

# Midwest Fruit Pest Management Guide

2026-2027

## STRAWBERRY

### Arkansas

University of Arkansas Cooperative Extension Service  
AG1304

### Illinois

University of Illinois Extension  
ICSG-18

### Indiana

Purdue Extension  
ID-465

### Iowa

Iowa State University Extension and Outreach  
HORT 3035

### Kansas

Kansas State Research and Extension  
MF3278

### Kentucky

University of Kentucky Cooperative Extension Service  
ID-232

### Ohio

Ohio State University Extension  
Bulletin 506

### Wisconsin

University of Wisconsin-Extension  
A4104





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## Foreword

Commercial fruit production has become a highly skilled, technical profession. Concerns about pesticide

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residues, operator risks, and the environment dictate that all fruit growers exercise extreme caution in the use of all pesticides, and indeed, all chemicals. Growers who use these 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 growers with up-to-date information about pesticides and their applicability to problems. We suggest that growers use this information to set up individualized spray programs. Always 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 read and follow all label instructions, as well as any websites directed by the label.
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 all personal protective equipment as required by the label. If a respirator is required, a medical exam and fit test is needed for some types of respirators.
7. Have a "buddy" around when using acutely toxic organophosphates, just in case.
8. If working with cholinesterase inhibitor insecticides, 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 pesticides in their 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.
16. Never allow someone under the age of 18 to handle or use pesticides.
17. Train workers according to worker protection standards (WPS). This is required for all workers who will enter areas treated with a pesticide within 30 days after the last application.
18. Suspend applications while people are within the Application Exclusion Zone (AEZ). Application may be resumed when they exit the AEZ.

## ***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. Check labels for posting and notification requirements to protect workers. Re-entry times and the required protective clothing for early entry are listed on product.
9. Inform all workers of re-entry restrictions and information on safe pesticide use and/or training to meet WPS requirements.
10. Comply with the Right-To-Know law. Have complete product labels readily available for workers to see. Have the Safety Data Sheet (SDS) 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). Training content must comply with WPS requirements.
12. Provide necessary PPE for your workers and regularly inspect and maintain PPE 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” are mandatory statements, 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 prohibited. 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 (PPE).

**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, 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, most states consider 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 to 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. 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 may be the foliage, flowers, fruit, woody surfaces, or entire plants. The equipment and methods used for such a diverse spray program must be versatile, and the equipment must be properly calibrated for each type of application.

## ***Dilute Spraying***

The objective of spraying is to distribute the spray material uniformly over plants or plant parts. Pesticide recommendations are based on the amount of dilute spray needed to wet plants thoroughly, to the point just “prior to runoff.” For example, 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.

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

The table on page 6 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 <sup>1</sup> )	Minimum Dilute Spray (Gallons/Acre <sup>2</sup> )
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

<sup>1</sup>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.

<sup>2</sup>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.

Growers 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 6x.

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 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 wind drift.

When making low-volume pesticide applications:

1. Use extreme care in calibrating the sprayer and maintaining a constant sprayer speed. As gallonage decreases, errors become much more critical.
2. Choose calm winds with 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 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, growers 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, growers 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.

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

#### Step 2. Calculate cu ft of TRV/acre.

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

#### Step 3. Select density factor.

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

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

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

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

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

#### Step 4. Calculate TRV gallonage/acre.

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

= gallons of dilute solution to be applied per acre

= TRV gal/acre

#### Example 1

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

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

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

**Step 3** Density has been chosen as 0.90.

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

#### Example 2

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

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

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

**Step 3** Density has been chosen as 0.90.

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

## Spraying Small Volumes

In some cases growers 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, when preparing sprayers 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 typically sprayed, 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
<b>Wettable Powder, Dry Flowable, etc.</b>	5 lb.	15 tbsp.	9 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.
<b>Emulsifiable Concentrate, Liquid</b>	5 gal.	1 qt.	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 tractor/sprayer speed.

Attach the sprayer to the tractor and make test runs to determine the tractor speeds (mph) in different gears. Run the tractor at the PTO speed used 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 (sod, not pavement or gravel)

Formula

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

#### Your tractor sprayer speed

$$\text{MPH} = \frac{\text{feet traveled}}{\text{seconds}} \times \frac{60}{88} = \underline{\hspace{2cm}}$$

**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 (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

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

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

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

Your figures

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

#### 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 your target, 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. Consistent spray patterns require that outputs from individual nozzles within 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. Applicators 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 applicators 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

To determine travel speed needed 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 is usually satisfactory, depending on the size and density of the canopy, and capacity of the sprayer.

Before sprayer calibration, applicators must determine the travel speed in miles per hour (mph). To determine 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 travel 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:

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

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

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

#### Determining Nozzle Flow Rate

To select the correct nozzle and whirlplate sizes, first 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. These variables will be used, to calculate the gpm. Note: This equation is for one side of the sprayer manifold only; double the calculated answer if using both sides of the sprayer. Use the same size nozzles and whirlplates on both sides of the sprayer.

##### Step 1. Calculate the total gpm required per side:

$$\text{GPM (per side)} = \frac{\text{GPA} \times \text{MPH} \times \text{W}}{1,000}$$

GPM = gallons per minute (per side)

GPA = gallons per acre

MPH = speed (in miles per hour)

W = spacing between rows (in feet)

**Example:** To apply 70 gpm while traveling 2 mph, with row spacing of 10 feet apart the gpm per side is:

$$\text{GPM} = \frac{70 \times 2 \times 10}{1,000} = \frac{1,400}{1,000} = 1.4 \text{ GPM}$$

**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:

$$100 \text{ gal (start)} - 75 \text{ gal (stop)} = 25 \text{ gal per 5 min.} = 5 \text{ gpm}$$

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

When actual output differs from the calculated output, adjust 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:

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

**Example:** A field test is run in which 10 rows, each 200 feet long, with row spacing of 10 feet and it took 35 gallons to refill the sprayer to the original level, the gpa is:

$$\frac{35 \text{ gal} \times 43,560 \text{ ft}^2}{2,000 \text{ ft} \times 10 \text{ ft}} = 76 \text{ GPA}$$

## 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. Most adjuvants (see definition in the next section) are multipurpose adjuvants, serving as spreaders, activators, etc. Read the labels of both the pesticide and adjuvant before use. 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 efficacy by increasing the penetration of a spray solution through leaf hairs or 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 spray droplets, allowing them to spread out more evenly on the surface of leaves 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 adjuvants are mixed 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 once. 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 within the formulation. 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 a mixture in the order the label specifies is critical; whether some pesticides are physically compatible or not depends on the order in which they are added 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. Labels provides mixing instructions for all registered tank mixes. Unless the label states otherwise, never 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 (water) and begin agitation. If a compatibility, buffering or defoaming agent is needed, these products should be added before the other products. If using a drift reduction additive, always consult the label; some are added in the mixing sequence.

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) when using liquid fertilizers as the carrier. Finally, continue adding the carrier to the desired level.

To assure 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.

## Summary

Pesticide recommendations are confusing because there are so many options for materials to use for certain diseases or insect pests. Additional references may be needed.

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

Certain fungicides and insecticides may be phytotoxic (cause foliar damage) to certain crops and/or cultivars. For example, many grape cultivars are sensitive to sulfur and/or copper. The **Relative Disease Susceptibility and Chemical Sensitivity among Grape Cultivars** table on page 163 lists cultivar sensitivity to these materials. Additionally, some grape cultivars are sensitive to certain strobilurin fungicides, and some strawberry cultivars are sensitive to Sinbar herbicide. Several apple cultivars 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 cultivar, disease or insect pressure, and other factors. Grower preference, experience with materials, and price often influence decisions as well. Pest management in fruit crops is relatively easy as long as growers 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.**

# 9. STRAWBERRY

## Strawberry Spray Schedule

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

Stage			
Pre-bloom	Bloom	Post-bloom Thru Harvest	Post-bloom And New Plantings
Tarnished Plant Bug		Tarnished Plant Bug	
Spittlebug		Spittlebug	
Spider Mite		Spider Mite	
		Slugs	
		Sap Beetles	
		Spotted wing Drosophila	
Eastern Flower Thrips		Eastern Flower Thrips	
Cyclamen Mite			
Bud Clipper			
		Leafroller	
		Leafhopper	
			Root Weevils

### 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

<sup>1</sup> 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.

<sup>2</sup> F/IRAC code represents the mode of action of the fungicide/insecticide.

<sup>3</sup> PHI refers to the pre-harvest interval, which is the number of days before harvest that the product may not be applied.

<sup>4</sup> 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.

<sup>5</sup> Max amt refers to the product's maximum amount/acre/year.

<sup>6</sup> Max app refers to the product's maximum number of applications per year.

RUP refers to restricted use pesticide.

## Strawberry Pre-plant - Diseases

### New Plantings

- For *Phytophthora* spp. prevention, an application of Orondis Gold or Ridomil Gold can be made at planting. A second application of Orondis Gold can be made at least 7-days after the first application.

### Fungicide Dips

- Recent research on the role of fungicide dips in disease management have shown inconsistent results. The information is included but not necessarily recom-

mended. 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 immediately. 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. Strawberry Diseases - Preplant<sup>1</sup>**

Product And Formulation	Active Ingredient	FRAC Code <sup>2</sup>	Anthraco- nose Crown Rot	Phytophthora (Crown Rot, Red Stele, Leather Rot)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
Abound (SC)		11	5-8 fl. oz.	5-8 fl. oz.	4h	61.5 fl. oz.
	azoxystrobin		G[r]	E	0d	NA
Aliette WDG		P07 (33)	x	2.5 lb./100 gal.	24h	30 lb.
	aluminum tris		x	E	12d	NA
Phostrol		33	x	2.5-5 pt./100 gal.	4h	NA
	phosphorous acid		x	E	NA	NA
Prophyte		P07 (33)	x	2 pt./100 gal.	4h	varies
	phosphorous acid		x	x	NA	4
Orandis Gold		49+4	x	20-62 fl. oz.	48h	124 fl. oz.
	Oxathiapiprolin+mefenoxam		x	E	14d	2
Ridomil Gold		4	x	1 pt.	48h	3 pt.
	mefenoxam		x	E	0d	3
Switch 62.5WG		9+12	5-8 oz./100 gal.	x	12h	56 oz.
	cyprodinil + fludioxonil		G	x	0d	NA

Footnotes: See how to read the spray schedule tables section at the beginning of the chapter.

