13.5-20.5 fl oz	x	x	x	x	12h	61.5 fl oz
cyantraniliprole		x	x	s	x	x	x	x	1d	NA
Grandevo	UN	x	2-3 lb	2-3 lb	2-3 lb	x	2-3 lb	x	4h	NA
Chromobacterium subtsugae		x	u	u	u	x	u	x	0d	NA
Kanemite 15SC	20B	x	x	x	21-31 fl oz	x	x	x	12h	62 fl oz
acequinocyl		x	x	x	E	x	x	x	1d	2
Malathion 5EC	1B	x	x	1.5-3.2 pt	1.5-3.2 pt	1.5-3.2 pt	1.5-3.2 pt	x	12h	12.8 pt
malathion		x	x	s	u	u	u	x	3d	4
Nealta (1.67SC)	25	x	x	x	13.7 fl oz	x	x	x	12h	27.4 fl oz
cyflumetofen		x	x	x	G	x	x	x	1d	2
Nexter (75WP)	21	x	x	x	4.4-10.6 oz	x	x	x	12h	21.34 oz
pyridaben		x	x	x	G	x	x	x	1d	2
Oberon 2SC	23	x	x	x	12-16 fl oz	x	x	x	12h	48 fl oz
spiromesifen		x	x	x	G	x	x	x	3d	3
Portal XLO (0.4EC)	21A	x	2 pt	x	2 pt	x	x	x	12h	4 pt
fenpyroximate		x	G	x	E	x	x	x	1d	2
Radiant SC (1SC)	5	x	x	6-10 fl oz	x	x	x	6-10 oz	4h	30 fl oz
spinetoram		x	x	G	x	x	x	x	1d	3
Rimon 0.83EC	15	x	x	6-12 fl oz	x	x	9-12 fl oz	x	12h	36 fl oz
novaluron		x	x	u	x	x	E	x	1d	NA

(Continued)

Table 9-3. Insect pest recommendations for pre-bloom through bloom[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	clipper	cyclamen mite	eastern flower thrips	spider mite	spittlebug	tarnished plant bug	thrips	REI[3] PHI[4]	Max amt[5] Max app[6]
Savey 50DF	10A	x	x	x	6 oz	x	x	x	12h	6 oz
hexythiazox		x	x	x	E	x	x	x	3d	1
Sevin XLR Plus (4F)	1A	1-2 qt	x	x	x	x	1.5-2 qt	x	12h	10 qt
carbaryl		G	x	x	x	x	G	x	7d	5
Transform WG	4C	x	x	2.2 oz	x	x	1.5-2.2 oz	x	24h	8.5 oz
sulfoxaflor		x	x	s	x	x	u	x	1d	4
Vendex 50WP **(RUP)**	12B	x	x	x	1.5-2 lb	x	x	x	2d	4 lb
fenbutatin-oxide		x	x	x	G	x	x	x	1d	2
Zeal (72WP)	10B	x	x	x	2-3 oz	x	x	x	12h	3 oz
etoxazole		x	x	x	E	x	x	x	1d	1

Strawberry Early Bloom through Bloom – Diseases

Apply from 5-10% bloom until flowers have finished blooming.

Disease management notes

- Carefully examine FRAC codes to confirm that fungicide rotations use different FRAC classes. For example, 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.
- **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.
- Captan and copper both pose a risk of phytotoxicity at bloom. Take care to avoid tank mixing, particularly with other products that have EC or SC formulations.
- 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 other fungicides for best control.
- Botrytis fungicide resistance to the FRAC 7 and 11 fungicides has been reported in botrytis in many strawberry producing states, but has not confirmed in the Midwest. Resistance to FRAC 1 has been a longstanding issue.

Table 9-4. Disease management during bloom[1]

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	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	5-8 fl oz	x	6-15.5 fl oz	x	x	x	6-15.5 fl oz	4h	61.5 fl oz
azoxystrobin		G[r]	x	s	x	x	x	G	0d	NA
Aftershock/Evito 480SC	11	2-5.7 fl oz	2-5.7 fl oz	x	x	x	x	2-5.7 fl oz	12h	22.8 fl oz
fluoxastrobin		G	G	x	x	x	x	G	1d	NA

(Continued)

Table 9-4. Disease management during bloom[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	REI[3] PHI[4]	Max amt[5] Max app[6]
Cabrio EG (20EG)	11	12-14 oz	12-14 oz	12-14 oz	x	x	12-14 oz	12-14 oz	12h	70 oz
pyraclostrobin		E	G	G	x	x	G	E	0d	NA
Captan (80WDG)	M	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	x	24h	30 lb
captan		E	G	G	G	G	G	x	0d	NA
Elevate 50WDG	17	x	x	1.5 lb	x	x	x	x	4h	6 lb
fenhexamid		x	x	E[r]	x	x	x	x	0d	NA
Flint Extra	11	2.5-3 fl oz	2.5-3 fl oz	2.5-3 fl oz	2.5-3 fl oz	x	x	2.5-3 fl oz	12h	18 fl oz
trifloxystrobin		G	E	G	G	x	x	G	0d	NA
Fontelis (SC)	7	16-24 oz	16-24 oz	16-24 oz	x	x	x	16-24 oz	12h	72 fl oz
penthiopyrad		G	E	E	x	x	x	E	0d	NA
Intuity (SC)	11	x	x	6 fl oz	x	x	x	6 fl oz	12h	12 fl oz
mandestrobin		x	x	E	x	x	x	s-E	0d	2
Kenja 400SC	7	13.5-15.5 fl oz	13.5-15.5 fl oz	13.5-15.5 fl oz	x	x	x	x	12h	54 fl oz
isofetamid		i	i	E	x	x	x	x	0d	NA
Luna Privilege	7	3.2-6.8 fl oz	3.2-6.8 fl oz	3.2-6.8 fl oz	x	x	3.2-6.8 fl oz	3.2-6.8 fl oz	12 h	13.7 fl oz
fluopyram		G	G	E	x	x	G	G	NL	2
Luna Sensation (SC)	7+11	4-7.6 fl oz	4-7.6 fl oz	4-7.6 fl oz	x	x	4-7.6 fl oz	4-7.6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		E	x	G	x	x	G	E	0d	NA
Luna Tranquility (SC)	7+9	x	x	16-27 fl oz	16-27 fl oz	x	16-27 fl oz	16-27 fl oz	12h	54.7 fl oz
fluopyram + pyrimethanil		x	x	E	G	x	G	E	1d	NA
Merivon	7+11	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	12h	33 fl oz
pyraclostrobin + fluxopyroxad		E	E	E	E	G	E	F	0d	3
Mettle 125ME	3	x	x	x	3-5 oz	3-5 oz	3-5 oz	3-5 oz	12h	20 fl oz
tetraconazole		x	x	x	G	G	G	E	0d	4
Miravis Prime	7+12	9.1-13.4 oz	9.1-13.4 oz	9.1-13.4 oz	9.1-13.4 oz	x	x	9.1-13.4 oz	12 h	27.2 oz
pydiflumetofen+fludioxonil		E	E	E	G	x	x	G	0 d	4
Nordox 75G	M	x	x	x	3-5 lb	3-5 lb	3-5 lb	x	12h	NA
cuprous oxide		x	x	x	F	F	F	x	NA	NA
PhD	19	6.2 oz	6.2 oz	6.2 oz	x	x	x	6.2 oz	4h	NA
polyoxin D		G	G	E	x	x	x	G	0d	NA

(Continued)

