

2006 Commercial Tree Fruit Spray Guide

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Midwest Tree Fruit Pest Management Handbook

The “Midwest Tree Fruit Pest Management Handbook” is a companion publication to this spray guide that contains further information on pesticide safety, sprayer calibration, tree fruit diseases and insect pests, pesticide characteristics, growth regulators and spray adjuvants, and other related topics. Copies of this publication are available from your state extension service.

Foreword

Commercial fruit production has become a highly skilled technological profession. Concerns for residues, operator risks, and the environment dictate that all fruit growers exercise extreme caution in the use of all pesticides and, indeed, all chemicals. The EPA has designated a number of fruit pesticides as “**restricted-use.**” Record-keeping and worker protection requirements have changed dramatically since 1994. Consult the Pesticide Applicator Training program or local extension office for more information.

Growers who wish to use these restricted-use materials must be certified as “**private applicators.**” Certification requires that applicators understand: labels and labeling, safety factors, potential environmental concerns, identification of common pests, knowledge of pesticides and their usage, proper equipment use, and applicable state and federal regulations. Contact your local extension office for information about training programs for your certification.

Pest management recommendations provide up-to-date information on pesticides and their applicability to your problem. We suggest that you use this information to set up your own spray program. You should include space for records in the program, such as, materials used, date of application, stage of growth, and weather. In case of questions, nothing beats a good set of records, and records are required for restricted-use pesticides.

Handling Pesticides

1. Know the pesticide toxicity and act accordingly.
2. When mixing pesticides, do not breathe the dust, powder, or vapor. Always mix outdoors.
3. Use an adequate respirator and protective clothing, especially when mixing pesticides. The necessary protective equipment is listed on the pesticide label. Suitable respirators should be available from your pesticide dealer.
4. Do not smoke, eat, or drink when handling or applying pesticides.
5. Stay out of drift from spray or dust.
6. Rinse out liquid containers with water at least three times, and pour 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 in accordance with the

pesticide label directions and as allowed by state and local authorities. Do not re-use pesticide containers.

7. Have a “buddy” around when using toxic organo-phosphates or carbamates, just in case.
8. For maximum safety, get a blood test to determine the cholinesterase level for each worker before the spraying season and periodically during the season. This will allow you to monitor the cholinesterase level in those people using insecticides and can help prevent overexposure.
9. Consult a doctor immediately if the following symptoms develop while spraying: blurred vision, nausea, headache, chest pain, weakness, diarrhea, or cramps.
10. Wash hands thoroughly before eating or smoking.
11. Bathe and change clothes daily.
12. Always store pesticides in their original marked container.
13. Always store pesticides under lock and key. Keep children away.
14. Follow all label instructions carefully.
15. Always use an anti-siphon device when filling spray tank from a domestic water source.

Management Tips for Safety

THE LABEL IS THE LAW: READ AND FOLLOW ITS INSTRUCTIONS.

1. Maintain accurate spray records. Show application rates, pesticides used, total gallonage, stage of plant development, and weather data.
2. Be prepared to show your records to the EPA or state agency inspectors.
3. Do not contaminate forage crops or pastures.
4. Prevent excess drift.
5. Do not allow animals to graze in orchards.
6. Maintain equipment in top condition.
7. Protect children, pets, livestock, and your environment from pesticides in any form.
8. Inform all workers of re-entry restrictions and other safety information.
9. Comply with the Right-To-Know Law. Have complete product labels readily available for workers. Have the Material Safety Data Sheet for each product available for workers to see, and for rescue or fire personnel to use in case of emergency.
10. Provide pesticide safety training for pesticide

handlers and other workers to comply with Worker Protection Standards.

11. Regularly inspect and maintain personal protective equipment used when applying pesticides.

Dilute Spraying

The object of spraying is to uniformly distribute a fungicide, insecticide, miticide, or growth regulator over all parts of the tree. Pesticide recommendations are based on the amount of dilute spray needed to wet trees thoroughly. In a standard apple or pear orchard, with trees approximately 20 ft tall, 22 ft wide, and set on rows 35 ft apart, 400 gal. water/acre is a standard dilute spray for fungicide and insecticide application. Recommendations are made per 100 gal or per acre. Dilute is considered 1x concentration. For cherry, peach, and plum, 300 gal water/acre is the standard dilute spray volume for full-size trees.

Table 1 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 more risky because any mistakes in concentration are magnified.

Read the growth regulator label for suggestions on

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.

Low-Volume Spraying

Low-volume, or concentrate, spraying refers to the use of 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 used. So, if a 3x concentration is used, apply only one-third the water per acre that would be used in dilute spraying.

Low-volume sprays must be applied with air-blast sprayers which use high-velocity airstream to distribute the spray mixture. Most conventional air-blast sprayers can be used to apply spray mixtures up to 6x concentration. Sprayers specifically designed for ultra low-volume applications should be used for applications at 10x or greater.

Using low-volume sprays requires less labor, less water, less time, and fewer refills than 1x or dilute mixtures. However, savings in gallowage and application costs decrease most rapidly down to about 50 gallons of water per acre. Below that, the savings may not be worth the additional risk of improper application and problems with wind. Table 2 illustrates an 80 percent savings of water at 5x, but only an additional 10 percent savings by

Table 1. Gallonage of dilute spray per acre required to provide equivalent coverage for mature trees of different sizes and spacing.