## Strawberry Prebloom - Diseases

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

### Disease management notes

- Thiram SC is recommended when the risk of Neopestalotiopsis disease is moderate to high. After two applications alternate with Switch (FRAC 12+9).
- 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. Follow label instructions carefully as Ridomil can cause stunting in young plants of some varieties. 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 Diseases - Prebloom<sup>1</sup>**

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Angular Leaf Spot	Anthraxnose Crown	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	Red Stele (Phytophthora)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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	0d	NA
Actigard 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.	24h	30 lb.
aluminum tris		x	x	x	x	x	x	E	12d	NA
Badge SC	M	1-2.5 pt.	x	1 – 2.5 pt.	2-2.5 pt.	x	1-2.5 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
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
Cuproxtat FL	M	2.5-5 pt.	x	2.5-5 pt.	2.5-5 pt.	2.5-5 pt.	x	x	48h	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
Evito 480SC	11	x	x	x	x	x	2.0-5.7 fl. oz.	x	12h	22.8 fl. oz.
fluoxastrobin		x	x	x	x	x	E	x	1d	4
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
Inspire	3	x	7 fl. oz.	x	x	x	7 fl. oz.	x	12h	28 fl. oz.
difenoconazole		x	u	x	x	x	u	x	0d	4
Inspire Super	3+9	x	16-20 fl. oz.	x	x	x	16-20 fl. oz.	x	12h	80 fl. oz.
difenoconazole+cyprodinil		x	u	x	x	x	F	x	0d	3 or 4
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

(Continued)

**Table 9-2. Strawberry Diseases - Prebloom<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Angular Leaf Spot	Anthraxnose Crown	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	Red Stele (Phytophthora)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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 Flex	7+3	x	12.0-13.6 fl. oz.	x	x	x	12.0-13.6 fl. oz.	x	12h	13.7 fl. oz.
fluopyram+difenoconazole		x	u	x	x	x	F-G	x	0d	2
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	12h	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 + fluxapyroxad		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	12h	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.	48h	124 fl. oz.
oxathiapiprolin + mefenoxam		x	x	x	x	x	x	E	28d	2
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
Prophyt	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

(Continued)

**Table 9-2. Strawberry Diseases - Prebloom<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Angular Leaf Spot	Anthraxnose Crown	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	Red Stele (Phytophthora)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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 SC	M	x	x	x	x	2.0-2.5 qt.	x	x	24h	29.7 qt.
thiram		x	x	x	x	i	x	x	1d	12
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

Footnotes: See how to read the spray schedule tables section at the beginning of the chapter.

## Strawberry Prebloom - 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. Strawberry Insect - Prebloom<sup>1</sup>**

Product And Formulation Active Ingredient	IRAC Code <sup>2</sup>	Clipper	Cyclamen Mite	Eastern Flower Thrips	Spider Mite	Spittlebug	Tarnished Plant Bug	Thrips	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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 fl. oz.	x	3.5 fl. oz.	x	x	x	12h	14 fl. oz.
abamectin		x	s	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
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 eVo	3A	2.56-12.8 oz.	x	x	6.4-12.8 oz.	2.56-12.8 oz.	2.56-12.8 oz.	x	12h	32 oz.
bifenthrin		E	x	x	F	E	E	x	0d	3
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 gal.	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

(Continued)

**Table 9-3. Strawberry Insect - Prebloom<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	IRAC Code <sup>2</sup>	Clipper	Cyclamen Mite	Eastern Flower Thrips	Spider Mite	Spittlebug	Tarnished Plant Bug	Thrips	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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 WDG	UN	x	2-3 lb.	2-3 lb.	2-3 lb.	x	2-3 lb.	x	4h	NA
<i>Chromobacterium subtsugae</i>		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	16 fl. oz.	x	x	x	12h	16 fl. oz.
spiromesifen		x	x	x	G	x	x	x	3d	1
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
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	1-2 qt.	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

Footnotes: See how to read the spray schedule tables section at the beginning of the chapter.

## Strawberry Prebloom - 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 all have the same FRAC code (FRAC 11) and cannot be alternated with each other as a fungicide resistance management strategy.
- Anthraco**se can be severe on both green and ripe (red) strawberry fruit. The disease is favored by moderate to warm temperatures accompanied by rainfall before and during harvest. A preventative spray program (7-10 days) with Captan beginning at 10% bloom is recommended. During periods of high disease pressure the addition of FRAC 11 or FRAC 3+11 (i.e., Quadris Top or Quilt Xcel) fungicides.
- 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.
- Fungicide resistance to the FRAC 7 and 11 fungicides has been reported in *Botrytis* in many strawberry producing states but has only confirmed in Ohio (FRAC 11 only) the Midwest. Resistance to FRAC 1 has been a longstanding issue.

Table 9-4. Strawberry Diseases - Bloom<sup>1</sup>

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Anthraco nose Crown	Anthraco nose Fruit Rot	Gray Mold ( <i>Botrytis</i> )	Leaf Blight Phomopsis	Leaf Scorch ( <i>Diplocarpon</i> )	Leaf Spot ( <i>Mycosphaerella</i> )	Powdery Mildew	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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
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
Evito 480SC	11	x	2.0-5.7 fl. oz.	x	x	x	x	2.0-5.7 fl. oz.	12h	22.8 fl. oz.
fluoxastrobin		x	E	s	x	x	x	E	0d	4
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
Inspire	3	7 fl. oz.	7 fl. oz.	x	x	x	x	7 fl. oz.	12h	28 fl. oz.
difenoconazole		u	G	x	x	x	x	u	0d	4

(Continued)

**Table 9-4. Strawberry Diseases - Bloom<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Anthraco- nose Crown	Anthraco- nose Fruit Rot	Gray Mold (Botrytis)	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
Inspire Super	3+9	16-20 fl. oz.	16-20 fl. oz.	16-20 fl. oz.	x	x	x	16-20 fl. oz.	12h	13.7 fl. oz.
difenoconazole+cyrodinil		u	G	F	x	x	x	F	0d	2
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 Flex	7+3	12-13.6 fl. oz.	12-13.6 fl. oz.	12-13.6 fl. oz.	x	x	12-13.6 fl. oz.	12-13.6 fl. oz.	12 h	13.7 fl. oz.
fluopyram+difenoconazole		u	u	F	x	x	u	F-G	0d	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 + fluxapyroxad		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
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

(Continued)

**Table 9-4. Strawberry Diseases - Bloom<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Anthracnose Crown	Anthracnose Fruit Rot	Gray Mold (Botrytis)	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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.
quinoxifen		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 SC	M	x	2.0-2.2 qt.	1.5-2.5 qt.	x	x	x	x	24h	29.7 qt.
thiram		F	G	G	x	x	x	x	1d	12
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
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

Footnotes: See how to read the spray schedule tables section at the beginning of the chapter.

## Strawberry Bloom - Insects

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

## Strawberry Postbloom To 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.
- Leather rot (*Phytophthora cactorum*) can be managed using the same fungicides used for anthracnose. Phosphorous acids like ProPhyt and Phostrol also provide good control.

Table 9-5. Strawberry Diseases - Postbloom Through Harvest<sup>1</sup>

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Anthracnose Crown Rot	Anthracnose Fruit Rot	Gray Mold (Botrytis)	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	Leather Rot (Phytophthora)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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	P07 (33)	x	x	x	x	x	x	x	2.5-5 lb.	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.	1.87-3.75 lb.	1.8-3.75 lb.	1.87-3.75 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
Evito 480SC	11	x	2-5.7 fl. oz.	x	x	x	x	2-5.7 fl. oz.	x	12h	22.8 fl. oz.
fluoxastrobin		x	E	s	x	x	x	E	x	1d	4
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
Inspire	3	7 fl. oz.	7 fl. oz.	x	x	x	x	7 fl. oz.	x	12h	28 fl. oz.
difenoconazole		u	G	x	x	x	x	u	x	0h	4

(Continued)

**Table 9-5. Strawberry Diseases - Postbloom Through Harvest<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Anthraxnose Crown Rot	Anthraxnose Fruit Rot	Gray Mold (Botrytis)	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	Leather Rot (Phytophthora)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
Inspire Super	3+9	16-20 fl. oz.	16-20 fl. oz.	16-20 fl. oz.	x	x	x	16-20 fl. oz.	x	12h	13.7 fl. oz.
difenoconazole+cyprodinil		u	G	F	x	x	x	F	x	0d	2
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
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 Flex	7+3	12.0-13.6 fl. oz.	12.0-13.6 fl. oz.	12.0-13.6 fl. oz.	x	x	12.0- 13.6 fl. oz.	12.0- 13.6 fl. oz.	x	12 h	13.7 fl. oz.
fluopyram + difeno- conazole		u	u	F	x	x	u	F-G	x	0d	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	271 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 + fluxopy- roxad		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	124.0 fl. oz.
oxathiapiprolin+ mefenox- am		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.	s	4h	NA
polyoxin D		G	G	E	x	x	x	G	x	0d	NA
Prophyt	P07 (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

(Continued)

**Table 9-5. Strawberry Diseases - Postbloom Through Harvest<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Anthraxnose Crown Rot	Anthraxnose Fruit Rot	Gray Mold (Botrytis)	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	Leather Rot (Phytophthora)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
Phostrol	P07 (33)	x	x	x	x	x	x	x	2.5 - 5.0 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
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
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 + azox- ystrobin		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 + propi- conazole		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.
quinoxifen		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
Rally 40WSP	4	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 SC	M	x	2-2.2 qt.	1.5-2.5 qt.	x	x	x	x	x	24h	29.7 qt.
thiram		x	G	G	x	x	x	x	x	1d	12
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

(Continued)

**Table 9-5. Strawberry Diseases - Postbloom Through Harvest<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	FRAC Code <sup>2</sup>	Anthraco- nose Crown Rot	Anthraco- nose Fruit Rot	Gray Mold (Botrytis)	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	Leather Rot (Phytophthora)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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 WSB6	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	X	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

Footnotes: See how to read the spray schedule tables section at the beginning of the chapter.