Table 9-4. Disease management during bloom[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	REI[3] PHI[4]	Max amt[5] Max app[6]
Protocol (L)	1+3	1.3 pt	1.3 pt	1.3 pt	x	x	1.3 pt	1.3 pt	24h	5.3 pt.
thiophanate-methyl + propiconazole		G[r]	G[r]	G[r]	x	x	G[r]	G[r]	1d	NA
Pristine	11+7	18.5-23 oz	18.5-23 oz	18.5-23 oz	18.5-23 oz	x	18.5-23 oz	18.5-23 oz	12h	115 oz
pyraclostrobin + boscalid		G	E	E	G	x	G	E	0d	5
ProBlad Verde	M12	x	x	24.4-36.6 fl oz	x	x	x	20.5-24.4 fl oz	4 h	NA
Banda de Lupinus alba doce		x	x	F	x	x	x	F	1d	5
Procure 480SC	3	x	x	x	x	x	x	4-8 fl oz	12h	32 fl oz
triflumizole		x	x	x	x	x	x	G	1d	NA
Quadris Top (SC)	3+11	12-14 fl oz	12-14 fl oz	12-14 fl oz	x	x	12-14 fl oz	12-14 fl oz	12h	56 fl oz
difenoconazole + azoxystrobin		G	E	G	x	x	G	G	0d	4
Quilt Xcel (SE)	11+3	14 fl oz	14 fl oz	14 fl oz	x	x	14 fl oz	14 fl oz	12h	56 fl oz
azoxystrobin + propiconazole		G	G	F	x	x	x	E	0d	4
Quintec 2.08F	13	x	x	x	x	x	x	4-6 fl oz	24h	24 fl oz
quinoxyfen		x	x	x	x	x	x	E	1d	4
Rally 40WSP	3	x	x	x	2.5-5 oz	x	2.5-5 oz	2.5-5 oz	24h	30 oz
myclobutanil		x	x	x	F	x	G	E	0d	NA
Rovral 4F	2	x	x	2 pt	x	x	2 pt	x	24h	1
iprodione		x	x	G[r]	x	x	G	x	0d	N/A
Scala SC	9	x	x	18 fl oz	x	x	x	x	12h	54 fl oz
pyrimethanil		x	x	E[r]	x	x	x	x	1d	NA
Switch 62.5WG	9+12	11-14 oz	11-14 oz	11-14 oz	x	x	11-14 oz	x	12h	56 oz
cyprodinil + fludioxonil		G	E	E	x	x	F	x	0d	NA
Thiram (65WP), Thiram Granuflow	M	4.4 lb	4.4 lb	4.4 lb	x	x	x	4.4 lb	24h	NA
thiram		F	F	G	x	x	x	G	1d	5
Tilt (EC)	3	x	x	x	x	x	4 fl oz	4 fl oz	12h	16 fl oz
propiconazole		x	x	x	x	x	G	G	0d	NA
Topguard EQ (SC)	3+11	5-8 oz	5-8 oz	x	x	x	x	5-8 oz	12h	32 fl oz
azoxystrobin + flutriafol		G	G	x	x	x	x	E	0d	4

(Continued)

Table 9-4. Disease management during bloom[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	REI[3] PHI[4]	Max amt[5] Max app[6]
Topsin-M WSB	1	0.75-1 lb	0.75-1 lb	0.75-1 lb	0.75-1 lb	x	0.75-1 lb	0.75-1 lb	24h	4 lb
thiophanate-methyl		G	E	G[r]	i	x	G	G-P[r]	1d	NA
Torino (SC)	U6	x	x	x	x	x	x	3.4 fl oz	4h	6.8 oz
cyflufenamid		x	x	x	x	x	x	E	3d	2

Strawberry Bloom – Insects

- Do not apply insecticides during bloom to protect bees and other pollinators.

Strawberry Post-bloom through Harvest – Diseases

Apply every 7-10 days as needed. Be sure to check PHIs.

- Abound, Cabrio, and Pristine also provide protection against leather rot when applied in a protectant program.

Table 9-5. Fungicide recommendations from post-bloom through harvest[1]

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 (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Abound (SC)	11	5-8 fl oz	x	6-15.5 fl oz	x	x	x	6-15.5 fl oz	6-15.5 fl oz	4h	61.5 fl oz
azoxystrobin		G[r]	x	s-G[r]	x	x	x	G	E	0d	NA
Aftershock/Evito 480SC	11	2-5.7 fl oz	2-5.7 fl oz	x	x	x	x	2-5.7 fl oz	x	12h	22.8 fl oz
fluoxastrobin		G	G	x	x	x	x	G	x	1d	NA
Aliette WDG	33	x	x	x	x	x	x	x	2 .5-5lb	12h	30 lb
aluminum tris		x	x	x	x	x	x	x	E	1d	NA
Cabrio EG (20EG)	11	12-14 oz	12-14 oz	12-14 oz	x	x	12-14 oz	12-14 oz	12-14 oz	12h	70 oz
pyraclostrobin		E	G	G	x	x	G	E	E	0d	NA
Captan (80WDG)	M	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	x	x	24h	30 lb
captan		E	G	G	G	G	G	x	x	0d	NA
Elevate 50WDG	17	x	x	1.5 lb	x	x	x	x	x	4h	6 lb
fenhexamid		x	x	E[r]	x	x	x	x	x	0d	NA
Flint Extra	11	2.5-3 fl oz	2.5-3 fl oz	2.5-3 fl oz	2.5-3 fl oz	x	x	2.5-3 fl oz	x	12h	18 fl oz
trifloxystrobin		G	E	G	G	x	x	G	x	0d	NA
Fontelis (SC)	7	16-24 oz	16-24 oz	16-24 oz	x	x	x	16-24 oz	x	12h	72 fl oz
penthiopyrad		G	E	E	x	x	x	E	x	0d	NA
Intuity (SC)	11	x	x	6 fl oz	x	x	x	6 fl oz	x	12h	12 fl oz
mandestrobin		x	x	E	x	x	x	s[E]	x	0d	2

(Continued)