Distance Between Rows (feet)	Tree Height (feet)	Tree Width (feet)	Maximum Tree Volume/Acre (1,000 cubic feet) ^a	Maximum Dilute Spray (gallons per acre) ^b
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	8	149	105
12	6	6	131	90

^a Maximum tree volume/acre = tree width x tree height x running feet or row per acre.

Running feet of row per acre = 43560 divided by the distance between rows.

^b Minimum dilute gallons per acre = approximately 0.7 gallon /1,000 cubic feet of tree volume.

increasing the concentrate to 10x. At concentrations of 5x or higher, one can reduce the mixing rate by 20 to 25 percent and achieve the same control. This is because sprays are no longer being applied to run-off.

Following are some precautions in the use of low-volume pesticide or growth regulator applications:

1. Use extreme care in calibrating the sprayer and maintaining a constant sprayer speed. As gallonage is decreased, errors become much more critical.
2. Choose calm, yet good drying conditions for spraying. This may mean spraying at night or early in the morning. Good coverage cannot be achieved when winds are over 5 miles-per-hour.
3. Prune trees to a very open canopy for spray penetration. Spray droplets will not penetrate large, thick trees.
4. Choose pesticide formulations that will mix satisfactorily. Pay careful attention to increased operator hazards and drift problems.

Tree Row Volume Spraying

Tree row volume (TRV) is a method of determining the dilute (1x) volume of a spray solution necessary to cover the entire tree surface. This is an objective method of determining the differences in spray volume required for different tree sizes and ages.

With the TRV method, the volume of dilute spray needed per acre can be easily calculated for each orchard based on tree age, size, amount of pruning, and row spacing. To determine the TRV, the between-row spacing, maximum tree height, and cross-row limb spread of trees must be accurately measured. See the step-by-step procedure below.

The TRV method also can be used to determine the pesticide rate for an orchard. Calculate the TRV gallonage for the orchard. Multiply this gallonage by the recommended dilute pesticide rate for dilute application.

For example, a fungicide is recommended at 2 lb/100 gal and is to be applied in an orchard with a TRV gallonage base of 400 gal/acre.

Therefore, the per acre rate for this pesticide is:
 $2 \text{ lb}/100 \text{ gal} \times 400 \text{ gal}/\text{acre} = 8 \text{ lb}/\text{acre}$.

To determine the rate of fungicide or insecticide per acre when using the low-volume spraying method (3x or greater), first calculate the dilute TRV gallonage. Multiply this concentrate gallonage by 0.75 to obtain a concentrate TRV gallonage. Multiply this concentrate gallonage by the recommended dilute pesticide rate per 100 gallons to determine the rate of pesticide per acre for concentration application.

For example, a fungicide is recommended at 2 lb/100 gal. and is to be applied at 5x in an orchard with a TRV gallonage base of 400 gal./acre. The rate of pesticide per acre is calculated as:

$$\begin{aligned} &(\text{TRV gallonage}) \\ &\times (0.75) \\ &\times \text{dilute pesticide rate}/100 \text{ gal.} \\ &= \text{concentrate pesticide application rate}/\text{acre} \end{aligned}$$

$400 \text{ gal.}/\text{acre} \times 0.75 \times 2 \text{ lb}/100 \text{ gal.} = 6.0 \text{ lb}/\text{acre}$
 If the TRV base gallonage is less than 200 gal/acre, use 200 gal. to compute the pesticide application rate.

	1x	2x	3x	4x	5x	6x	7x	8x	9x	10x
Apples	400	200	132	100	80	64	56	48	44	40
Peaches	300	150	100	75	60	50	45	38	33	30
Percent water savings over dilute		50%	67%	75%	80%	84%	86%	88%	89%	90%
	Greatest Savings					Diminished Savings				

How to calculate tree row volume gallonage:

Step 1

Calculate feet row/acre

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

Step 2

Calculate cubic feet of TRV/acre.
 Feet of row/acre (from Step 1)
 x tree height (ft)
 x cross-row limb spread (ft)
 = cu ft of TRV/acre

Step 3

Select density factors from Table 3.

Select the density factor that best indicates the canopy density of each separate orchard or block.

Step 4

Calculate TRV gallonage/acre

cu ft of TRV/acre (from Step 2) x density (from Step 3)

$$\frac{\quad \quad \quad}{1,000}$$

 = gallons of dilute solution applied per acre
 = TRV gal/acre

Example:

An orchard has rows spaced 20 feet apart, tree height is 14 ft and the cross row-limb spread is 12 ft. The tree density is 0.85.

Step 1

43,560 square ft/acre / 20 ft
 = 2,178 feet of row/acre

Step 2

2,178 x 14 ft x 12 ft
 = 365,904 cubic feet of TRV/acre

Step 3

Density has been given as 0.85.

Step 4

(365,904 x 0.85) / 1,000
 = 311 TRV gallons/acre

For additional information on calculating TRV gal/acre refer to the Ohio State Extension Bulletin 892 *Orchard Spray Rates: How to Determine the Amount of Pesticide and Water to Use in Your Orchard* by C. Welty.

Table 3. Determining density factors using tree density estimates.

0.70 gal./1,000 cubic feet	Trees extremely open, light visible through entire tree, less than 15 scaffold limbs per tree, young trees.
0.75 gal. /1,000 cubic feet	Trees very open, 18 to 21 scaffold limbs per tree, light penetration throughout the tree, healthy spurs within the tree canopy.
0.80 gal./1,000 cubic feet	Trees well pruned, adequate light in trees for healthy spurs throughout trunk and scaffold limbs, many holes in foliage where light can be seen through tree.
0.85 gal./1,000 cubic feet	Trees moderately well pruned, reasonable spur population within canopy, tree thick enough that light cannot be seen through the tree.
0.90 gal./1,000 cubic feet	Trees minimally pruned, spurs inside canopy are weak due to limited light, very few holes where light can be seen through the tree.
1.00 gal./1,000 cubic feet	Tree unpruned, extremely thick, no light visible anywhere through tree canopy, trees more than 20 feet high.