### Strawberry Postbloom 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. Platinum 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 XLR Plus) is labeled for control of this pest. 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 root-worm**. 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. Strawberry Insects - Postbloom Through Harvest<sup>1</sup>**

Product And Formulation Active Ingredient	IRAC Code <sup>2</sup>	Eastern Flower Thrips	Leafhopper	Leafroller	Sap Beetle	Slugs	Spider Mite	Spittlebug	Spotted wing Drosophila	Tarnished Plant Bug	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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

(Continued)

**Table 9-6. Strawberry Insects - Postbloom Through Harvest<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	IRAC Code <sup>2</sup>	Eastern Flower Thrips	Leafhopper	Leafroller	Sap Beetle	Slugs	Spider Mite	Spittlebug	Spotted wing Drosophila	Tarnished Plant Bug	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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	x	x	x	x	3.5 fl. oz.	x	x	x	12h	14 fl. oz.
abamectin		x	x	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 eVo	3A	x	x	2.56-12.8 oz.	2.56-12.8 oz.	x	6.4-12.8 oz.	2.56-12.8 oz.	x	2.56-12.8 oz.	12h	32 oz.
bifenthrin		x	x	G	E	x	F	E	x	E	0d	3
Danitol 2.4EC (RUP)	3A	x	16-21.3 fl. oz.	10.66-21.33 fl. oz.	16-21.3 fl. oz.	x	16-21.3 fl. oz.	16-21.3 fl. oz.	16 fl. oz.	16-21.3 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 gal.	x	x	12.75 fl. oz./100 gal.	x	x	x	3d	64 fl. oz.
diazinon		x	x	G	x	x	F	x	x	x	5d	2
Dibrom 8E (RUP)	1B	1 pt.	x	1 pt.	x	x	1 pt.	1 pt.	x	1 pt.	2d	4.7 lbs.
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	61.5 fl. oz.
cyantraniliprole		s	x	x	x	x	x	x	E	x	1d	NA
Grandevo WDG	UN	2-3 lb.	x	1-3 lb.	x	x	2-3 lb.	x	2-3 lb.	2-3 lb.	4h	NA
<i>Chromobacterium subsugae</i>		u	x	G	x	x	u	x	u	u	0d	NA

(Continued)

**Table 9-6. Strawberry Insects - Postbloom Through Harvest<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	IRAC Code <sup>2</sup>	Eastern Flower Thrips	Leafhopper	Leafroller	Sap Beetle	Slugs	Spider Mite	Spittlebug	Spotted wing Drosophila	Tarnished Plant Bug	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
Javelin WG	11A	x	x	0.25-1.5 lb.	x	x	x	x	x	x	4h	UN
<i>Bacillus thuringiensis</i>		x	x	G	x	x	x	x	x	x	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	12h	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
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	16 fl. oz.	x	x	x	12h	16 fl. oz.
spiromesifen		x	x	x	x	x	G	x	x	x	3d	1
Platinum 75SG	4A	x	1.7-4.01 oz.	x	x	x	x	x	x	x	12h	4.01 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	1-2 qt.	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

(Continued)

**Table 9-6. Strawberry Insects - Postbloom Through Harvest<sup>1</sup> (continued)**

Product And Formulation Active Ingredient	IRAC Code <sup>2</sup>	Eastern Flower Thrips	Leafhopper	Leafroller	Sap Beetle	Slugs	Spider Mite	Spittlebug	Spotted wing Drosophila	Tarnished Plant Bug	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
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	u	x	x	x	x	u	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

Footnotes: See how to read the spray schedule tables section at the beginning of the chapter.

## Strawberry Postharvest And New Plantings - Disease

Apply every 10-14 days as needed.

**Table 9-7. Strawberry Diseases - Postharvest And New Plantings<sup>1</sup>**

Product And Dormulation Active Ingredient	FRAC Code <sup>2</sup>	Anthrachnose Crown	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	Fed Stele (Phytophthora)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
Aliette WDG	P07 (33)	x	x	x	x	x	2.5-5 lb.	12h	30 lb.
aluminum tris		x	x	x	x	x	E	1d	NA
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	30 lb.
captan		E	G	G	G	x	x	0d	NA
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
Nordox 75G	M	x	1.25-2.5 lb.	1.25-2.5 lb.	1.25-2.5 lb.	x	x	12h	NA
cuprous oxide		x	F	F	F	x	x	NA	NA
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

(Continued)

**Table 9-7. Strawberry Diseases - Postharvest And New Plantings<sup>1</sup> (continued)**

Product And Dormulation Active Ingredient	FRAC Code <sup>2</sup>	Anthraco- nose Crown	Leaf Blight Phomopsis	Leaf Scorch (Diplocarpon)	Leaf Spot (Mycosphaerella)	Powdery Mildew	Fed Stele (Phytophthora)	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
Phostrol	33	x	x	x	x	x	2.5-5 pt.	4h	NA
phosphorous acid		x	x	x	x	x	G	NA	NA
Prophyt	P07 (33)	x	x	x	x	x	2-4 pt.	4h	varies
phosphorous acid		x	x	x	x	x	G	UL	4

Footnotes: See how to read the spray schedule tables section at the beginning of the chapter.

## Strawberry Postharvest And New Plantings - Insects

**Table 9-8. Strawberry Insects - Postharvest and New Plantings<sup>1</sup>**

Product And Formulation Active Ingredient	IRAC Code <sup>2</sup>	Leafhopper	Leafroller	Root Weevils	Slugs	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
Actara (25WDG)	4A	4 oz.	x	4 oz.	x	12h	12 oz.
thiamethoxam		E	x	E	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 eVo	3A	x	2.56-12.8 oz.	3.2-12.8 oz.	x	12h	32 oz.
bifenthrin		x	G	G	x	0d	3
Danitol 2.4EC (RUP)	3A	16-21.3 fl. oz.	10.66-21.33 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 gal.	x	x	3d	64 fl. oz.
diazinon		x	G	x	x	5d	2
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 WDG	UN	x	1-3 lb.	x	x	4h	NA
<i>Chromobacterium subtsugae</i>		x	G	x	x	0d	NA
Javelin WG	11A	x	0.25-1.5 lb.	x	x	4h	NA
Bacillus thuringiensis		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

(Continued)

**Table 9-8. Strawberry Insects - Postharvest and New Plantings<sup>1</sup>**

Product And Formulation Active Ingredient	IRAC Code <sup>2</sup>	Leafhopper	Leafroller	Root Weevils	Slugs	REI <sup>3</sup> PHI <sup>4</sup>	Max Amt <sup>5</sup> Max App <sup>6</sup>
Platinum 75SG	4A	1.7-4.01 oz.	x	1.7-4.01 oz.	x	12h	4.01 oz.
thiamethoxam		E	x	G	x	50d	NA
Radiant SC (ISC)	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

Footnotes: See how to read the spray schedule tables section at the beginning of the chapter.

## ***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. To prevent the build-up of pathogens in the soil a second year of production with annual plants is not recommended.

### **Neopestalotiopsis disease**

Neopestalotiopsis disease is an emerging fungal disease in the Midwest. The fungus can affect all parts of the plant (leaves, crown, roots, fruit) with leaf symptoms usually being the first to appear in the Midwest. The disease progresses rapidly under cool and wet conditions and can cause significant plant losses in a short amount of time. Fruit symptoms are uncommon in the Midwest because the plants typically die before the flowers develop into fruit.

Management is extremely difficult. The primary source of the fungus is contaminated nursery stock. Transplants should be inspected upon delivery for symptoms and plants confirmed to be infected should not be planted. There are currently no resistant cultivars and no fungicides specifically registered for Neopestalotiopsis disease. A few fungicides (Thiram and Switch), which are registered for other strawberry diseases have good to excellent efficacy but must be applied intensively throughout the production season.

Images and additional information on Neopestalotiopsis disease can be found at: <https://plantpathology.mgcafe.uky.edu/files/ppfs-fr-s-12.pdf>.

**Table 9.9 Disease Resistance Of Strawberry Cultivars Commonly Grown In The Midwest<sup>1</sup>**

Cultivar	Leaf Spot	Leaf Scorch	Powdery Mildew	Verticillium Wilt	Phytophthora Crown Rot	Red Stele (Phytophthora)
<b>June Bearing</b>						
AC Valley Sunset	R	R	U	R	U	R
AC Wendy	T	T	R	S	U	R
Allstar	T	T	R	R	S	R
Annapolis	S	S	S	T	U	R
Brunswick	U	U	U	U	U	R
Cabot	T	T	R	U	U	R
Camarosa	S	S	S	U	R	U
Cavendish	R	R	R	T	S	R
Chandler*	S	S	S	S	S	S
Clancy	R	R	R	U	U	R
DarSelect	T	T	S	U	U	U
Daroyal	U	U	U	U	U	U
Donna	U	U	U	U	U	U
Earliglow	R	R	T	R	S	R
Flavorfest	R	R	T	T	U	R
Galletta	U	U	U	U	U	U
Glooscap	T	T	T	S	U	S
Guardian	S	R	S	R	S	R
Herriot	T	T	U	R	U	U
Honeoye	R	R	T	S	S	S
Itasca	R	R	U	U	U	R
Jewel*	S	S	T	S	S	S
Kent	S	S	T	S	U	S
L'Amour	R	R	T	U	U	R
Lateglow	R	R	T	R	S	R
Mayflower	U	U	U	U	U	U
Mesabi	R	R	R	R	U	R
Mira	S	S	R	U	U	R
Northeast	T	T	S	R	U	R
Ovation	R	R	S	U	U	R
Redchief	S	R	R	R	S	R
Seneca	U	U	U	S	U	S
Sonata	U	U	T	U	U	S
Sparkle	S	S	S	S	S	S
Surecrop	R	R	R	R	S	R
Sweet Charlie	U	U	R	U	R	U
Winona	R	R	T	T	U	R
<b>Day Neutral</b>						
Albion*	T	T	S	R	T	R
Tribute	R	R	R	R	S	R
Tristar	R	R	R	R	S	R
Seascape	S	S	R	U	U	R
San Andreas	S	S	R	T	U	U

R=resistant. S=susceptible. T=tolerant. U=unknown.