Table 9-5. Fungicide recommendations from post-bloom through harvest[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 (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Kenja 400SC	7	13.5-15.5 fl oz	13.5-15.5 fl oz	13.5-15.5 fl oz	x	x	x	x	x	12h	54 fl oz
isofetamid		i	i	E	x	x	x	x	x	0d	NA
Luna Privilege	7	3.2-6.8 fl oz	3.2-6.8 fl oz	3.2-6.8 fl oz	x	x	3.2-6.8 fl oz	3.2-6.8 fl oz	3.2-6.8 fl oz	12 h	13.7 fl oz
fluopyram		G	G	E	x	x	G	G	x	NL	2
Luna Sensation (SC)	7+11	4-7.6 fl oz	4-7.6 fl oz	4-7.6 fl oz	x	x	4-7.6 fl oz	4-7.6 fl oz	4-7.6 fl oz	12h	27.1 fl oz
fluopyram + trifloxystrobin		E	x	G	x	x	G	E	E	0d	NA
Luna Tranquility (SC)	7+9	x	x	16-27 fl oz	16-27 fl oz	x	16-27 fl oz	16-27 fl oz	x	12h	54.7 fl oz
fluopyram + pyrimethanil		x	x	E	G	x	G	E	x	1d	NA
Merivon	7+11	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	4-8 fl oz	x	12h	33 fl oz
pyraclostrobin + fluxopyroxad		E	E	E	E	G	E	F	x	0d	3
Mettle 125ME	3	x	x	x	3-5 oz	3-5 oz	3-5 oz	3-5 oz	x	12h	20 fl oz
tetraconazole		x	x	x	G	G	G	E	x	0d	4
Miravis Prime	7+12	9.1-13.4 oz	9.1-13.4 oz	9.1-13.4 oz	9.1-13.4 oz	x	x	9.1-13.4 oz	x	12 h	27.2 oz
pydiflumetofen+fludioxonil		E	E	E	G	x	x	G	x	0 d	4
Nordox 75G	M	x	x	x	1.25-2.5 lb	1.25-2.5 lb	1.25-2.5 lb	x	x	12h	NA
cuprous oxide		x	x	x	F	F	F	x	x	NA	NA
Orondis Gold	49+4	x	x	x	x	x	x	x	20–62 fl oz	48 h	124 fl oz
oxathiapiprolin+ mefenoxam		x	x	x	x	x	x	x	E	28d	2
PhD	19	6.2 oz	6.2 oz	6.2 oz	x	x	x	6.2 oz	x	4h	NA
polyoxin D		G	G	E	x	x	x	G	x	0d	NA
Prophyte	33	x	x	x	x	x	x	x	2 pt/100 gal	4h	varies
phosphorous acid		x	x	x	x	x	x	x	G	NA	4
Phostrol	33	x	x	x	x	x	x	x	2.5-5 pt/100 gal	4 h	NA
phosphorous acid		x	x	x	x	x	x	x	G	NA	NA
Protocol (L)	1+3	1.3 pt	1.3 pt	1.3 pt	x	x	1.3 pt	1.3 pt	x	24h	5.3 pt
thiophanate-methyl + propiconazole		G[r]	G[r]	G[r]	x	x	G[r]	G[r]	x	1d	NA

(Continued)

Table 9-5. Fungicide recommendations from post-bloom through harvest[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 (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Pristine	11+7	18.5-23 oz	18.5-23 oz	18.5-23 oz	18.5-23 oz	x	18.5-23 oz	18.5-23 oz	18.5-23 oz	12h	115 oz
pyraclostrobin + boscalid		G	E	E	G	x	G	E	E	0d	5
ProBlad Verde	M12	16-24 oz	16-24 oz	16-24 oz	x	x	x	16-24 oz	x	12h	NA
Banda de Lupinus alba doce		G	G	G	x	x	x	G	x	0d	5
Procure 480SC	3	x	x	x	x	x	x	4-8 fl oz	x	12h	32 fl oz
triflumizole		x	x	x	x	x	x	G	x	1d	NA
Quadris Top (SC)	3+11	12-14 fl oz	12-14 fl oz	12-14 fl oz	x	x	12-14 fl oz	12-14 fl oz	x	12h	56 fl oz
difenoconazole + azoxystrobin		G	E	G	x	x	G	G	x	0d	4
Quilt Xcel (SE)	11+3	14 fl oz	14 fl oz	14 fl oz	x	x	14 fl oz	14 fl oz	x	12h	56 fl oz
azoxystrobin + propiconazole		G	G	F	x	x	x	E	x	0d	4
Quintec 2.08F	13	x	x	x	x	x	x	4-6 fl oz	x	24h	24 fl oz
quinoxyfen		x	x	x	x	x	x	E	x	1d	4
Rally 40WSP	3	x	x	x	2.5-5 oz	x	2.5-5 oz	2.5-5 oz	x	24h	30 oz
myclobutanil		x	x	x	F	x	G	E	x	0d	NA
Ridomil Gold SL	4	x	x	x	x	x	x	x	1 pt	48h	1
mefenoxam		x	x	x	x	x	x	x	E[r]	0d	N/A
Scala SC	9	x	x	18 fl oz	x	x	x	x	x	12h	54 fl oz
pyrimethanil		x	x	E[r]	x	x	x	x	x	1d	NA
Switch 62.5WG	9+12	11-14 oz	11-14 oz	11-14 oz	x	x	11-14 oz	x	x	12h	56 oz
cyprodinil + fludioxonil		G	E	E	x	x	F	x	x	0d	NA
Thiram (65WP), Thiram Granuflow	M	4.4 lb	4.4 lb	4.4 lb	x	x	x	4.4 lb	x	24h	NA
thiram		F	F	G	x	x	x	G	x	1d	5
Tilt (EC)	3	x	x	x	x	x	4 fl oz	4 fl oz	x	12h	16 fl oz
propiconazole		x	x	x	x	x	G	G	x	0d	NA
Topguard EQ (SC)	3+11	5-8 oz	5-8 oz	x	x	x	x	5-8 oz	5-8 oz	12h	32 fl oz
azoxystrobin + flutriafol		G	G	x	x	x	x	E	G	0d	4
Topsin-M WSB	1	0.75-1 lb	0.75-1 lb	0.75-1 lb	0.75-1 lb	x	0.75-1 lb	0.75-1 lb	x	24h	4 lb
thiophanate-methyl		G	E	G[r]	i	x	G	G-P[r]	x	1d	NA
Torino (SC)	U6	x	x	x	x	x	x	3.4 fl oz	x	4h	6.8 oz
cyflufenamid		x	x	x	x	x	x	E	x	3d	2

Strawberry Post-bloom to Harvest – Insects

- Apply every 7-10 days as needed. Be sure to check PHIs.
- Make every effort to protect bees by spraying when bees are not active, typically after sunset or early morning before 6 am.
- **Strawberry root weevil larvae** 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.
- **Leafhoppers** damage strawberry foliage, feed for a short time, then leave. Damaged leaves can 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.
- In June-bearing strawberry, **spotted-wing Drosophila** is not considered a major pest in the Midwest as harvest concludes before spotted-wing Drosophila populations start ramping up. In day-neutral strawberry, spotted-wing Drosophila can be a major pest and should be managed.
- No insecticides are registered for **strawberry rootworm**. This pest is best managed by post-harvest site rotation.
- Diazinon AG600 allows for one foliar and one soil application per year.

Table 9-6. Post-bloom to harvest insect management[1]

Product and formulation Active ingredient	IRAC code[2]	eastern flower thrips	leafhopper	leafroller	sap beetle	slugs	spider mite	spittlebug	spotted-wing Drosophila	tarnished plant bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Acramite 50WS	20D	x	x	x	x	x	0.75-1 lb	x	x	x	12h	NA
bifenazate		x	x	x	x	x	E	x	x	x	1d	2
Actara (25WDG)	4A	x	4 oz	x	x	x	x	x	x	4 oz	12h	12 oz
thiamethoxam		x	E	x	x	x	x	x	x	s	3d	NA
Admire Pro (4.6F)	4A	x	x	x	x	x	x	1.3 fl oz	x	x	12h	3.9-14 fl oz
imidacloprid		x	x	x	x	x	x	G	x	x	7 or 14d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	x	3.5 oz	x	x	x	3.5 oz	x	x	x	12h	14 fl oz
abamectin		x	G	x	x	x	E	x	x	x	3d	NA
Apta (1.34SC)	21A	27 fl oz	x	x	x	x	x	x	27 fl oz	27 fl oz	12h	81 fl oz
tolfenpyrad		u	x	x	x	x	x	x	s	u	1d	3
Assail 30SG	4A	4-6.9 oz	4-6.9 oz	4-6.9 oz	4-6.9 oz	x	x	1.9-6.9 oz	x	4-6.9 oz	12h	13.8 oz
acetamiprid		G	G	G	G	x	x	G	x	G	1d	2
Beleaf 50SG	29	x	x	x	x	x	x	x	x	2.8 oz	12h	8.4 oz
flonicamid		x	x	x	x	x	x	x	x	E	0d	2
Brigade WSB (10WP) **(RUP)**	3A	x	x	6.4-32 oz	6.4-32 oz	x	16-32 oz	6.4-32 oz	x	6.4-32 oz	12h	80 oz
bifenthrin		x	x	G	E	x	F	E	x	E	0d	NA