Spray Tank pH

Several pesticides break down rapidly in alkaline water. 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, Carzol, Cygon, Imidan, Kelthane, Malathion, and Omite are examples of compounds that are 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). Buffercide, Buffer-X, Unifilm B, and LI 700 Acidiphactant are examples of such buffering agents.

APPLE

About 400 gallons of dilute spray per acre are required to adequately cover an acre of mature, standard, well-pruned apple trees in full leaf, 20 to 22 feet in height, in rows spaced 35 feet apart.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
APPLE DORMANT TO SILVER TIP				
Apply before growth starts in spring and when temperatures are above 45F.				
Fire Blight	Bordeaux mixture	8-8-100, plus oil ¹		¹ If fire blight was severe last year, a Bordeaux mixture or fixed copper spray at silver tip is suggested. Use a dilute Bordeaux spray of 8 pounds copper sulfate, 8 pounds spray lime, and 1 gallon miscible superior oil per 100 gallons of water. To mix, dissolve the copper sulfate in one-half tank of water. Once completely dissolved, add the spray lime with constant agitation as the tank fills. Add the oil last but before completely filling the tank. The mixture must be agitated continuously. Do not apply after 1/4 -inch green leaf stage or when drying conditions are slow, as severe injury can occur. Bordeaux mixture and its residue have many compatibility problems with other pesticides. There are many fixed copper fungicides registered for use on apple. Fixed coppers can be mixed with oil. However, never combine copper sulfate alone with dormant oil.
	OR Fixed copper fungicides (Copper hydroxide) (Copper oxychloride) (Basic copper sulfates)			
Crown rot (Collar Rot)	Ridomil Gold EC			Refer to crown rot section on page 12 for fungicide use recommendations.
	OR Aliette 80WP			
	OR Phosphorous Acid			

APPLE GREEN TIP

If using a protectant fungicide program, begin sprays at green tip and repeat every seven days through second cover.

Primary scab	¹ Topsin-M 70 WSB	4 - 6 oz	1 - 1.5 lb	¹ Topsin-M and other formulations of thiophanate methyl are very similar in activity to Benlate and is an excellent alternative to Benlate on labeled crops. Topsin-M is also available in a flowable formulation (4.5FL). ² See note on Captan on page 14. ³ See note on Mancozeb and Polyram on page 12.
	<i>plus</i>			
	² Captan 50 WP or	1 lb	4 lb	
	Mancozeb 75 DF or	12 oz	3 lb	
	Polyram 80 DF	12 oz	3 lb	
	OR ² Captan 50 WP	1.5 lb	6 lb	
	OR Syllit 65 WP	0.25 - 0.5 lb	1 - 2 lb	
	OR Thiram 65 WP	2 lb	8 lb	
	OR Ziram 76 DF	2 lb	6 - 8 lb	
	OR ³ Mancozeb 75 DF	1.5 lb	6 lb	
OR ³ Polyram 80 DF	1.5 lb	6 lb		
OR Vanguard 75 WG		5 oz		
OR Scala 5 SC		7 - 10 fl oz		

APPLE GREEN TIP (cont.)

Primary Scab (continued)				Fungicide Resistance Management: Sovran, Pristine & Flint (strobilurin fungicides) and Nova, Rubigan and Procure (sterol-inhibiting fungicides): to limit the potential for development of fungicide resistance, do not make more than four applications of a strobilurin or sterol-inhibiting fungicide per season. In addition, no more than two sequential sprays of a strobilurin or sterol-inhibiting fungicide should be made without alternating to a fungicide with different chemistry. For example: two sprays of Sovran alternated with two sprays of Nova mixed with a broad spectrum protectant. See note on fungicide resistance management on page 14.
San Jose Scale, European Red Mite eggs, Aphid eggs	Superior oil <i>plus</i> Lorsban 4 E OR Lorsban 50 W OR Lorsban 75 WG OR Supracide 25 WP OR Supracide 2 E OR Diazinon AG 600	2 gal 0.5 - 1 pt 0.33 - 0.67 lb 1 - 2 pt 12.75 fl oz	2 - 3 lb 1 - 2.67 lb 4 - 6 lb 3 - 12 pt	Apply oil when temperature is above 40F; never during freezing weather. Check label for fungicide/oil compatibility. Oil is most effective when sprayed dilute under calm conditions to assure thorough coverage of all woody tissue. Where San Jose scale is a main target of oil sprays, the best timing for application is at green tip. Wait until half-inch green or pink if European red mite or rosy apple aphid is the primary target. Although Lorsban, Supracide, and Diazinon are labeled for use with oil to increase scale control, trials have shown that oil alone results in greater than 98 percent control of scales if coverage is thorough. Adding an insecticide does improve aphid control.
Spotted Tentiform Leafminer (monitoring)				Put pheromone traps in place now to monitor adult leafminer activity.