\*Recent research from Ohio and Indiana indicate that these varieties are very susceptible to aggressive isolates of *Neopestalotiopsis* sp. Transplants should be monitored for symptoms before and immediately after planting.

## Vole Control in Fruit Plantings

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.
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

## Growth Regulator Pre-harvest Intervals and Restricted Entry Intervals

Trade Name	Common Name	Preharvest Interval (Days)						REI (Hours)
		Apple	Pear	Peach	Sweet Cherry	Tart Cherry	Plum	
Apogee, Cryova <sup>2</sup> , Kudos, Pro-Hex <sup>2</sup>	Prohexadione-calcium	45	— <sup>1</sup>	—	20	—	—	12
Amid Thin-W	NAD	2	2	—	—	—	—	48
Blush		7	—	—	—	—	—	4
Cytokin <sup>2</sup>	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-benzlidenine	86	86	—	—	—	—	12
ProGibb	gibberellic acid (GA3)	—	—	—	0	0	0	4
ProVide	GA4 + 7	—	—	—	—	—	—	4
Promalin, Typy, Cytoplex HMS, Perlan	6BA + GA4 + 7	0	NB <sup>3</sup>	0	NB <sup>3</sup>	—	—	4/24
ReTain	AVG	7	7	7	—	—	7	12

<sup>1</sup> — = not registered or not recommended

<sup>2</sup> Check label for state registration

<sup>3</sup> Non-bearing trees only.

## Chemical Weed Control in Fruit Crops

Controlling weeds in fruit plantings is important. Weeds may reduce yields by competing for water and nutrients, harbor insects and other pests, and serve as alternate hosts for diseases. Herbicides can provide good weed management with less labor and frequently at a lower cost compared to manual weed control.

### Proper Application

Herbicide effectiveness depends on the selection of the appropriate product and application of the product at the proper time, and the proper rate, with the proper equipment. The level of weed management depends largely on the operator's skill and attention to detail. 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 amount of herbicide needed per

acre of crop is 4/10 of the broadcast amount per acre. Make sprayer adjustments and calibrations as precise as possible to assure accurate and uniform applications. Improper application can damage fruit plantings and may result in illegal residues on the fruit crop. Over- or under-application also can reduce the profitability of the planting. 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. The HRAC code on the label indicates what group the chemical is in and chemicals with the same number function the same way. We recommend that you rotate herbicides with different modes of action 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 herbicides to gain better weed control. **Always follow label recommendations. Improper mixing can form chemical compounds that are not compatible and that may damage your sprayer.**

## ***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.

## ***Site Preparation Before Planting***

Management of perennial weeds in perennial fruit crops can be challenging. Growers should strive to eradicate established perennial weeds during site preparation in the season prior to establishing the crop. Most perennial weeds cannot be controlled effectively in the spring before planting or once the crop is planted. 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 non-selective weed control as flushes of weed seedlings appear.

Establishment of a grass crop on the site several years before planting will give the grower more options for control of perennial broadleaf weeds. Alternatively, cultivation combined with a non-selective herbicide can also be an effective strategy.

## ***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 255-260 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.

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 Strawberry

Weed Problem	Material And Rate Per Acre	Notes And Comments
<b>Pre-emergence</b>		
Annual broadleaves and suppression of grasses	Chateau SW (flumioxazin 51% a.i.) at 3 oz.  Chateau EZ (flumioxazin 41.4% a.i.) at 3 oz.	<b>Annual Strawberries Grown on Plastic Mulch:</b> Apply a minimum of 30 days before transplanting and before laying plastic. Can be mixed with Gramoxone or Roundup. <b>Pre-emergence on Dormant Plants:</b> 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. <b>Shielded or Hooded Application in Row Middles:</b> Do not apply after fruit set and not over strawberry plants. Apply prior to weed emergence.
Annual grasses and certain broadleaves	Devrinol 2-XT (napropamide 2 lb. a.i./gal.) at 2 gal.	<b>Established Plantings (spring):</b> 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. <b>Established Plantings (fall):</b> 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. <b>Strawberries Not Grown with Plastic:</b> 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. <b>Annual Strawberries Grown on Plastic Mulch:</b> 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.
Annual broadleaves, especially winter annuals	Goal 2XL (oxyfluorfen 2 lb. a.i./gal.) at 1-2 pt. in minimum of 40 gal. water	<b>Fallow Bed Preparation Only:</b> 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.
Broadleaves and suppression of certain grasses	Optogen (bicyclopyrone 0.045 lb. a.i.) at 3.5 fl. oz.	Apply after strawberry emergence or transplanting as either a row middle or post-directed application. Avoid contacting the crop with direct or indirect spray or crop injury will occur. Using a hooded or shielded sprayer will minimize potential crop injury when applying as a post-directed application. Add a nonionic surfactant (NIS) at 1 qt./100 gal. of water (0.25% v/v) or a crop oil concentrate (COC) at the rate of 1 gal./100 gallons of water (1.0% v/v). In addition to NIS or COC, dry spray grade ammonium sulfate (AMS) may be added at a rate of 8.5 to 17 lb./gal. of water. Liquid AMS may be substituted at an equivalent rate. The use of AMS will improve the consistency level of weed control. For optimal control, make application to small (<2") weeds.
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.
Annual grasses and broadleaves	Sinbar WDG (terbacil 80% a.i.) at 2-8 oz. in minimum of 20 gal. water	<b>Planting Year:</b> 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. <b>Harvest Years:</b> 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. <b>Note: Strawberry varieties differ in sensitivity to Sinbar, and significant plant injury is possible.</b> Conduct a field test before adoption as a normal practice, particularly for new varieties.

(Continued)

## Herbicide Recommendations For Strawberry (*continued*)

Weed Problem	Material And Rate Per Acre	Notes And Comments
Annual broadleaf weeds, grasses and nutsedge	Spartan 4F (sulfentrazone 39.6%) at 4-8 oz. in 20-40 gal. water	Rate depends on soil texture. Some cultivars may be sensitive. 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. Some states may have supplemental or Special Local Need labels.
<b>Post-emergence</b>		
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.
Annual and some perennial broadleaves	2,4-D amine (4 lb. a.i./ gal.) at 2-3 pt. in 25-50 gal. water	<b>Several 2,4-D amine products are available, but only a few are labeled for strawberry. For Established Plantings Only:</b> 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. Check label for specific use directions.
Most annual and perennial grasses	Fusilade DX (fluazifop-p-butyl 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.
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.
Most annual grasses and broadleaves and top kill of perennial weeds	Gramoxone SL 3.0 (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. <b>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 <a href="https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators">https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-training-certified-applicators</a> Containers under 120 gallons will have "closed-system" packaging to be used with a closed-transfer system.</b>
Broadleaves and suppression of certain grasses	Optogen (bicyclopyrone 0.045 lb.) at 3.5 fl. oz.	See Pre-emergence section for details.
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.
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. Can be mixed with labeled pre-emergence herbicides. Rate depends on weed species and stage of growth.
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 with Inside Technology (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 add COC. 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.
		<i>(Continued)</i>

## Herbicide Recommendations For Strawberry (*continued*)

Weed Problem	Material And Rate Per Acre	Notes And Comments
Annual and perennial broadleaves	Spur (clopyralid 3 lb. a.i./gal.) at 2/3 pt. in minimum of 10 gal. water	<b>Not registered in all states, but has 24(c) special local needs registration in several states. For perennial strawberries only.</b> Make 1 application after harvest. Make only 1 application per crop year. Do not tank mix with other herbicides.
Annual grasses and broadleaves	Ultra Blazer 2E (acifluorfen 2 lb. a.i./gal.) at 1.5 pt. in minimum of 20 gal. water	<p>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.</p> <p><b>Annual Strawberries Grown on Plastic Mulch:</b> 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.</p> <p><b>Perennial Strawberry (matted row):</b> 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.</p>

# Relative Effectiveness Of Herbicides For Fruit Crops<sup>1</sup>

Herbicide	Grasses					Annual Broadleaves																Perennial Weeds						
	Barnyardgrass	Crabgrass	Foxtails	Goosegrass	Panicum, Fall	Chickweed	Cocklebur	Groundsel, Common	Henbit	lambquarters	maretail	Morningglory, Annual	Mustards	Nightshades	Palmer Amaranth	Pigweed	Purslane	Ragweed	Shepherdspurse	Smartweeds	Velvetleaf	Waterhemp	Dandelion	Johnsongrass	Nutsedge, Yellow	Thistle, Canada	Woodsorrel, Yellow	
<b>Pre-emergence</b>																												
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	
Bellum	N	N	N	N	N	G	G	N	N	G	F	F	G	G	F	G	N	F	N	G	G	G	N	N	N	N	N	
Broadloom	N	N	N	N	N	N	F	F <sup>2</sup>	N	F	N	F	F	N	N	N	F	F <sup>2</sup>	F	G	F	N	N	N	N	N	N	
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	
Chateau Complete	G	G	G	G	G	F	F	N	N	G	G	G	N	G	G	G	G	G	G	F	F	F	N	N	N	N	N	
Crew	G	G	G	G	N	G	N	F	G	G	G	G	G	N	N	G	G	N	G	N	N	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		
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		
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 <sup>2</sup>	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	
Optogen	F	F	F	F	F	F	F	N	G	F	N	F	F	G	F	G	F	G	N	F	G	F	N	N	N	N	N	
Pindar GT	F	N	N	N	N	N	G	N	N	G	G	N	N	G	N	G	F	N	N	F	G	N	N	N	N	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 <sup>2</sup>	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	
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	
Spartan	N	F	N	N	G	G	N	N	N	F	N	G	F	G	G	G	G	N	F	F	N	G	N	N	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 <sup>2</sup>	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 <sup>2</sup>	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	
<b>Post-emergence</b>																												
2,4-D	N	N	N	N	N	F	F	G	N	F	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	F	G	G	F	F	F	G	F	N	N	N	F	N		
Broadloom	N	N	N	N	N	N	F	F <sup>2</sup>	N	F	N	F	F	N	N	N	F	F <sup>2</sup>	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	
Chateau Complete	G	G	G	G	G	F	F	N	N	G	G	G	N	G	G	G	G	G	G	F	F	F	N	N	N	N	N	
Crew	G	G	G	G	N	G	N	F	G	G	G	G	G	N	N	G	G	N	G	N	N	N	N	N	N	N		
Embed	N	N	N	N	N	F	F	G	N	F	G	G	G	F	F	N	G	G	F	F	F	G	N	N	F	N		
Fusilade	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	F <sup>2</sup>	N	N	N		
Gamma	F	F	N	N	N	F	N	N	G	N	F	N	N	N	N	N	N	N	F	N	G	F	F	G	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	
Homeplate	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	G	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	N <sup>2</sup>	N	N	N	N <sup>2</sup>		