(Continued)

Table 9-6. Post-bloom to harvest insect management[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	eastern flower thrips	leafhopper	leafroller	sap beetle	slugs	spider mite	spittlebug	spotted-wing Drosophila	tarnished plant bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Bt (Bacillus thuringiensis)	11A	x	x	See label	x	x	x	x	x	x	4h	NA
Bacillus thuringiensis		x	x	G	x	x	x	x	x	x	0d	NA
Closer SC	4C	4.5 fl oz	x	x	x	x	x	x	x	2.7-4.5 fl oz	12h	17 oz
sulfoxaflor		s	x	x	x	x	x	x	x	u	1d	4
Danitol 2.4EC **(RUP)**	3A	x	16-21.3 fl oz	16-21.3 fl oz	16-21.3 fl oz	x	16-21.3 fl oz	10.6 fl oz	16 fl oz	10.6 fl oz	24h	See label
fenpropathrin		x	G	E	u	x	F	u	E	u	3d	See label
Deadline MP's (4% bait)	UN	x	x	x	x	25 lb	x	x	x	x	12h	75 lb
metaldehyde		x	x	x	x	G	x	x	x	x	0d	3
Diazinon AG600 WBC **(RUP)**	1B	x	x	12.75 fl oz /100 g	x	x	12.75 fl oz /100 g	x	x	x	3d	25.5 fl oz
diazinon		x	x	G	x	x	F	x	x	x	5d	1
Dibrom 8E **(RUP)**	1B	1 pt	x	1 pt	x	x	1 pt	1 pt	x	1 pt	2d	5 pt
naled		u	x	u	x	x	u	u	x	u	1d	5
Entrust SC (2SC)	5	4-6 fl oz	x	4-6 fl oz	x	x	x	x	x	x	4h	18 fl oz
spinosad		G	x	G	x	x	x	x	x	x	1d	3
Exirel (0.83SE)	28	13.5-20.5 fl oz	x	x	x	x	x	x	13.5-20.5 fl oz	x	12h	0.4 lb
cyantraniliprole		s	x	x	x	x	x	x	E	x	1d	NA
Grandevo	UN	2-3 lb	x	1-3 lb	x	x	2-3 lb	x	x	2-3 lb	4h	NA
Chromobacterium subtsugae		u	x	G	x	x	u	x	x	u	0d	NA
Kanemite 15SC	20B	x	x	x	x	x	21-31 fl oz	x	x	x	12h	62 fl oz
acequinocyl		x	x	x	x	x	E	x	x	x	1d	2
Magister SC (1.7SC)	21A	x	x	x	x	x	32-36 fl oz	x	x	x	12 h	36 fl oz
fenazaquin		x	x	x	x	x	u	x	x	x	1d	1
Malathion 5EC	1B	1.5-3.2 pt	1.5-3.2 pt	1.5-3.2 pt	x	x	1.5-3.2 pt	1.5-3.2 pt	x	1.5-3.2 pt	12h	12.8 pt
malathion		s	G	u	x	x	u	u	x	u	3d	4
Nealta (1.67SC)	25	x	x	x	x	x	13.7 fl oz	x	x	x	12h	27.4 fl oz
cyflumetofen		x	x	x	x	x	G	x	x	x	1d	2

(Continued)

Table 9-6. Post-bloom to harvest insect management[1] *(continued)*

Product and formulation Active ingredient	IRAC code[2]	eastern flower thrips	leafhopper	leafroller	sap beetle	slugs	spider mite	spittlebug	spotted-wing Drosophila	tarnished plant bug	REI[3] PHI[4]	Max amt[5] Max app[6]
Nexter (75WP)	21	x	x	x	x	x	4.4-10.6 oz	x	x	x	12h	21.34 oz
pyridaben		x	x	x	x	x	G	x	x	x	1d	2
Oberon 2SC	23	x	x	x	x	x	12-16 fl oz	x	x	x	12h	48 fl oz
spiromesifen		x	x	x	x	x	G	x	x	x	3d	3
Platinum (2SC)	4A	x	5-12 fl oz	x	x	x	x	x	x	x	12h	12 fl oz
thiamethoxam		x	E	x	x	x	x	x	x	x	50d	NA
Portal XLO (0.4EC)	21A	x	x	x	x	x	2 pt	x	x	x	12h	4 pt
fenpyroximate		x	x	x	x	x	E	x	x	x	1d	2
Radiant SC (1SC)	5	6-10 fl oz	x	6-10 fl oz	x	x	x	x	6-10 fl oz	x	4h	30 fl oz
spinetoram		G	x	E	x	x	x	x	E	x	1d	3
Rimon 0.83EC	15	6-12 fl oz	x	x	6-12 fl oz	x	x	x	x	9-12 fl oz	12h	36 fl oz
novaluron		u	x	x	E	x	x	x	x	E	1d	NA
Savey 50DF	10A	x	x	x	x	x	6 oz	x	x	x	12h	6 oz
hexythiazox		x	x	x	x	x	E	x	x	x	3d	1
Sevin XLR Plus (4F)	1A	x	1-2 qt	1-2 qt	x	x	x	x	x	1.5-2 qt	12h	10 qt
carbaryl		x	G	F	x	x	x	x	x	G	7d	5
Sluggo	UN	x	x	x	x	20-44 lb	x	x	x	x	0d	UN
iron phosphate		x	x	x	x	G	x	x	x	x	0d	UN
Transform WG	4C	2.2 oz	x	x	x	x	x	x	x	1.5– 2.2 oz	24h	8.5 oz
sulfoxaflor		s	x	x	x	x	x	x	x	u	1d	4
Vendex 50WP **(RUP)**	12B	x	x	x	x	x	1.5-2 lb	x	x	x	2d	4 lb
fenbutatin-oxide		x	x	x	x	x	G	x	x	x	1d	2
Verdepryn 100SL (0.83SL)	28	x	x	8.2-11 fl oz	x	x	x	x	8.2-11 fl oz	x	4h	33 fl oz
cyclaniliprole		x	x	x	x	x	x	x	x	x	1d	3
Zeal (72WP)	10B	x	x	x	x	x	2-3 oz	x	x	x	12h	3 oz
etoxazole		x	x	x	x	x	E	x	x	x	1d	1

Strawberry Post-harvest and New Plantings – Disease

Apply every 10-14 days as needed.