APPLE HALF-INCH GREEN

Primary Scab	Same as for green tip			Same as for green tip.
San Jose Scale	Same as for green tip OR Esteem 35 WP		4 - 5 oz	
European Red Mite eggs	Superior oil	2 gal		Oil application delayed until this time will give better control of mites than earlier applications.
Spotted Tentiform Leafminer, adults	OR Esteem 35 WP OR Ambush 25 WP OR Ambush 2 EC OR Asana XL 0.66 EC OR Danitol 2.4 EC OR Decis 1.5 EC OR Pounce 25 WP OR Pounce 3.2 EC OR Proaxis 0.5 EC OR Warrior 1 E OR Vydate L 2 L OR Endosulfan 50 WP OR Endosulfan 3 EC	2 - 5.8 fl oz	3 - 5 oz 6.4 - 25.6 oz 6.4 - 25.6 fl oz 4.8 - 14.5 fl oz 10.7 - 21.3 fl oz 0.9 - 1.9 fl oz 6.4 - 12.8 oz 4 - 8 fl oz 2.56 - 5.12 fl oz 2.5 - 5.1 fl oz 2 - 4 pt 1 lb 4 lb 0.67 qt 2.67 qt	Killing adults at half inch green is not as effective as killing hatching eggs at early petal fall. Control may be improved by spraying in the evening when moths are most active. Use of pyrethroids (Ambush, Asana, Pounce, Danitol, Decis, Proaxis, and Warrior) is likely to cause mite outbreaks because pyrethroids are persistent and kill mite predators. Esteem at this time will also control rosy apple aphids.

APPLE TIGHT CLUSTER

7 days after Half-Inch Green

Scab, Rust, and Powdery Mildew ¹ Extended Protectant Program 10-day Interval		Bayleton 50 WP or	0.5 - 2 oz	2 - 8 oz	¹ Growers using an <u>Extended Protectant</u> program should use an SI fungicide (Nova, Rubigan, or Procure) in combination (tank-mixed) with a protectant fungicide such as Captan, Mancozeb, Polyram, or Ziram through the period from at least tight cluster to second cover. With a 10-day spray interval, this should result in no more than four applications during this period. Sovran, Flint and Pristine are generally recommended for use alone. However, due to the risks of fungicide resistance development in the scab fungus, they should probably be tank-mixed with a protectant fungicide as well. ² Do not apply Flint with an organo silicate surfactant to avoid damage on leaves and fruit. ³ See note on Captan on page 14. ⁴ See note on Mancozeb and Polyram on page 12. Fungicide Resistance Management: See note on page 15.
		Nova 40 WP or	1.25 - 2 oz	5 - 8 oz	
		Rubigan EC or	3 fl oz	8 - 12 fl oz	
	OR	Procure 50 WP	3 - 4 oz	12 - 16 oz	
		Sovran 50 WG	1 - 1.6 oz	4 - 6.4 oz	
		² Flint 50 WG		2 - 2.5 oz	
	OR	Pristine 38 WG		14.5 - 18.5 oz	
		<i>plus</i>			
	³ Captan 50 WP or	1.5 lb	6 lb		
	⁴ Mancozeb 75 DF or	12 oz	3 lb		
	⁴ Polyram 80 DF or	12 oz	3 lb		
	Ziram 76 DF	1.5 - 2 lb	6 - 8 lb		

APPLE PINK

7-10 days after Tight Cluster

Scab, Rust, and Powdery Mildew	Same as for tight cluster.	A critical time for control for scab, rust and powdery mildew. Rust diseases need to be controlled with sprays at regular intervals from pink through the second cover spray. Nova, Bayleton, Rubigan, Procure, Mancozeb, Polyram, Ziram, Flint, Sovran and Pristine will control rust; Topsin-M and Captan will not. See green tip comments regarding primary scab fungicides.
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Pest/Problem	Material	Rate/100 gal	Rate/ Acre	Comments
APPLE PINK (cont.)				
Rosy Apple Aphid	Dimethoate 4 EC	0.5 - 1 pt	2 - 4 pt	Scout for curled leaves at early pink. Apply aphicide at pink if any curled leaves with rosy apple aphid inside are found.
	OR Dimethoate 25 WP	1 - 2 lb	4 - 8 lb	
	OR Dimethoate 2.67 EC	0.75 - 1.5 pt	3 - 6 pt	
	OR Lorsban 50 WP	8 - 12 oz	2 - 3 lb	
	OR Lorsban 75 WG	0.33 - .067 lb	1 - 2.67 lb	
	OR Endosulfan 50 WP	1 lb	4 lb	
	OR Endosulfan 3 EC	0.7 qt	2.7 qt	
	OR Diazinon 50 WP	1 lb	4 lb	
	OR Diazinon AG 600	12.7 fl oz	51 fl oz	
	OR Vydate 2 L	1 - 2 pt	4 - 8 pt	
	OR Danitol 2.4 EC		10.7 - 21.3 fl oz	
	OR Proaxis 0.5 EC		2.56 - 5.12 fl oz	
	OR Esteem 35 WP		3 - 5 oz	
	OR Assail 70 WP		1.1 - 1.7 oz	
	OR Calypso 4 F	0.5 - 1 fl oz	2 - 4 fl oz	
	OR Actara 25 WDA		4.5 oz	
Spotted Tentiform Leafminer	Same as half inch green			
	OR Carzol SP	4 - 5 oz	1 - 1.25 lb	
	OR Calypso 4 F	0.5 - 1 fl oz	2 - 4 fl oz	
	OR Assail 70 WP		1.1 oz	
	OR Actara 25 WDA		4.5 oz	
Tarnished Plant Bug	Endosulfan, Ambush, Asana, Danitol, Warrior, Proaxis, Decis Pounce as listed for tentiform leafminer at half-inch green			Use of pyrethroids (Ambush, Asana, Danitol, Proaxis, Pounce, and Warrior) is likely to cause mite outbreaks because they are persistent and kill mite predators.
	OR Avaunt 30 WDG	1 - 2 fl oz	5 - 6 oz	
	OR Calypso 4 F	0.5 - 1 fl oz	2 - 4 fl oz	
	OR Lannate 90 SP	0.1 - 0.2 lb	0.5 - 1 lb	
	OR Lannate LV	0.4 - 0.75 pt	1.5 - 3 pt	
San Jose Scale				Put pheromone traps in place now to monitor adult scale activity; crawlers are expected 4 to 6 weeks after adult emergence.
Nutrient Level	Solubor (boron)	1 lb	2 lb	Add Solubor to pesticide spray; check compatibility before adding. Urea can be added to pesticide sprays when needed.
	AND/OR Feed Grade Urea (nitrogen)	3 lb	3 lb	