(Continued)

# Relative Effectiveness Of Herbicides For Fruit Crops<sup>1</sup> (continued)

Herbicide	Grasses					Annual Broadleaves																Perennial Weeds							
	Barnyardgrass	Crabgrass	Foxtails	Goosegrass	Panicum, Fall	Chickweed	Cocklebur	Groundsel, Common	Henbit	lambquarters	marestail	Morningglory, Annual	Mustards	Nightshades	Palmer Amaranth	Pigweed	Purslane	Ragweed	Shepherdspurse	Smartweeds	Velvetleaf	Waterhemp	Dandelion	Johnsongrass	Nutsedge, Yellow	Thistle, Canada	Woodsorrel, Yellow		
<b>Post-emergence</b>																													
Mission	N	G	G	N	N		G	N	G	G	G	N	G	N	N	G	G	G	G	N	N	N		F	N	G	G	N	
Optogen	F	F	F	F	F		F	F	N	G	F	N	F	F	G	F	G	F	G	N	F	G	F		N	N	N	N	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	F	G	G	G	G	G	G	F	F		G	F <sup>2</sup>	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 <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>		G	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>	F <sup>2</sup>		N <sup>2</sup>	N	N	N	N <sup>2</sup>	
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
Starane Ultra	N	N	N	N	N		G	G	N	N	N	N	F	F	F	N	N	N	F	N	N	G	N		N	N	N	N	N
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
Targa	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
Treevix	N	N	N	N	N		N	G	F	N	G	G	G	G	N	G	G	G	G	G	G	G	G		N	N	N	N	N
Trellis	N	N	N	N	N		G	N	F	G	G	F	N	G	G	N	N	G	N	G	G	N	N		N	N	N	N	N
Ultra Blazer	N	N	G	N	G		N	F	N	N	G	N	G	G	G	G	G	G	N	G	G	G	G		N	F <sup>2</sup>	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 <sup>2</sup>	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
Zalo	G	G	G	G	G		G	G	N	N	G	F	G	G	F	G	G	G	G	G	G	G	G		N	N	N	N	N

G = good. F = fair. N = not listed, based on product labels.

<sup>2</sup>Provides partial control.

## Small Fruit Herbicide REI, PHI And Special Notes

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	--	--	--	--
Callisto	mesotrione	27	medium	12	--	no bloom to harvest	no bloom to harvest	--	no bloom to harvest
Casoron 4G	dichlobenil	20	medium	12	--	N/A	N/A	N/A	N/A
Chateau SW/EZ	flumioxazin	14	medium	12	Row middle application - Do not apply after fruit set	7	7	60	7
Chateau Complete	flumioxazin + rimsulfuron	14 + 2	medium	12	--	--	--	60	21
Devrinol DF-XT	napropamide	15	low	24	N/A <sup>5</sup>	N/A	N/A	70	N/A
Fusilade DX	fluazifop	1	high	12	14	1	1	50	NB/10 mo
Gallery DF or SC	isoxaben	21	medium	12	--	NB/1 yr	NB/1 yr	NB/1 yr	NB/1 yr
Gama	tiafenacil	14	medium	12				7	
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 <sup>3</sup>	N/A <sup>3</sup>	N/A <sup>5</sup>	N/A <sup>3</sup>
Homeplate	Caprylic + capric acids		low	12	N/A	N/A	N/A	N/A	N/A
Karmex DF	diuron	7	medium	12	--	0	0	0	0
Kerb SC	pronamide	3	low	24	--	--	--	N/A <sup>1</sup>	N/A <sup>2</sup>
Matrix FNV	rimsulfuron	2	medium	4	--			14	--
Mission	flazasulfuron	2	medium	12	--	--	--	75	--
Optogen	bicyclopyrone	27	medium	24	30	--	--	--	--
Poast 1.5 EC	sethoxydim	1	high	12	7	45	45	50	1 HB/30 LB
Princep 4L	simazine	5	medium	12	--	N/A <sup>6</sup>	N/A <sup>6</sup>	N/A <sup>8</sup>	N/A <sup>6</sup>
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
Sinbar WDG	terbacil	5	medium	12	110	70	70	--	N/A
Sinbar WDG	terbacil	5	medium	12	110	70	70	--	N/A

(Continued)

## Small Fruit Herbicide REI, PHI And Special Notes (continued)

Trade Name	Common Name	WSSA	Risk of Resistance	REI	Strawberry	Raspberry	Blackberry	Grape	Blueberry
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 <sup>1</sup>	--	--	--	--
Surflan 4AS	oryzalin	3	low	24	--	N/A	N/A	N/A	HB N/A
Treflan	trifluralin	3	low	12	--	--	--	60	--
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 <sup>4</sup>
Ultra Blazer	acifluorfen	14	medium	48	60/120	--	--	--	--
Velpar L CU	hexazinone	5	medium	48	--	--	--	--	HB 90/LB 450
Venue	pyraflufen ethyl	14	medium	12	--	--	--	0	--
Zeus Prime XC	carfentrazone- ethyl+ sulfentrazone	14	medium	12	--	3	3	3	3
Zeus XC	sulfentrazone	14	medium	12	--	3	3	3	3

-- = not 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

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)	
Abound (Syngenta) Quadris (Syngenta)	azoxystrobin	Aframe (Syngenta) Azaka (FMC) Azoxystar, Equation	
Aliette 80WDG (Bayer)	fosetyl-Al	Legion 80WDG (Makhteshim) Linebacker WDG (NovaSource)	
Apogee (BASF)	prohexadione-calcium (Pro-Ca)	Cryova PGR (Makhteshim) Kudos (Fine Americas) Pro Hex (Axil Solutions) Regalis PLUS (BASF)	
Bravo Weather Stick (Syngenta)	chlorothalonil	Echo (Sipcam Agro) Equus DF (Sipcam Agro, AMVAC) Chlorothalonil 720 (Albaugh)	
Captec 4L (Arysta LifeScience North America LLC)	captan	Has several formulations including 50W	
Copper	copper hydroxide	Champ (Nufam) Kocide (Certis) KOP-Hydroxide (Drexel) Nu-Cop (Albaugh)	
	copper octanoate	Camelot-O (SePRO) Cueva (Certis)	
	copper oxychloride	COC (Albaugh)	
	copper oxychloride+copper hydroxide	Badge (Gowan)	
	copper (cuprous) oxide	Nordox (NOROX Industrier)	
	copper sulfate (basic)	Basic Copper (Albaugh) Cuprofix (UPL)	
	copper sulfate pentahydrate	KOP-5 (Drexel) Mastercop (ADAMA) Phyton 35 (Phyton Corp)	
	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.)
PH-D (United Phosphorous Inc.)	Polyoxin D zinc salt	Affirm (Nufarm) OSO (Certis Biologicals)	
ProBlad Verde SymAgro	Banda Lupinus Albus Doce	Fracture (FMC)	
Prophyt (Helena)	Phosphite (mono- and dibasic salts)	AgriFos (Monterey)/Agri-Fos (AgriChem) K-Phite (Plant Food Systems) Phostrol (Nufarm) Reliant (Quest Products)	
Quilt Xcel (Syngenta)	azoxystrobin+ propiconazole	Aframe Plus (Syngenta) Cover XL (AgriStar)	

(Continued)

## Generic Fungicides (continued)

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Rally 40WSP (Dow AgriSciences)	myclobutanil	Sonoma 40WSP (Albaugh)
Ridomil 2E (Syngenta)	metalaxyl	Metastar 2E (Arysta Life Science)
Ridomil Gold SL (Syngenta)	mefenoxam	Apron XL (Syngenta) ReCon Bold SL (Atticus) Thrive 4M (Albaugh) 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

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Acramite (UPL)	bifenazate	Actuate (Atticus) Bifenamite 2SC (Albaugh) Bizate (Loveland) Engulf (Nufarm) Floramite SC (OHP) Floramite SC/LS (UPL) Vigilant 4SC (UPL)
Admire Pro (Bayer)	imidacloprid	Acronyx 4F (Atticus) Advise Four (WinField) Alias 4F (ADAMA) Macho 2FL, 4 (Albaugh) Madari 4F (Avalaire) Malice 75WSP (Loveland) Midash 2SC, Forte 4F (Sharda) Montana 2F, 4F (Albaugh) Nuprid 4F Max (Nufarm) Prey 1.6F (Loveland) Provoke (Innvictis) Sherpa 1.6F (Loveland) Viloprid 4, FC 1.7 (Vive) Widow 2F (Loveland) Willowood 4SC (Generic) Wrangler 4F (Loveland)

(Continued)