Table 9-7. Post-harvest disease management[1]

Product and formulation Active ingredient	FRAC code[2]	anthracnose crown	leaf blight Phomopsis	leaf scorch (Diplocarpon)	leaf spot (Mycosphaerella)	powdery mildew	red stele (Phytophthora)	REI[3] PHI[4]	Max amt[5] Max app[6]
Aliette WDG	33	x	x	x	x	x	2 .5-5 lb	12h	NA
aluminum tris		x	x	x	x	x	E	1d	30 lb
Captan (80WDG)	M	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	1.8-3.75 lb	x	x	24h	NA
captan		E	G	G	G	x	x	0d	30 lb
Cuproxat FL	M	x	2.5-5 pt	2.5-5 pt	2.5-5 pt	x	x	48h	NA
tribasic copper sulfate		x	F	F	F	x	x	NA	NA
ProBlad Verde	M12	x	x	x	x	20.5-24.4 fl oz	x	4h	5
Banda de Lupinus alba doce		x	x	x	x	F	x	1d	NA
Nordox 75G	M	x	1.25-2.5 lb	1.25-2.5 lb	1.25-2.5 lb	x	x	12h	3
cuprous oxide		x	F	F	F	x	x	NA	15 lb
Orondis Gold	49+4	x	x	x	x	x	20-62 fl oz drench; 7-13.9 fl oz foliar	48h	124 fl oz
oxathiapipralin+ mefenoxam		x	x	x	x	x	E	28d	2
Phostrol	33	x	x	x	x	x	2.5-5 pt	4h	NA
phosphorous acid		x	x	x	x	x	G	NA	NA
Prophyte	33	x	x	x	x	x	2-4 pt	4h	varies
phosphorous acid		x	x	x	x	x	G	NA	4
Thiram (65WP), Thiram Granuflow	M	4.4 lb	x	x	x	4.4 lb	x	24h	12
thiram		F	x	x	x	G	x	1d	NA

Strawberry Post-harvest and New Plantings – Insects

Table 9-8. Post-harvest insect management[1]

Product and formulation Active ingredient	IRAC code[2]	leafhopper	leafroller	root weevils	slugs	REI[3] PHI[4]	Max amt[5] Max app[6]
Actara (25WDG)	4A	4 oz	x	4 oz	x	12h	12 oz
thiamethoxam		E	x	E	x	3d	NA
Agri-Mek SC (0.7SC) **(RUP)**	6	3.5 oz	x	x	x	12h	14 fl oz
abamectin		G	x	x	x	3d	NA
Assail 30SG	4A	4-6.9 oz	4-6.9 oz	x	x	12h	13.8 oz
acetamiprid		G	G	x	x	1d	2
Brigade WSB (10WP) **(RUP)**	3A	x	6.4-32 oz	8-32 oz	x	12h	80 oz
bifenthrin		x	G	G	x	0d	NA
Bt *(Bacillus thuringiensis)*	11A	x	see label	x	x	4h	NA
Bacillus thuringiensis		x	G	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	see label
fenpropathrin		G	E	G	x	3d	see label
Deadline MP's (4% bait)	UN	x	x	x	25 lb	12h	75 lb
metaldehyde		x	x	x	G	0d	3
Diazinon AG600 WBC **(RUP)**	1B	x	12.75 fl oz/100 g	x	x	36h	25.5 fl oz
diazinon		x	G	x	x	5d	1
Dibrom 8E **(RUP)**	1B	x	1 pt	x	x	48h	5 pt
naled		x	u	x	x	1d	5
Entrust SC (2SC)	5	x	4-6 fl oz	x	x	4h	18 fl oz
spinosad		x	G	x	x	1d	3
Grandevo	UN	x	1-3 lb	x	x	4h	NA
Chromobacterium subtsugae		x	G	x	x	0d	NA
Malathion 5EC	1B	1.5-3.2 pt	1.5-3.2 pt	1.5-3.2 pt	x	12h	8 pt
malathion		G	u	u	x	3d	4
Platinum (2SC)	4A	5-12 fl oz	x	5-12 fl oz	x	12h	12 fl oz
thiamethoxam		E	x	G	x	50d	NA
Radiant SC (1SC)	5	x	6-10 fl oz	x	x	4h	30 fl oz
spinetoram		x	E	x	x	1d	3
Sevin XLR Plus (4F)	1A	1-2 qt	1-2 qt	x	x	12h	10 qt
carbaryl		G	F	x	x	7d	5
Sluggo	UN	x	x	x	20-44 lb	0d	NA
iron phosphate		x	x	x	G	0d	NA

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.

Neopestalotiopsis: A new disease of strawberries in the US.

By Dan Egel, Extension Plant Pathologist, Purdue University

Over the last few years, a relatively new disease of strawberry (which at this point lacks an official name) has been causing problems in the southeast U.S. In 2020, this disease was discovered in Indiana strawberry production. It is not clear how many states in the Midwest are affected by this disease. Initial surveys of Indiana have not found many instances of this disease. Nevertheless, strawberry growers in the Midwest should familiarize themselves with the potential of this new disease. Images and additional information can be found at Pest Alert: Neopestalotiopsis – an emerging strawberry disease in North America. available online at: https://onfruit.ca/2021/03/11/pest-alert-neopestalotiopsis-an-emerging-strawberry-disease-in-north-america

Management of this disease is not well understood. However, bare root and plug plants should be inspected upon delivery for disease symptoms. Avoid planting diseased or weakened plants. Unusual symptoms observed in the field or on bare root or plug plants should be sent to a diagnostic clinic. Research is ongoing to understand which fungicides are appropriate and what varieties might have some resistance; however, standard fungicides applications to control other foliar diseases should be continued.

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

(Continued)

Disease Resistance of Strawberry Cultivars Commonly Grown in the Midwest[1] *(continued)*

Cultivar	Verticillium wilt	red stele	leaf disease[2]	powdery mildew
June Bearing				
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 IPhomopsis)	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 WSB	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.

[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 thrip	leafhopper	leafroller	root weevil	rootworm	slug	sap beetle	spider mite	spittlebug	tarnished plant bug	white grub	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 thrip	leafhopper	leafroller	root weevil	rootworm	slug	sap beetle	spider mite	spittlebug	tarnished plant bug	white grub	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	5 pt 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 NA
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
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
Nexter (75WP) pyridaben	21A	x	x	x	x	x	x	x	x	x	G	x	x	x	x	12h 1d	21.34 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 thrip	leafhopper	leafroller	root weevil	rootworm	slug	sap beetle	spider mite	spittlebug	tarnished plant bug	white grub	spotted-wing Drosophila	REI[3] PHI[4]	Max amt[5] Max app[6]
Oberon 2SC	23	x	x	x	x	x	x	x	x	x	G	x	x	x	x	12h	48 fl oz
spiromesifen																3d	3
Platinum (2SC)	4A	x	x	x	E	x	G	x	x	x	x	x	x	E	x	12h	12 fl oz
thiamethoxam																50d	NA
Portal XLO (0.4EC)	21	x	G	x	x	x	x	x	x	x	E	x	x	x	x	12h	4 pt
fenpyroximate																1d	2
Radiant SC (1SC)	5	x	x	G	x	E	x	x	x	x	x	x	x	x	E	4h	30 fl oz
spinetoram																1d	3
Rimon 0.83EC	15	x	x	u	x	x	x	x	x	E	x	x	E	x	x	12h	36 fl oz
novaluron																1d	NA
Savey 50DF	10A	x	x	x	x	x	x	x	x	x	E	x	x	x	x	12h	6 oz
hexythiazox																3d	1
Sevin XLR Plus (4F)	1A	G	x	x	G	F	x	x	x	x	x	x	G	x	x	12h	10 qt
carbaryl																7d	5
Sivanto Prime (1.67SC)	4D	x	x	x	x	x	x	x	x	x	x	x	x	x	x	4h	28 fl oz
flupyradifurone																0d	NA
Sluggo	UN	x	x	x	x	x	x	x	G	x	x	x	x	x	x	0d	UN
iron phosphate																0d	UN
Transform WG	4C	x	x	s	x	x	x	x	x	x	x	x	u	x	x	24h	8.5 oz
sulfoxaflor																1d	4
Vendex 50WP **(RUP)**	12B	x	x	x	x	x	x	x	x	x	G	x	x	x	x	2d	4 lb
fenbutatin-oxide (hexakis)																1d	1d
Zeal (72WP)	10B	x	x	x	x	x	x	x	x	x	E	x	x	x	x	12h	3 oz
etoxazole																1d	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.