Pest/Problem	Material	Rate/100 gal	Rate/ Acre	Comments
APPLE BLOOM				
7-10 days after Pink				
Scab, Powdery Mildew, and Rust	Same as for tight cluster.			Start fire blight sprays at the first sign of open blossoms. Repeat sprays at 4- to 5-day intervals through bloom and petal fall on susceptible varieties. If warm, wet weather occurs during bloom, it is critical that sprays are applied on a tight schedule using the maximum strength of 100 ppm (0.5 lb per 100 gal of streptomycin). Growers can improve timing and confidence in using streptomycin with assistance from a computer program (MARYBLYT). Streptomycin is not recommended for use after petal fall. Do not make more than 4 applications of streptomycin per season.
Fire Blight (Blossom Blight)	OR Streptomycin 17 W	0.5 lb	2 lb	
	plus Regulaid	0.25 lb	1 lb 1 pt	
Fire Blight (Shoot Blight)	<u>Growth Regulator</u> Apogee 27.5 W plus Regulaid		36 - 48 oz 1 pt	Consider using Apogee to reduce the threat of shoot blight on vigorous trees of susceptible varieties that have nearly filled their space. See comments on pages 12 - 13.
Insects or Mites	SAVE THE BEES! Do not use insecticides or miticides.			
Codling Moth (monitoring)	Pheromone traps		1 per 10 acres; minimum of 2 per block	Put out pheromone traps now to monitor adult codling moth activity. See page 14 for information on how to use traps to determine optimal timing of insecticides.
Codling Moth (control)	Isomate-C Plus		400 dispensers	See section on mating disruption on page 13. Additional products and formulations are also available.
Red Delicious shape	Promalin		1 pt	Apply in early bloom when most of the king flowers are open and before petals fall from the king flowers. Promalin can cause fruit thinning if guidelines for time of application are not followed.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
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APPLE PETAL FALL

7-10 days after Bloom

Scab, Powdery mildew and Rust	Same as for tight cluster.			
Fire Blight	Same as for bloom.			Continue sprays on susceptible varieties until all petals have fallen.
Plum Curculio, Leafrollers, Oriental Fruit Moth	Guthion 50 WP OR Imidan 70 WP OR Avaunt 30 WDG OR Ambush 25 WP OR Ambush 2 EC OR Asana XL OR Danitol 2.4 EC OR Decis 1.5 EC OR Pounce 25 WP OR Pounce 3.2 EC OR Proaxis 0.5 EC OR Warrior 1 E OR Surround	0.5 - 0.75 lb 0.75 - 1 lb 2 - 5.8 fl oz 25 - 50 lb	2 - 3 lb 2.1 - 5.3 lb 5 - 6 oz 6.4 - 25.6 oz 6.4 - 25.6 fl oz 4.8 - 14.5 fl oz 16 - 21.3 fl oz 0.9 - 1.9 fl oz 6.4 - 12.8 oz 4 - 8 fl oz 2.5 - 5.1 fl oz 2.5 - 5.1 fl oz	Peak hatch of redbanded leafroller usually coincides with petal fall. Control at this time helps prevent late-season problems. If plum curculio has been severe, increase Guthion or Imidan to high end rates. Use of pyrethroids (Asana, Ambush, Danitol, Decis, Pounce, Proaxis, and Warrior) is likely to trigger mite outbreaks because these insecticides are persistent and they kill predaceous mites that feed on European red mite and two-spotted spider mite.
Leafrollers	Products listed above for 3 species combined OR Intrepid 2 F OR Confirm 2 F OR Esteem 35 WP OR SpinTor 2 SC OR Entrust 80 WP	 2 - 4 fl oz 5 fl oz 1 - 1.5 fl oz 0.5 - 0.75 oz	 8 - 16 fl oz 20 fl oz 4 - 5 oz 4 - 6 fl oz 2 - 3 oz	
Plum Curculio	Products listed above for 3 species combined OR Calypso 4 F OR Assail 70 WP OR Clutch 50 WDA OR Actara 25 WDA OR Surround	 1 - 2 fl oz 25 - 50 lb	 4 - 8 fl oz 2.3 - 3.4 oz 3 oz 4.5 - 5.5 oz	
Oriental Fruit Moth	Products listed above for 3 species combined OR Assail 70 WP OR Calypso 4 F OR Clutch 50 WDA OR Intrepid 2 F OR SpinTor 2 SC	 1 - 2 fl oz 3 - 4 fl oz 1.25 - 2.5 fl oz	 2.3 - 3.4 oz 4 - 8 fl oz 3 - 6 oz 12 - 16 fl oz 2 - 3 oz	Oriental fruit moth is not present in many mid-western apple orchards.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
APPLE PETAL FALL (cont.)				
For Thinning Summer Varieties	Refer to section on thinning (p. 43)			
Nutrient level	Solubor (boron)	1 lb	4 lb	May be added to insecticide/fungicide spray solutions, but check for compatibility, and order of mixing, etc.
	AND/OR Feed Grade Urea	2 lb	8 lb	

APPLE FIRST AND SECOND COVER

Seven to 10 days after petal fall and 7 to 10 days later.