## Generic Insecticides (continued)

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Agri-Mek SC (Syngenta)	abamectin	Abacus 0.15EC (Rotam) Abamex 0.15ED (Nufarm) Abba Ultra 0.30EC (Amvac) Averland 0.7FC (Vive) Borrada 0.15EC (ADAMA) Enterik 0.15LV, 0.7SC (Atticus) Reaper 0.15EC Advance 0.15EC Clearform 0.15EC (Loveland) Willowood Abamectin 0.15LV, 0.7SC (Generic)
Asana XL 0.66EC (Valent)	esfenvalerate	S-Fenvalostar 0.66EC (LG Life Sciences)
Assail 30SG, 30SC, 70WP (UPL)	acetamiprid	Afflict 30SG, 70WP (Aceto) Anarchy 30SG, 70WP (Loveland) ArVida 30SG (Atticus) Intruder Max 70WP (UPL)
Baythroid XL 1EC (Bayer)	Beta-cyfluthrin, cyfluthrin	Cryptoid XL 1EC (Atticus) Tombstone 2E (Loveland) Tombstone Helios 2E (Loveland)
Brigade 2EC, eVo (FMC)	bifenthrin	Banister 2EC (Avalaire) Batallion 2EC (Atticus) Bi-Dash 2EC (Sharda) Bifen 2AG Gold (WinField) Bifender 1.75FC (Vive) Bifenthrin 2EC (Aceto) Bifenture 2EC (UPL) Discipline 2EC (Amvac) Fanfare 2EC (ADAMA) GCS Bifenthrin 2EC, LFC 1.5EC (Generic) Lancer 2EC, FC 1.5EC (Albaugh) Reveal 2EC, Endurx 2EC (Innvectis) Sniper 2EC (Loveland) Tundra 2EC (Winfield)
Cygon 400EC (FMC)	dimethoate	Dimate 4EC (Winfield) Dimethoate 400, 400EC, 4EC (Loveland, FMC, Drexel)
Dimilin	diflubenzuron	Diflumas 2L (Helm Agro) Dimilin 2L, 25W (UPL) Durant 2L (Atticus) Micromite 2L (UPL) Unforgiven (Loveland)
Dipel (Valent)	<i>Bacillus thuringiensis</i>	Agree (Certis) Biobit (Valent) Bt Now (BioSafe) CryMax (Certis) Deliver (Certis) Javelin (Certis) Leptotec (Vestaron) Xentari (Valent)
Esteem 0.86EC, 35WP (Valent) Knack 0.83EC (Valent)	pyriproxyfen	Pitch (0.83EC), Pitch 35WP (ADAMA)

(Continued)

## Generic Insecticides (continued)

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Intrepid 2F (Corteva AgriSciences)	methoxyfenozide	GCS Methoxy 2F (Generic) Inspirato 2F (Atticus) Invertid 2F (Loveland) Invicar 2SC (Albaugh) Thwartex (Agsurf) Troubador 2F (Helena) Turnstyle 2F (UPL) Vexer (Innvictis) Zylo (UPL)
Mustang Maxx (FMC)	zeta-cypermethrin	Cortes Maxx (Atticus)
Pounce 25WP (FMC)	permethrin	Arctic 3.2EC (Winfield) Permethrin 3.2EC (Loveland) Perm-Up 3.2EC, 25DF (UPL) Permastar AG (LG Life Sciences)
Savey 50DF, Onager, Onager Optek, Hexy- gon, Hexygon IQ (Gowan)	hexythiazox	Hexamite (Albaugh) Hexcel EW (Atticus)
Sevin XLR Plus, 4L (Novasource)	carbaryl	Carbaryl 4L (Drexel, Loveland)
Warrior II 2.08CS (Syngenta)	lambda-cyhalothrin	Actylis Lambda-Cy (Aceto) Calvary II (Growmark) Crusader 1EC, 2ME (Albaugh) Firestone (Altitude) Grizzly Too, Z 1CS (Winfield) Kaiso 24WG (Nufarm) Kendo 22.8CS (Helm) L - C Insecticide (Drexel) Lambda-Cy AG (Winfield) Lambda-Cy 1EC (UPL) Lambdastar 1CS, Plus (FarmHannong) Lambda T 1EC (Helena) Lamcap II (Syngenta) Lunge (UPL) Nufarm Lambda-Cyhalothrin 1EC (Nufarm) Paradigm 1VC (Winfield) Province II (Tenkoz) Ravage 1EC (Innvictus) Serpent 1EC (Atticus) Silencer 1EC (ADAMA) Willowood Lambda-Cy 1EC (Generic)
Zeal (Valent)	etoxazole	Suremite SC (Aceto) Zara WSB, Zara SC (Atticus)

## Generic Herbicides'

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Aim® EC Herbicide (FMC Corporation)	carfentrazone-ethyl	Antik™ EC (Atticus Ag) Longbow™ EC (Nufarm Americas, Inc.) Maxunitech Carfentrazone 2 EC (Maxunitech North America, Inc.) Quinark™ EW (Atticus Ag) Shark® EW (FMC Corporation)
Alion® Herbicide (Bayer CropScience)	Indaziflam	Sage™ (Altamont)
Amine4 2,4-D (Tenkoz)	2,4-D amine	2,4-D Amine 4 (WinField United) 2,4-D/Amine 4 Herbicide (WinField United) Amine 4 2,4-D (Loveland Products, Inc.) Amine 6 (Loveland Products, Inc.) Base Camp® Amine 4 (Wilber-Ellis Company LLC) Clean Amine® (Loveland Products, Inc.) Cornbelt® 4Lb. Amine (Van Diest Supply Company) De-Amine® 4 (Drexel Chemical Company) Defy® Amine 4 (ADAMA) Embed® Extra (Corteva Agrisciences) Embed™ (Corteva Agriscience) Orchard Clean® (Nufarm Americas, Inc.) Orchard Master® Broadleaf Herbicide (PBI-Gordon Professional) Orchard Star® (Albaugh, LLC Agricultural Products) Rugged® Herbicide (WinField United) Saber® (Loveland Products, Inc.) Savage® Dry Soluble (Loveland Products, Inc.) Solution Water Soluble® (Nufarm Americas, Inc.) Usha 6 (Sharda USA LLC) Weedar® 64 (Nufarm Americas, Inc.) WeeDestroy® AM-40 Amine Salt (Nufarm Americas, Inc.)
Assure® II Herbicide (Ampac Chemical Corporation)	quizalofop p-ethyl	Targa® (Gowan Company, LLC)
Callisto (Syngenta Crop Protection, LLC)	mesotrione	Atticus Cavallo™ 4 SC (Atticus Ag) Bellum® (Albaugh, LLC Agricultural Products) Meso Star (Sharda USA LLC) Mesotrione 4SC (Albaugh, LLC Agricultural Products) MesoTryOne™ 4L (Drexel Chemical Company) Motif® Herbicide (UPL NA Inc.) Undercover™ (Innervictis Crop Care, LLC)

(Continued)

## Generic Herbicides' (continued)

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Chateau WDG (Valent USA)	flumioxazin	Chateau® EZ (Valent U.S.A. LLC) Chateau® Herbicide SW (Valent U.S.A. LLC) Flumi® 51 WDG (NuFarm Americas, Inc.) Flumi® SX Herbicide (Valent U.S.A. LLC) Flumigard Herbicide (Alligare, LLC) Flumigard SC (Alligare, LLC) Flumioxazin 51WDG Select (Alligare, LLC) Semera 51.0% WDG (Atticus EcoCore) Semera SC (Atticus EcoCore) SureGuard Herbicide (Nufarm Americas, Inc.) Tuscany® (Nufarm Americas, Inc.) Tuscany® SC Herbicide (Nufarm Americans, Inc.) Varsity® (Innkvictis Crop Care, LLC) Varsity® SC (Innkvictis Crop Care, LLC) Zaltus™ SC (Atticus Ag)
Gallery 75 DF / SC (Corteva Agrisciences)	isoxaben	Trellis and Trellis SC (Corteva AgriSciences)
Goal® 2XL Herbicide (Nufarm Americas, Inc.)	oxyfluorfen	Collide™ Herbicide (UPL NA Inc.) Galigan® 2E (ADAMA) Galigan® H2O Herbicide (ADAMA) GoalTender® Herbicide (Nufarm Americas, Inc.) Govee™ (Innkvictis Crop Care, LLC) Oxystar® 2E (Albaugh, LLC Agricultural Products) Oxystar® 4L (Albaugh, LLC Agricultural Products) ScrollOVR™ (Atticus Ag) Scroll™ 2 XL (Atticus Ag) Willowood OxyFlo 2EC (Generic Crop Science LLC)
Gramoxone (Syngenta Crop Protection, LLC)	paraquat	Axill Solutions Paraquat 3SL (Axill Solutions, LLC) Devour™ (Innkvictis Crop Care, LLC) Gramoxone® SL 3.0 (Syngenta Crop Protection, LLC) Helmquat 3SL (Helm Agro US, Inc.) Paraquat Concentrate (Solera Sources Dynamics, LLC) Para-Shot 3.0 (Sharda USA LLC) Parazone® 3SL (Amvac Chemical Corporation) Quik-Quat™ (Drexel Chemical Company) Willowood Paraquat 3SL (Generic Crop Science LLC)
HomePlate® (Certis USA, L.L.C.)	caprylic acid + capric acid	Fireworxx™ (OHP, Inc.) SUPPRESS® Herbicide EC (SAN Group Biotech USA Inc.)
Karmex DF (ADAMA)	diuron	Direx 4L (ADAMA) Diuron 4L/80 DF (Alligare, LLC) Diuron 4L/80 (Drexel, Chemical Company) Diuron 4L (ADAMA) Diuron 4L (Loveland Products, Inc.) Diuron 80 (Drexel Chemical Company) Diuron 80 DF (Alligare, LLC) Diuron 80 (WDG Weed Killer (Loveland Products, Inc.) Drill (Sharda USA LLC)

(Continued)