[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, also 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 need to be 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 pre-harvest 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.

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[2]	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, and Stephen Meyer

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, 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. Use caution when tank mixing herbicides that are not specifically 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 cultivation 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 281-284 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 pages 281-284.

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 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 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 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 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 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 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 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 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.

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Herbicide Recommendations for Apple and Pear *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual grasses and broadleaves	Princep 4L (simazine 4 lb a.i./ gal) at 2-4 qt in minimum of 40 gal 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 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.
annual grasses and broadleaves	Sinbar WDG (terbacil 80% a.i.) at 0.5-4 lb in minimum of 20 gal 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 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.
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 water	Apply as a broadcast or banded soil application directed to the base of the trunks. 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. Do not apply after petal fall except with a hooded shielded sprayer. 14-day PHI. Do not tank mix with Chateau or with other products containing sulftentrazone. **Age Restriction:** Apply to crops that have been growing for at least 2 years and are in good condition.
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 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.

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Herbicide Recommendations for Apple and Pear *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Post-emergence		
annual broadleaves and suppression of grasses	Chateau WDG (flumioxazin 51% a.i.) at 6-12 oz in 15-75 gal 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 water	See Pre-emergence section (page 253) for details.
annual broadleaves	GoalTender (oxyfluorfen 4 lb a.i./gal) at 2.5-4 pt in minimum 40 gal water	See Pre-emergence section (page 253) 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 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 water	See Pre-emergence section (page 253) 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 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 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 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.

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Herbicide Recommendations for Apple and Pear *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Post-emergence		
broadleaves and nutsedge	Sandea (halosulfuron- methyl 75% a.i.) 0.5-1 oz in minimum of 15 gal 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.
annual and perennial broadleaves	Treevix (saflufenacil 0.7 lb a.i.) at 1 oz in 20-40 gal 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 3.0-4.0 fl oz plus other labeled herbicides in minimum of 20 gal 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 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 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 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 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 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 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.
annual and perennial grasses and certain broadleaves	Kerb SC (pronamide 35.6% a.i.) at 2.5-9.5 pt in 40-50 gal 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 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 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.

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Herbicide Recommendations for Peach, Nectarine, Plum, and Cherry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual grasses and broadleaves	Sinbar WDG (terbacil 80% a.i.) at 0.5-4 lb in minimum of 20 gal 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 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 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 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 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.
most annual and perennial grasses	Fusilade DX (Fluazifop-P-butyl 2 lb a.i./gal) at 16-24 fl oz in 20-40 gal 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 water	See Pre-emergence section (page 257) for details.
annual broadleaves	GoalTender (oxyfluorfen 4 lb a.i./gal) at 2.5-4 pt in minimum of 40 gal water	See Pre-emergence section (page 257) for details.

(Continued)

Herbicide Recommendations for Peach, Nectarine, Plum, and Cherry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Post-emergence		
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 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 water	See Pre-emergence section (page 257) 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 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 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 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 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	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.

(Continued)

Herbicide Recommendations for Peach, Nectarine, Plum, and Cherry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Post-emergence		
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 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 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 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 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 water **Long-term weed control:** 4.8 qt in minimum of 20 gal 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 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, and best control is on weeds 1"-6" in height. Can be used during site preparations and up to within 1 year of harvest. Do not allow contact with green stems, foliage, or fruits. Apply when wind speeds are 3-10 mph. Do not use for food or feed for 1 year after application. 1-year PHI.
annual grasses and broadleaves	Showcase 1.25G (granular) (trifluralin + 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.

(Continued)

Herbicide Recommendations for Non-bearing Fruit Trees Only *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre- and Post-emergence		
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 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 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 20 gal 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 feet 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 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.

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Herbicide Recommendations for Grape *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual grasses and broadleaves	Karmex DF (diuron 80% a.i.) at 2-6 lb in 25-40 gal 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 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 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 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.
annual grasses and certain broadleaves	Prowl H2O (pendimethalin 3.8 lb a.i./ gal) at 3.2-6.3 qt in minimum of 20 gal 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 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 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.

(Continued)

Herbicide Recommendations for Grape *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual and perennial broadleaves	Trellis (isoxaben 75% a.i.) at 0.67-1.33 lb in minimum of 10 gal 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 water	Apply as a broadcast or banded soil application directed to the base of the 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 water	Apply as a broadcast or banded soil application directed to the base of the 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 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.
most annual and perennial grasses	Fusilade DX 2EC (fluazifop-p 2 lb a.i./gal) at 16-24 fl oz in 25 gal 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 water	See Pre-emergence section (page 261) for details.
annual broadleaves	GoalTender (oxyfluorfen 4 lb a.i./gal) at 2.5-4 pt in minimum of 40 gal water	See Pre-emergence section (page 261) for details.

(Continued)

Herbicide Recommendations for Grape *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Post-emergence		
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 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 water	See Pre-emergence section (page 262) 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 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 harvestewithin 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 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 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, pages 281-284)	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 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 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 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 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 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 nutsedge 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.

(Continued)

Herbicide Recommendations for Blueberry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual grasses and broadleaves	Sinbar WDG (terbacil 80% a.i.) at 2-3 lb in minimum of 25 gal 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.
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 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 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 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 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 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 a.i/.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 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.

(Continued)

Herbicide Recommendations for Blueberry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Post-emergence		
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 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.
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 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 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 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 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 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 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 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.
annual grasses and broadleaves	Princep 4L (simazine 4 lb a.i./ gal) at 2-4 qt in minimum of 40 gal 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 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 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 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.

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Herbicide Recommendations for Brambles *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
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 water	Apply as a broadcast or banded soil application directed to the base of the trunks of bushes. 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 water	Apply as a broadcast or banded soil application directed to the base of the trunk of bushes. 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 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 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 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 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 80% a.i.) at 3 lb in 25-40 gal water	Selected states only. See Pre-emergence on page 268 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 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 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.

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Herbicide Recommendations for Brambles *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Post-emergence		
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 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 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.

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Herbicide Recommendations for Strawberry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Pre-emergence		
annual broadleaves, especially winter annuals	Goal 2XL (oxyfluorfen 2 lb a.i./gal) at 1-2 pt in minimum of 40 gal 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 H2O 3.8E (pendimethalin 3.8 lb a.i./ gal) at 1-2 pt in minimum of 20 gal 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 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 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 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 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 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 water	See Pre-emergence section for details.

(Continued)

Herbicide Recommendations for Strawberry *(continued)*

Weed Problem	Material and Rate per Acre	Notes and Comments
Post-emergence		
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 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. **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 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.
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 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 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 (aciflurorfen 2 lb a.i./gal) at 1.5 pt in minimum of 20 gal 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.