Scab and Fruit Rots	¹ Captan 50 WP	1.5 lb	6 lb	¹ See note on Captan on page 14.	
	OR Thiram 65 WP	1.5 lb	6 lb		
	OR Ziram 76 DF	2 lb	6 - 8 lb		
	OR ² Topsin-M 70 WSB	4 - 6 oz	1 - 1.5 lb		
	<i>plus</i> Captan 50 WP or Mancozeb 75 DF or Polyram 80 DF or Ziram 76 DF	1 lb 12 oz 12 oz 1.5 - 2 lb	4 lb 3 lb 3 lb 6 - 8 lb		
Scab, Rust, Powdery Mildew and Fruit Rots	Bayleton 50 WP	0.5 - 2 oz	2 - 8 oz	³ The sterol-inhibiting fungicides do not provide adequate control of fruit scab when applied alone. They should be combined with a protectant fungicide listed.	
	OR ³ Nova 40 WP	1.25 - 2 oz	5 - 8 oz		
	OR ³ Rubigan EC	3 fl oz	8 - 12 fl oz		
	OR ³ Procure 50 WP	3 - 4 oz	12 - 16 oz	⁴ See note on Mancozeb and Polyram on below. Sprays beyond second cover for powdery mildew control should be based on previous field history and orchard scouting.	
	OR Sovran 50 WG	1 - 1.6 oz	4 - 6.4 oz		
	OR Flint 50 WG		2 - 2.5 oz		
	OR Pristine 38 WG		14.5 - 18.5 oz		
	<i>Plus</i> Captan 50 WP or ⁴ Mancozeb 75 DF or ⁴ Polyram 80 DF or Ziram 76 DF	1.5 lb 12 oz 12 oz 1.5 - 2 lb	6 lb 3 lb 3 lb 6 - 8 lb		
	Fungicide Resistance Management: See note comments on page 14.				

Note on Mancozeb and Polyram (EBDC Products)

Mancozeb and Polyram cannot be used past bloom at the 6 lb per acre rate; however, the permissible 3 lb per acre rate may not be sufficient under heavy scab pressure. If sterol inhibiting (SI) fungicides (Nova, Rubigan or Procure) are used in an extended protectant program for primary scab control (tight cluster to second cover), the last spray containing the SI fungicide is a "transition spray," where you are moving from the use of the SI fungicide to strictly protectant fungicides for control of summer diseases and secondary scab. This "transition spray" should contain the full label rate of a protectant fungicide in combination with the SI fungicide. If growers choose to use Mancozeb or Polyram, no more than 3 lbs per acre can be used at this time. This rate may be too low, especially under heavy scab disease pressure. In situations such as this, growers should consider the use of Captan, which can be applied at higher rates in the "transition spray." Do not apply mancozeb or Polyram within 77 days of harvest.