## Generic Herbicides (continued)

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Kerb SC (Corteva AgriSciences)	pronamide	Kerb® 50-W Herbicide (Corteva Agriscience) Kerb® SC (RUP) (Corteva Agriscience) Willowood Pronamide 3.3SC (Generic Crop Science LLC) Willowood Pronamide 50WSP (Generic Crop Science LLC)
Matrix® FNV/SG (Corteva AgriSciences)	rimsulfuron	DuPont Matrix® SG (Corteva Agriscience) Grapple™ (Nufarm Americas, Inc.)Hinge™ (Albaugh, LLC Agricultural Products) Matrix® FNV (Corteva Agriscience) Pravin® Herbicide (ADAMA) Revolt™ (Innvictis Crop Care, LLC) Tetris™ SG (Atticus Ag)
Poast (BASF)	sethoxydim	Segment (BASF)
Princep® 4L (Syngenta Crop Protection, LLC)	simazine	Princep® Caliber 90° Herbicide (Syngenta Crop Protection, LLC) Simazine 4L (Drexel Chemical Company) Simazine 4L (WinField United) Simazine 4L Flowable (Loveland Products, Inc.) Simazine 90DF (Drexel Chemical Company) Simazine 90 WDG (Loveland Products, Inc.) Sim-Trol® 4L Simazine Flowable Herbicide (Sipcam Agro USA, Inc.) Sim-Trol® 90DF Simazine Dry Flowable Herbicide (Sipcam Agro USA, Inc.)
Prowl® 3.3 EC herbicide (BASF Ag Products)	pendimethalin	Acumen® Herbicide (TENKOZ, Inc.) Acumen® Microcap (TENKOZ, Inc.) Framework® 3.3 EC Herbicide (WinField United) Pendulum® 2G granule herbicide (BASF Professional and Specialty Solutions) Pendulum® 3.3 EC herbicide (BASF Professional and Specialty Solutions) Pendulum® AquaCap™ herbicide (BASF Professional and Specialty Solutions) Pin-Dee™ 3.3 EC (Drexel Chemical Company) Pin-Dee™ 3.3 T & O (Drexel Chemical Company) Prowl® H2O herbicide (BASF Ag Products) Satellite® 3.3 herbicide (UPL NA Inc.) Satellite® Flex (UPL NA Inc.) Satellite® HydroCap herbicide (UPL NA Inc.) Stealth® Herbicide (Loveland Products, Inc.)
Reglone (Syngenta Crop Protection, LLC)	diquat	Aceto Diquat 2L AG (Aceto Life Sciences, L.L.C. d/b/a Actylis) Capone™ Desiccant (Atticus Ag) Dessicash Ag (Sharda USA LLC) Nufarm Diquat 2 L (Nufarm Americas, Inc.) Nufarm Diquat SPC 2 L (Nufarm Americas, Inc.) Verdure-X-Herbicide (Helm Agro US, Inc.)

(Continued)

## Generic Herbicides (continued)

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Rely 280 (BASF Agricultural Solutions US LLC)	glufosinate-ammonium	Axill Solutions Glufosinate 280SL (Axill Solutions, LLC) Cheetah® Herbicide (Nufarm Americas, Inc.) Fever™ (Innactivis Crop Care, LLC) Forfeit® 280 (Loveland Products, Inc.) Inflammé™ 280 SL (Atticus Ag) Interline® Herbicide (UPL NA Inc.) Lifeline® (UPL NA Inc.) Opportunity (Sharda USA LLC) Reckon™ 280SL (Solera Source Dynamics, LLC) Refer® 280 SL Herbicide (Summit Agro USA, LLC) Rely® 280 Herbicide (BASF Ag Products) Scout™ Herbicide (Valent U.S.A. LLC) Surmise® (Albaugh, LLC Agricultural Products) Surmise® 5 (Albaugh, LLC Agricultural Products) Total TNV (WinField United) Total® 2.3 (WinField United) Total® Herbicide (WinField United) Willowood Glufosinate 280SL (Generic Crop Science LLC)
Roundup PowerMAX® Herbicide (Bayer Crop-Science)	glyphosate	Abundit® Edge (Corteva Agriscience) Aquamaster® (Bayer CropScience) Buccaneer® 5 Extra (TENKOZ, Inc.) Buccaneer® Plus (55467-9) (TENKOZ, Inc.) Clearout™ 5 Extra (Albaugh, LLC Agricultural Products) Cornerstone K Herbicide (WinField United) Cornerstone® 5 Plus (WinField United) Cornerstone® Plus (1381-192) (WinField United) Credit® 41 Extra (Nufarm Americas, Inc.) Credit® 5.4 Extra (Nufarm Americas, Inc.) Credit® Xtreme (Nufarm Americas, Inc.) Duramax® Herbicide (Corteva Agriscience) Durango® DMA® Herbicide (Albaugh, LLC Agricultural Products) Envy™ (Innactivis Crop Care, LLC) Envy™ Intense (Innactivis Crop Care, LLC) Envy™ Six Max (Innactivis Crop Care, LLC) Four Power Plus® (Loveland Products, Inc.) Gly Star® 5 Extra (Albaugh, LLC Agricultural Products) Gly Star® K-Plus (Albaugh, LLC Agricultural Products) Gly Star® Original (Albaugh, LLC Agricultural Products) Gly Star® Plus (Albaugh, LLC Agricultural Products) Honcho® K6 Herbicide (Bayer CropScience) Honcho® Plus (Bayer CropScience) Mad Dog® (Loveland Products, Inc.) Mad Dog® Plus (Loveland Products, Inc.) Makaze® Herbicide (Loveland Products, Inc.)

(Continued)

## Generic Herbicides (continued)

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Roundup PowerMAX® Herbicide (Bayer Crop-Science) <b>(Continued)</b>	glyphosate	Roundup PowerMAX® 3 Herbicide (Bayer Crop-Science) Roundup PowerMAX® Herbicide (Bayer CropScience) Roundup PowerMAX® II (Bayer CropScience) Roundup Ultra® (Bayer CropScience) Roundup WeatherMAX® Herbicide (Bayer Crop-Science) Shar-Max Glyphosate 41% SL (Sharda USA LLC) Willowood Glypho 6 (Generic Crop Science LLC) Wynca USA™ Sunphosate 41% Herbicide (Wynca USA) Wynca USA™ Sunphosate® 5 MAX (Wynca USA)
Sandea® (Gowan Company, LLC)	halosulfuron	Herbivore® Herbicide (WinField United)
Select Max® Herbicide with Inside Technology™ (Valent U.S.A. LLC)	clethodim	Arrow® 2 EC (ADAMA) Avatar™ (Innvictis Crop Care, LLC) Avatar™ S2™ (Innvictis Crop Care, LLC) Axill Solutions Clethodim 2EC (Axill Solutions, LLC) Ceridian™ 2 EC (Atticus Ag) Cleanse® (WinField United) Cleanse® 2EC (WinField United) Clethodim 2E (Albaugh, LLC Agricultural Products) Dakota™ (Albaugh, LLC Agricultural Products)Envoy Plus™ Herbicide (Valent U.S.A. LLC Professional Products) Shadow® (UPL NA Inc.) Shadow® 3EC (UPL NA Inc.) Signature Clethodim (Albaugh, LLC Agricultural Products) Trizenta™ 3EC Herbicide (UPL NA Inc.) Trizenta™ Herbicide (UPL NA Inc.) Vaquero® (Wilbur-Ellis Company LLC) Volunteer® (TENKOZ, Inc.) Volunteer® Herbicide (42750-72-55467) (TENKOZ, Inc.) Volunteer® Herbicide (70506-484-55467) (TENKOZ, Inc.) Willowood Clethodim 2EC (Generic Crop Science LLC)
Stinger® Herbicide (Corteva AgriSciences)	clopyralid	Bite (Sharda USA LLC) Clean Slate (Nufarm Americas, Inc.) GCS Clogy 360SL (Generic Crop Science LLC) Spur® (Albaugh, LLC Agricultural Products) Stigmata™ (Atticus Ag)
Starane® Ultra Herbicide (Corteva Agriscience)	fluroxypyr	Comet® Selective Herbicide (Nufarm Americas, Inc.) Fancy (Sharda USA LLC) Stark™ Ultra (Atticus Ag)
Surflan AS	oryzalin	Fugitive (ADAMA) Oryzalin 4 AS (ADAMA)
Trellis® (Corteva Agriscience)	isoxaben	Trellis® SC (Corteva Agriscience) Gallery® 75 Dry Flowable Specialty Herbicide (Corteva Agriscience) Gallery® SC (Corteva Agriscience)

(Continued)

## Generic Herbicides (continued)

Original Trade Name (Current Manufacturer)	Common Name	Other Trade Names (Manufacturers)
Treflan™ 4L Herbicide (Loveland Products, Inc.)	trifluralin	Treflan HFP Herbicide (Gowan Company, LLC) Treflan TR-10 Granular Herbicide (Gowan Company, LLC) Trifluralin 10G (Loveland Products, Inc.) Trifluralin 4 EC Herbicide (Aceto Life Sciences, L.L.C. d/b/a Actylis) Trifluralin 4EC (Albaugh, LLC Agricultural Products) Trifluralin 4EC (Drexel Chemical Company) Trifluralin HF (Loveland Products, Inc.) Trust (WinField United)
Ultra Blazer (United Phosphorus)	acifluorfen	Acifin 2 L (Summit) 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)
Venue® (Nichino America, Inc.)	pyraflufen ethyl	Venue® Max Herbicide (Nichino America, Inc.)
Zeus /XC (FMC Corporation )	sulfentrazone	Maxunitech Sulfentrazone 4 SC Herbicide (Maxunitech North America, Inc.) Passage™ Herbicide (Alligare, LLC) Shutdown® Herbicide (UPL NA Inc) Willowood Sulfen 4SC (Generic Crop Science LLC) Zone 4F (Helm Agro US, Inc.)

<sup>1</sup> Check label to make sure product is labeled for the crop that it is to be used on.