Relative Effectiveness of Herbicides for Fruit Crops[1]

Compiled and edited by Shawn Wright, Elizabeth Wahle and Stephen Meyers

	Grasses						Annual Broadleaves																		Perennial Weeds				
Herbicide	barnyardgrass	crabgrass	foxtails	goosegrass	panicum, fall		chickweed	cocklebur	groundsel, common	henbit	lambsquarters	marestail	morningglory, annual	mustards	nightshades	palmer amaranth	pigweed	purslane	ragweed	shepherdspurse	smartweeds	velvetleaf	waterhemp		dandelion	johnsongrass	nutsedge, yellow	thistle, Canada	woodsorrel, yellow
Pre-emergence																													
Alion	G	G	G	G	G		G	N	G	F	F	G	F	G	N	N	G	G	F	G	G	G	N		G	N	N	N	F
Callisto	N	N	N	N	N		G	G	N	N	G	F	F	N	G	F	G	N	G	N	G	G	G		N	N	F	N	N
Casoron	N	G	G	G	G		G	F	G	G	G	F	N	G	N	N	G	G	G	G	G	G	N		G	N	N	G	G
Chateau	N	N	N	N	N		F	F	N	N	G	G	F	N	G	F	G	G	F	G	F	F	F		N	N	N	N	N
Dacthal	G	G	G	G	G		F	N	N	N	F	N	N	N	N	N	F	F	N	N	N	N	N		N	N	N	N	N
Devrinol	G	G	G	G	G		G	F	N	N	F	N	N	N	N	N	G	G	N	N	N	N	N		N	N	N	N	N
Gallery, Trellis	N	N	N	N	N		G	F	G	G	G	F	N	G	G	N	G	G	G	N	N	G	N		N	N	N	N	G
Goal	N	N	F	F	N		N	F	G	F	G	F	F	G	G	N	G	F	N	F	F	F	F		N	N	N	N	F
Karmex	G	G	F	G	F		G	F	G	G	G	F	F	G	G	N	G	G	G	G	N	P	N		N	N	N	N	N
Kerb	G	N	F	G	G		G	N	N	G	G	N	G	G	G	N	N	G	F	G	F	N	N		N	N	N	N	N
Matrix	G	G	G	N	G		N	F	G	G	F	G	N	G	F	N	F	G	F	F	F	F	N		G	N[2]	F	F	N
Mission	N	N	G	N	N		G	N	G	G	G	F	N	F	N	N	G	G	G	G	N	N	N		G	N	G	N	N
Princep	G	G	G	G	G		G	N	G	G	G	N	G	G	G	N	G	G	G	G	N	F	N		N	N	F	N	N
Prowl	G	G	G	G	G		G	N	N	N	G	N	N	N	N	G	F	F	N	G	F	F	G		N	N[2]	N	N	N
Sandea	N	N	N	N	N		N	F	G	N	G	F	N	G	N	N	G	F	G	G	G	G	N		N	N	G	N	N
Showcase	G	G	G	G	G		G	F	G	G	G	F	F	G	G	F	G	G	G	G	G	G	G		G	F	N		G
Sinbar	G	G	G	N	G		G	N	F	G	G	N	N	G	G	N	G	G	G	G	G	N	N		G	F	F	N	N
Snapshot	G	G	F	G	G		G	F	G	G	G	F	F	G	F	N	G	N	N	G	F	G	N		G	F	N	N	G
Solicam	G	G	G	G	G		G	G	F	F	G	F	N	G	F	F	G	F	G	G	N	G	F		N	F	F	N	N
Surflan	G	G	G	G	G		G	N	F	G	G	N	N	N	F	N	G	G	F	G	F	F	N		N	N[2]	N	N	N
Treflan	G	G	G	G	G		N	N	N	G	F	N	N	F	N	F	G	G	N	N	N	N	N		N	F	N	N	F
Velpar	G	N	F	N	G		G	N	G	N	G	F	N	N	N	N	N	N	G	N	G	F	N		F[2]	N	N	N	N
Zeus Prime|XC	G	G	G	G	G		G	N	G	G	G	N	G	G	G	F	G	G	N	G	G	N	G		N	N	G	G	N
Zeus XC, Spartan	N	G	N	G	N		G	N	G	N	G	N	G	G	G	F	G	G	N	G	F	F	F		G	F	G	G	F
Post-emergence																													
2,4-D	N	N	N	N	N		F	F	G	N	F	G	G	G	G	F	F	N	G	G	F	F	F		G	N	N	F	N
Aim	N	N	N	N	N		N	F	G	F	G	N	G	G	G	F	G	G	F	F	F	G	F		N	N	N	F	N
Broadloom	N	N	N	N	N		N	F	F[2]	N	F	N	F	F	N	N	N	F	F[2]	F	G	F	N		N	N	N	N	N
Chateau	N	N	N	N	N		G	N	N	N	G	G	F	N	F	F	F	G	F	G	F	G	F		N	N	N	N	N
Fusilade	G	G	G	G	G		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N		N	F[2]	N	N	N
Goal	N	F	F	F	N		N	F	G	G	G	F	F	G	G	N	G	F	N	F	F	F	F		N	N	N	N	F
Gramoxone	G	G	G	G	G		G	G	G	G	G	G	G	G	G	G	G	G	G	N	G	G	G		N	N	N	N	N
Mission	N	G	G	N	N		G	N	G	G	G	G	N	G	N	N	G	G	G	G	N	N	N		F	N	G	G	N
Poast	G	G	G	G	G		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N		N	F	N	N	N
Reglone	G	G	G	G	G		G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		N	N	N	N	N
Rely,	G	N	G	G	G		G	G	N	N	G	G	G	G	G	F	G	G	G	G	G	F	F		G	F[2]	F	G	N
Roundup	G	G	G	G	G		G	G	G	G	G	F	G	G	G	F	G	G	G	G	G	G	F		G	F	F	G	G
Scythe	F[2]	F[2]	F[2]	F[2]	F[2]		G	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]	F[2]		N[2]	N	N	N	N[2]
Select	G	G	G	G	G		N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N		N	N	N	N	N
Spur, Stinger	N	N	N	N	N		N	F	G	N	N	G	N	N	G	N	N	N	G	N	F	N	N		G	N	N	G	N
Treevix	N	N	N	N	N		N	G	F	N	G	G	G	G	G	N	G	G	G	G	G	G	G		N	N	N	N	N
Ultra Blazer	N	N	G	N	G		N	F	N	N	G	N	G	G	G	G	G	G	G	N	G	G	G		N	F[2]	N	N	N
Velpar	G	N	F	N	G		G	N	G	N	G	F	N	N	N	N	N	N	G	N	G	F	N		F[2]	N	N	N	N
Venue	N	N	N	N	N		G	G	N	G	G	F	G	N	G	F	G	G	G	G	G	G	F		G	N	N	N	N

[1]G = good. F = fair. N = not listed, based on product labels. [2]Provides partial control.