Pest/Problem	Material	Rate/100 gal	Rate/ Acre	Comments
APPLE FIRST AND SECOND COVER (cont.)				
Blister Spot on 'Mutsu' ('Crispin')	Streptomycin 17 W	0.5 lb	2 lb	First application no later than 2 weeks following petal fall and followed weekly by two additional sprays. Do not concentrate Regulaid. Use 1 pt per 100 gal or 1 pt per acre.
	OR Streptomycin 17 W	0.25 lb	1 lb	
	<i>plus</i> Regulaid	1 pt	1 pt	
Codling Moth, Plum Curculio, Leafrollers, and Oriental Fruit Moth	Guthion, Imidan, Asana, Danitol, Decis, Proaxis, Warrior, Avaunt, Assail, Calypso, Clutch, or Surround as listed at petal fall for Plum Curculio.			Timing for plum curculio control usually extends through first cover. Codling moth control should be initiated at first or second cover based on timing of capture of moths in pheromone traps. See product labels for specific recommendations; timing ranges from 50 to 250 base 50 F degree-days after biofix; see page 15. Use Surround for plum curculio control only. Apply Intrepid or Confirm at 100 base 50 F degree-days after biofix. See page 14.
Codling Moth, Leafrollers, Oriental Fruit Moth	Intrepid 2 F	2.4 fl oz	16 fl oz	
	OR Confirm 2 F	5 fl oz	20 fl oz	
	OR SpinTor 2 SC	1 - 1.5 fl oz	4 - 6 fl oz	
	OR Entrust 80 WP		1.5 - 3 oz	
Codling Moth	Cyd-x		1 - 6 fl oz	Apply at beginning of egg hatch. Repeat at weekly intervals.
	OR Carpovirusine	1 pt		
	OR Virosoft CP4		1.3 fl oz	
Mites	Same as for mites at petal fall except do not use Carzol.			See miticide section on page 13.
San Jose Scale (crawlers)	Diazinon 50 WP	1 lb	4 lb	San Jose scale "crawlers" may be present by second or third cover in blocks of trees that had red spots on fruit and concentration of scales in the calyx end of fruit last year.
	OR Esteem 35 WP		4 - 5 oz	
	OR Provado 1.6 F	2 fl oz	8 fl oz	
	OR Assail 70 WP		3.4 fl oz	
	OR Centaur 70 WP		34.5 fl oz	
Green Apple Aphid	Same as for aphids at petal fall.			Do not use the AG 600 formulation of Diazinon after petal fall. Treat green apple aphid when numerous, but before excessive terminal leaf curling and honeydew deposits are observed.
Excess Crop	Refer to section on thinning on page 43.			
Cork Spot, Bitter Pit and Jonathan Spot	Calcium chloride	2 lb	8 lb	Start calcium chloride sprays in the first or second cover. Do not reapply calcium chloride anytime during the growing season if rain has not washed off residue from previous calcium spray. Do not exceed 4 pounds per acre for low volume spray.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
APPLE THIRD COVER				
Ten days after second cover.				
Scab, Fruit Rots,	¹ Captan 50 WP	1.5 lb	6 lb	¹ See note on Captan on page 14.
Sooty Blotch	OR Thiram 65 WP	1.5 lb	6 lb	
and Flyspeck	OR Ziram 76 DF	1.5 - 2 lb	6 - 8 lb	The strobilurin fungicides Sovran, Flint and
	OR Topsin-M 70 WSB	4 - 6 oz	1 - 1.5 oz	Pristine are very effective for control of most
	<i>plus</i>			summer fruit nuts as well as sooty blotch and
	¹ Captan 50 WP or	1 lb	4 lb	flyspeck. Topsin-M is also highly effective
	Ziram 76 DF	1.5 - 2 lb	6 - 8 lb	for prevention of sooty blotch and flyspeck.
	OR Sovran 50 WG	1 - 1.6 oz	4 - 6.4 oz	However, excessive use of Topsin-M may result
	OR Flint 50 WG		2 - 2.5 oz	in a buildup of resistant strains of the apple scab
	OR Pristine 38 WG		14.5 - 18.5 oz	fungus and/or increased mite injury due to the
Codling Moth,	Same as for first			adverse effect of this fungicide on predatory
Leafrollers,	and second cover.			mites.
Oriental Fruit				
Moth				
White Apple	Same as for petal fall			
Leafhopper	(except do not use			
	Ambush or Pounce).			
	OR Sevin 50 WP	1 lb	4 lb	Delay use of Sevin until at least 30 days after
	OR Sevin 80 S	0.7 lb	2.7 lb	full bloom to avoid fruit thinning.
	OR Sevin 4 F	0.5 qt	2 qt	
	OR Sevin XLR(4 EC)	0.5 qt	2 qt	
Apple Maggot	Guthion 50 WP	0.5 - 0.75 lb	2 - 3 lb	Apple maggot flies generally begin emerg-
	OR Imidan 70 WP	0.75 - 1 lb	2.1 - 5.3 lb	ing from the soil about mid-June. Monitor for
	OR Diazinon 50 WP	1 lb	4 lb	the first appearance of flies each year with a
	OR Sevin 80 S	0.9 lb	3.75 lb	detailed examination of fruit and leaves in
	OR Sevin 4 F	0.75 qt	3 qt	the center of trees, the use of yellow sticky
	OR Sevin XLR(4EC)	0.75 qt	3 qt	board traps baited with an attractant by hang-
	OR Sevin 50 WP	1.5 lb	6 lb	ing red or green spheres coated with a sticky
	OR Calypso 4 F	1 - 2 fl oz	4 - 8 fl oz	substance in trees, or with a combination of all
	OR Assail 70 WP		3 - 4 oz	three methods. Continue applications until late
	OR Clutch 50 WDA		3 oz	September or as long as flies are present. Use of
	OR Asana XL	2 - 5 .8 fl oz	4.8 - 14.5 fl oz	pyrethroids (Asana, Ambush, Pounce, Danitol,
	OR Danitol 2.4 EC		16 - 21.3 fl oz	Proaxis, and Warrior) or Sevin is likely to trig-
	OR Decis 1.5 EC		0.9 - 1.9 fl oz	ger mite outbreaks because these insecticides
	OR Proaxis 0.5 EC		2.5 - 5.1 fl oz	kill predaceous mites that feed on European red
	OR Warrior 1 E		2.5 - 5.1 fl oz	mite and two-spotted spider mite.
	OR Avaunt 30 WDG		5 - 6 oz	
	OR Entrust 80 WP		2 - 3 oz	
Aphids	Same as for petal fall.			
Mites	Same as for first cover.			Refer to miticide section on page 13. Vydate
	OR Vydate L	1 - 2 pt	2 - 4 pt	can cause fruit thinning if used within 30 days
San Jose Scale	Same as for first cover.			of bloom. Agri-Mek is not as effective once
crawlers				leaves harden off.
(if present)				
Cork Spot,	Same as for first cover.			
Bitter Pit, and				
Jonathan Spot				