## Fruit Grower Newsletters

### Arkansas

University of Arkansas Division of Agriculture Cooperative Extension Service offers *Arkansas Fruit, Vegetable, and Nut Update*. 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](http://ipm.illinois.edu/ifvn)). This newsletter covers production practices and insect and disease management. For more information, contact Local Food Systems and Small Farms Educator: Bronwyn Aly (1715 College Ave., Carmi, IL 62821, 618-395-2441, [baly@illinois.edu](mailto:baly@illinois.edu)); or Commercial Agriculture Educator: Nathan Johanning, 901 Illinois Avenue, PO Box 117, Waterloo, IL 62298, 618-939-3434). 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](mailto:plantclinic@illinois.edu).

### Indiana

Purdue Extension offers *Facts for Fancy Fruit*, a newsletter issued biweekly throughout the growing season, that provides timely information on diseases and insects throughout the state, cultural practices and announcements about upcoming events. Subscribe to the online version free of charge at [fff.hort.purdue.edu](http://fff.hort.purdue.edu) or receive a printout via first class mail for \$15 a year.

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://yardandgarden.extension.iastate.edu/>

### Kentucky

Cooperative Extension issues a monthly newsletter, *Kentucky Fruit Facts* (<https://horticulture.mgcafe.uky.edu/ky-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 subscribe, send an email message:

TO: [listserv@lsv.uky.edu](mailto:listserv@lsv.uky.edu)  
SUBJECT: Fruit Facts  
MESSAGE: subscribe KY-FRUITFACTS

Followed by a blank line

OR to unsubscribe, the lines:  
signoff KY-FRUITFACTS  
Followed by a blank line

You should receive confirmation by return email. If you have a problem, or if you wish to communicate with a person about "fruitfacts", the owner's address (the TO: line of the message) is: [owner-ky-fruit-facts@lsv.uky.edu](mailto:owner-ky-fruit-facts@lsv.uky.edu)

### Ohio

*Ohio Fruit News (OFN)* is published six times a year by the Department of Plant Pathology at The Ohio State University, CFAES-Wooster. The newsletter is available free of charge in electronic format at [u.osu.edu/fruitpathology/fruit-news-2/](http://u.osu.edu/fruitpathology/fruit-news-2/), or as a printed copy by request. To subscribe, contact Melanie Lewis Ivey at [ivey.14@osu.edu](mailto:ivey.14@osu.edu) or 330-263-3849.

The Ohio State University Extension Specialty Crop Team maintains an online blog, *Fruit, Vegetable, and Specialty Crop News* ([u.osu.edu/vegnetnews/](http://u.osu.edu/vegnetnews/)). New posts are added daily and feature timely updates and information on all specialty food crops.

The *Ohio Grape-Wine Electronic Newsletter (OGEN)* is available at [ohiograpeweb.cfaes.ohio-state.edu/news](http://ohiograpeweb.cfaes.ohio-state.edu/news). To subscribe, email Maria Smith at [smith.127203@osu.edu](mailto:smith.127203@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, Ohio, New Mexico, North Carolina, Wisconsin, and Saskatchewan, Canada.

The Ohio Sensitive Crop Registry is available at [www.agri.ohio.gov/scr](http://www.agri.ohio.gov/scr) <https://agri.ohio.gov/divisions/plant-health/resources/oscr>.

Check with the state department of agriculture in your state about similar tools.

## Network for Environment and Weather Applications (NEWA)

NEWA collects weather data through the Internet from weather stations primarily located on farms and generates real-time weather data summaries, crop production tools, and IPM forecasts.

Contact your NEWA State coordinators for additional information on purchasing a weather station and connecting to NEWA for IPM weather tools and IPM crop forecasts. If you don't have a state coordinator you can contact Dan Olmstead at [newa@cornell-ipm.org](mailto:newa@cornell-ipm.org).

**Illinois:** Elizabeth Wahle, University of Illinois at Urbana-Champaign; 618-344-4230; [wahle@illinois.edu](mailto:wahle@illinois.edu).

**Kentucky:** Brent Arnoldussen, University of Kentucky; 859-257-4721; [bar244@uky.edu](mailto:bar244@uky.edu).

**Ohio:** Melanie Lewis Ivey, The Ohio State University, CFAES-Wooster; 330-263-3849; [ivey.14@osu.edu](mailto:ivey.14@osu.edu)

**Wisconsin:** Amaya Atucha, University of Wisconsin-Madison; 608-262-6452; [atucha@wisc.edu](mailto:atucha@wisc.edu)

## 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](http://www.npdn.org)) lists diagnostic laboratories by state and region. Check with your local County Extension Office or Diagnostic lab for any costs associated with this service.

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 soft fruit (i.e., strawberry, raspberry, blackberry, etc.) in 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 or formaldehyde, or without rubbing 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

479-502-9713

<https://www.uaex.uada.edu/yard-garden/plant-health>

Clinic: <https://www.facebook.com/UAEXPlantHealthClinic>

#### **Contact:**

Taylor Klass, [tklass@uada.edu](mailto:tklass@uada.edu)

### ***Illinois***

University of Illinois Plant Clinic

S-417 Turner Hall

1102 S. Goodwin Ave.

University of Illinois

Urbana, IL 61801

217-333-0519

<https://extension.illinois.edu/plant-clinic>

[plantclinic@illinois.edu](mailto:plantclinic@illinois.edu)

[www.facebook.com/UofIPlantClinic](http://www.facebook.com/UofIPlantClinic)

#### **Contacts:**

Diane Plewa, [dplewa@illinois.edu](mailto:dplewa@illinois.edu), (217) 300-3441

### ***Indiana***

Plant and Pest Diagnostic Laboratory

Purdue University

LSPS 101

915 Mitch Daniels Blvd, LSPS 116

West Lafayette, IN 47907-2054

765-494-7071

Fax: 765-494-3958

<https://ag.purdue.edu/department/btny/ppdl/index.html>

[ppdl-samples@purdue.edu](mailto:ppdl-samples@purdue.edu)

[www.facebook.com/PurduePPDL](http://www.facebook.com/PurduePPDL)

#### **Contact:**

Tom Creswell, [creswell@purdue.edu](mailto:creswell@purdue.edu)

John Bonkowski, [jbonkows@purdue.edu](mailto: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

<https://yardandgarden.extension.iastate.edu/pidc>

[pidc@iastate.edu](mailto:pidc@iastate.edu)

[www.facebook.com/ISUPIDC](http://www.facebook.com/ISUPIDC)

### ***Kentucky***

Plant Disease Diagnostic Laboratory Agricultural

Science Building-North

1100 South Limestone Street

University of Kentucky

Lexington, KY 40546-0091

859-257-8949

Fax: 859-323-1961

<https://plantpathology.mgcafe.uky.edu/extension/diagnostic-laboratories>

#### **Contact:**

Julie Beale, [jbeale@uky.edu](mailto:jbeale@uky.edu)

### ***Ohio***

C. Wayne Ellett

The Ohio State University, CFAES-Wooster

234 Selby Hall

1680 Madison Avenue

Wooster, OH 44691

Phone: 330-263-3650

Email: [ppdc@osu.edu](mailto:ppdc@osu.edu)

[ppdc.osu.edu](http://ppdc.osu.edu)

#### **Contact:**

Francesca Rotondo, [rotondo.11@osu.edu](mailto:rotondo.11@osu.edu)

CFAES-Wooster, 330-263-3650

### ***Wisconsin***

Plant Disease Diagnostics Clinic Department of Plant

Pathology

1630 Linden Drive

University of Wisconsin-Madison

Madison, WI 53706-1598

[pddc.wisc.edu](http://pddc.wisc.edu)

608-262-2863

Fax: 608-263-2626

#### **Contact:**

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# 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/PSEPDDirectory.cfm>.

## University of Arkansas

<https://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](http://www.extension.iastate.edu/psep)

## University of Kentucky

<https://entomology.mgcafe.uky.edu/uk-pesticide-safety-education-program-psep>

## Ohio State University

[pested.osu.edu](http://pested.osu.edu)

## Purdue University

<https://ag.purdue.edu/department/extension/ppp/>

## 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.

## National Pesticide Information Retrieval System

(NPIRS): 765-494-5249

## National Pesticide Information Center:

800-858-7378

**CHEMTREC:** (800) 424-9300

## Arkansas

**Arkansas Poison Center:** 800-222-1222

**Arkansas State Plant Board:** 501-225-1595

*Pesticide training, licensing, and education for applying restricted use pesticides.*

## Illinois

**Illinois Poison Control Centers Emergency**

**Nationwide:** 800-222-1222

**Emergency TTY/TDD:** 312-906-6185

## Indiana

**Indiana Poison Center:** 800-222-1222

*Pesticide Poisoning*

**Indiana Department of Environmental**

**Management:**

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:**

800-621-8431 or 312-353-2000

## Iowa

**Iowa Statewide Poison Control Center Emergency**

**Phone Number:** 800-222-1222

**Administrative Phone Number:** 712-273-7757

## Kentucky

**Kentucky Regional Poison Control Center:**

800-222-1222

**KY Environmental Response:** 800-928-2380 or

502-564-2380

## Ohio

**Ohio Poison Exposure Centers:** 800-222-1222

**TDD number:** 800-253-7955

## Wisconsin

**Wisconsin Poison Center:** 800-222-1222

# Conversion Factors for Weights and Measures: Equivalents

	Metric	U.S.
<b>Length</b>	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
<b>Area</b>	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
<b>Weight</b>	1 Gram	0.035 ounces
	1 Kilogram (1,000 g)	2.2 pounds
	1 Ton (metric) – 1,000 kg	1.1 tons (U.S.)
<b>Volume</b>	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
<b>Length</b>	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
<b>Area</b>	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
<b>Weight</b>	1 Ounce	28.3 grams
	1 Pound (16 oz)	0.454 kilograms
	1 Ton (U.S.) – 2,000 lb	0.907 tons (metric)
<b>Volume</b>	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

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The Midwest Fruit Pest Management Guide 2026-2027 was developed by the Midwest Fruit Workers Group.

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