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
2, 4-D 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 Pre-plant|N-B|Dormant	Fallow Pre-plant|N-B|Dormant	Fallow Pre-plant|N-B|Dormant	Fallow Pre-plant|N-B|Dormant	Fallow Pre-plant|N-B|Dormant	Fallow Pre-plant|N-B|Dormant
Goal 2XL	oxyfluorfen 22.3%	14	medium	24	Fallow Pre-plant|N-B|Dormant	Fallow Pre-plant|N-B|Dormant	Fallow Pre-plant|N-B|Dormant	Fallow Pre-plant|N-B|Dormant	Fallow Pre-plant|N-B|Dormant	Fallow Pre-plant|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/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
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/A[7]	--	N/A[7]	N/A[7] 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	clethodim	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
Sinbar WDG	terbacil	5	medium	12	60	--	60	--	--	--

(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
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 +sulfentra-zone	14	medium	12	14	--	--	--	--	--

-- = not labeled
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

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	--	--	--	--
Devrinol DF-XT	napropamide	15	low	24	N/A[5]	N/A	N/A	70	N/A
Fusilade DX	fluazifop	1	high	12	14	1	1	50	NB/10 mo

(Continued)

Small Fruit Herbicide REI, PHI and Special Notes *(continued)*

Trade Name	Common Name	WSSA	Risk of Resistance	REI	Strawberry	Raspberry	Blackberry	Grape	Blueberry
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/A[6]	N/A[6]	N/A[8]	N/A[6]
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
Scythe	pelargonic acid	26	low	12	N/A	N/A	N/A	N/A	N/A
Select Max	clethodim	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/A[1]	--	--	--	--
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	--

(Continued)

Small Fruit Herbicide REI, PHI and Special Notes *(continued)*

Trade Name	Common Name	WSSA	Risk of Resistance	REI	Strawberry	Raspberry	Blackberry	Grape	Blueberry
Zeus Prime XC	carfentra-zone- ethyl+ sulfentrazone	14	medium	12	--	3	3	3	3
Zeus XC	sulfentrazone	14	medium	12	--	3	3	3	3

-- = not labeled

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

Updated by Janna Beckerman

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.)
ProBlad Verde SymAgro	Banda Lupinus Albus Doce	Fracture (FMC)
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 Phosphorous)
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, Elizabeth Wahle, Shawn Wright 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) Base Camp 4 (Wilber-Ellis) 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) Willowood Mesotrione 4SC (Generic Vrop Science)
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) Tuscany 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) ScrollOVR (Atticus Ag)

(Continued)

Generic Herbicides *(continued)*

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
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) Quik-Quat (Drexel) Willowood Paraquat 3 SL (Generic Crop Sci)
Karmex DF (ADAMA)	diuron	Direx 4L (ADAMA) Diuron 4L/80 DF (Alligare) Diuron 4L/80 (Drexel) Diuron 4L (ADAMA) Diuron 4L (WinField) Diuron 4L and 80 WDG (Loveland)
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)

(Continued)

Generic Herbicides *(continued)*

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Rely 280 (Bayer CropScience)	glufosinate-ammonium	Cheetah (Nufarm) Fever (Innvictis Crop Care) 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
Inside Technology (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) Dakota (Rotam) Envoy Plus (Valent) Intensity and Intensity One (Loveland) Omni Clethodim 2 EC (Helena) Section 2 EC/Three(Winfield) Shadow (Arysta) Vaquero (Wilbur Ellis) Trizenta 3EC (UPL NA) Volunteer (Tenkoz)
Stinger (Corteva AgriSciences)	clopyralid	Bite (Sharda) Clean Slate(Nufarm) Savant (Innvictis) Spur (Albaugh) Stigmata (Atticus)
Surflan AS/AS Specialty/Flex (UPL NA)	oryzalin	Fugitive (ADAMA) Oryzalin 4 AS (ADAMA)
Treflan HFP/TR 10 G (Gowan)	trifluralin	Cornbelt Trifluralin EC (Van Diest) Trifluralin 4 EC (several producers/suppliers) Treflan 4 EC (Helena) Treflan 4L (Loveland) Trifluralin HF (Helena) Trifluralin 10G (Loveland) Triflurex HFP (ADAMA) Trust (Winfield)

(Continued)

Generic Herbicides *(continued)*

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Ultra Blazer (United Phosphorus)	acifluorfen	Acifin 2 L (Summit) Acifluorfen 2 (Red Eagle) Acifluorfen 20.1% (Sharda) Avalanche Ultra (WinField) Derecho (Atticus) Levity (Innvictis) 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

Fruit Grower Newsletters

Arkansas

University of Arkansas Division of Agriculture Cooperative Extension Service offers *Arkansas Fruit and Nut News*. 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. To subscribe, go to: https://www.uaex.uada.edu/farm-ranch/crops-commercial-horticulture/horticulture/ar-fruit-veg-nut-update-blog

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 monthly newsletter, *Kentucky Fruit Facts* (https://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.

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 Pesticide 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 page 288).

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 (aphid, mites, thrips, caterpillars, grubs, spiders) in a small, leak-proof bottle or vial that is 1 ounce or less filled 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 page 288).

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
https://www.uaex.edu/yard-garden/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
John Bonkowski, jbonkows@purdue.edu

Iowa

Iowa State University Plant and Insect Diagnostic Clinic
2445 ATRB
2213 Pammel Dr
Ames, IA 50011
515-294-0581
Fax: 515-294-9420
clinic.ipm.iastate.edu
pidc@iastate.edu
www.facebook.com/ISUPIDC

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

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

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 https://nifacontacts.ipmcenters.org/PSEPDirectory.cfm.

University of Arkansas
https://www.uaex.uada.edu/farm-ranch/pest-management/pesticide-licensing/private-applicator-training.aspx

University of Illinois
https://extension.illinois.edu/psep

Iowa State University
www.extension.iastate.edu/psep

University of Kentucky
http://entomology.ca.uky.edu/uk-pesticide-safety-education-program-psep

Ohio State University
pested.osu.edu

Purdue University
ppp.purdue.edu

University of Wisconsin
https://fyi.extension.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.

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:
(888) 233-7745 or (317) 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

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

National Pesticide Information Retrieval System (NPIRS): 765-494-6616

National Pesticide Information Center: 800-858-7378

CHEMTREC: (800) 424-9300

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.

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

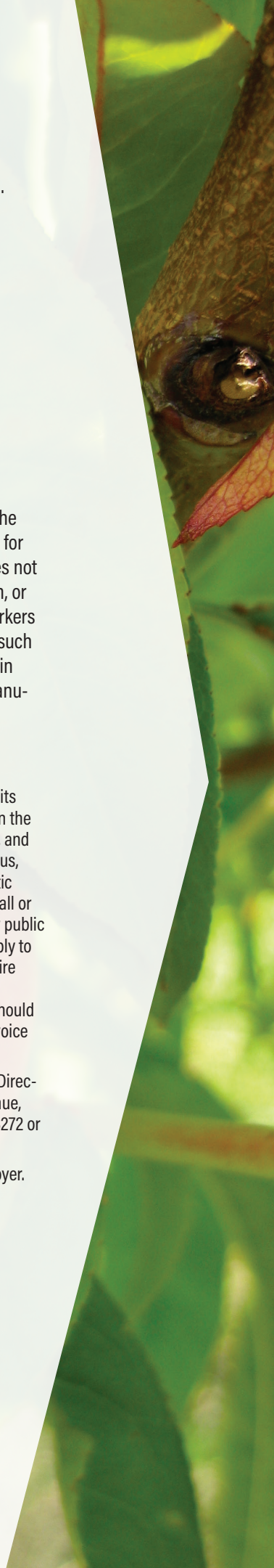
Metric Abbreviations: mm=millimeter; cm=centimeter; m=meter; km=kilometer; ha=hectare; mg=milligram; g=gram; kg=kilogram; ml=milliliter; l=liter.

NOTES

Midwest Fruit Pest Management Guide 2023-2024

The Midwest Fruit Pest Management Guide 2023-2024 was developed by the Midwest Fruit Workers Group.

Printed copies of this publication are available from the Purdue Extension Education Store, https://edustore.purdue.edu. A free PDF download also is available from the Education Store.



Citation

Beckerman, J., Bessin, R., Welty, C., Athey, K., Wahle, E., Lewis, D., Long, E., Joshi, N., Guedot, C., Meyer, S., Strang, J., Gaulthier, N. 2022. Midwest Fruit Pest Management Guide 2023-2024. Available online at: https://ag.purdue.edu/department/hla/extension/_docs/id-465.pdf

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