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
APPLE SUMMER COVER SPRAYS				
Depending on rainfall, apply at intervals of 10 to 14 days.				
Scab, Fruit Rots, Sooty Blotch and Flyspeck	Same as for third cover.			See comments under third cover regarding late season use of Topsin-M. Check preharvest interval and re-entry restrictions of various materials before making the final application.
Codling Moth	Same as for first and second cover.			Apply Intrepid or Confirm at the initiation of egg hatch for the second generation, 1200 degree days after biofix.
Apple Maggot	Same as for third cover.			
Mites	Same as for third cover.			Refer to the miticides on page 13.
Leafhoppers	Same as for third cover.			
Spotted Tentiform Leafminer	Same as for petal fall except do not use Ambush or Pounce.			Treatment is recommended if there is an average of more than two miners per leaf from petal fall to mid-summer, and more than three miners per leaf for the late-summer third generation. Vydate may cause fruit thinning if used within 30 days of bloom.
	OR Vydate 2 L	1 - 2 pt	2 - 4 pt	
	Same as for first and second cover.			
Leafrollers	OR <i>Bacillus thuringiensis</i> (Agree, Biobit, Dipel Javelin, and others)			<i>Bacillus thuringiensis</i> sprays will kill only caterpillar larvae that ingest residues. Reapply at 4- to 5-day intervals; thorough coverage is essential.
Japanese Beetle	Imidan 70 WP OR Sevin 80 S OR Sevin 4 F OR Neemix 4.5 OR Assail 70 WP OR Warrior 1 E OR Proaxis 0.5 EC	0.75 - 1 lb 0.9 lb 0.75 qt	2.1 - 5.3 lb 3.75 lb 3 qt 7 - 16 fl oz 2.3 - 3.4 oz 2.5 - 5.1 fl oz 2.5 - 5.1 fl oz	
Woolly Apple Aphid	Diazinon 50 WP OR Dimethoate 4 EC OR Endosulfan 3 EC OR Endosulfan 50 WP	1 lb 0.5 - 1 pt 0.7 qt 1 lb	4 lb 2 - 4 pt 2.7 qt 4 lb	
Aphids	Same as for petal fall.			
Cork Spot, Bitter Pit and Jonathan Spot	Same as for first cover.			During August and September, the rate for calcium chloride may be increased to 3 lb/100 gal or 12 lb/acre.

Special Problems and Pests of Apple

For more detailed information on disease and insect control and integrated pest management (IPM), growers should obtain a copy of the **Midwest Tree Fruit Pest Management Handbook**. The handbook should be used in conjunction with this spray guide, and can be obtained from your state cooperative extension service.

Crown Rot (Collar Rot) of Apple

Ridomil Gold EC is labeled for use on bearing apple trees. Applications should be made before symptoms appear, especially in areas of the orchard where water drainage is poor. Ridomil Gold EC will not revitalize trees showing moderate to severe crown rot symptoms. Mix 0.5 pint of Ridomil Gold EC with 100 gal of water. Apply the amount of diluted mixture indicated in the table below, around the trunk of each tree. Applications should be made in early spring before growth starts, and in the fall after harvest and before the ground freezes. On new plantings, delay the first application until 2 weeks after planting. To determine trunk diameter, measure the trunk 12 inches above the soil line.

Trunk Diameter	Quarts of Diluted Mixture/Tree
< 1 inch	1 quart
1-3 inches	2 quarts
3-5 inches	3 quarts
> 5 inches	4 quarts

Notes: (1) Do not dip roots of trees or spray bare roots with solutions containing Ridomil Gold EC.

(2) Do not graze in or feed cover crops from treated orchards. Illegal residues may occur.

Aliette 80 WDG (Fosetyl-Al) is registered as a foliar spray for control of collar and root rot on apples and pears. Under moderate disease pressure, apply Aliette 3 or 4 times at 5 lb/100 gal on a 60-day spray interval, or 6 to 8 times at 2.5 lbs/100 gal on a 30-day schedule. Make the first application in the spring, after sufficient foliage is present to absorb the chemical. Do not apply more than 5 lb of Aliette per acre per application. Do not exceed 20 lb of Aliette per acre per season. Nursery tree resets and new plantings should be treated after leaf emergence. Do not apply within 2-3 weeks of leaf color change in the fall. Foliage must be green and living for Aliette to be taken up and transported to the roots. Read the label.

Phosphorous Acid (phosphonates and phosphites)

Several products containing phosphorous acid are being registered in the United States as nutritional supplements and "plant conditioners." A few of these products are being registered for use as fungicides for control of root and collar rot on pome fruit (apple and pear). Agri-Fos is a systemic fungicide registered for control of root and collar rot on apple and pear. Its active ingredient is phosphorous acid. This is essentially the same active ingredient in Aliette, and the use recommendations for Aliette and Agri-Fos are very similar. Both Agri-Fos and Aliette are applied as a

foliar spray. The active ingredient is highly systemic and will translocate down the tree to the crown and roots. No currently registered fungicides, other than Aliette, have this type of systemic activity. The Agri-Fos label states "Apply at 1.25 to 2.5 quarts per acre. One to two month intervals between treatments. Under high disease pressure, use higher application rate and shorter interval. Ensure thorough coverage."

Restrictions On EBDC Products

Users should carefully read, understand, and follow all restrictions prior to using EBDC products. EBDC products have two rate recommendations, depending upon how you choose to use the fungicides. Label recommendations for Mancozeb are identical for apples and pears. The following information is taken from the label:

1. Pre-Bloom Use. Begin applications at 1/4- to 1/2-inch green tip and continue on a 7- to 10-day schedule through-bloom. **DO NOT:** 1) apply more than 6 lb Mancozeb per acre per application; 2) apply more than 24 lb of Mancozeb or Polyram per acre, per year; 3) apply after bloom.

2. Extended Application Schedule Or Use In Tank Mixtures. Begin applications at 1/4- to 1/2-inch green tip and continue applications on a 7- to 10-day schedule through the second cover spray. **DO NOT:** 1) apply more than 3 lb per acre per application; 2) apply within 77 days of harvest; 3) apply more than 21 lb of Mancozeb or Polyram per acre per year. **DO NOT combine or integrate the two treatment schedules.**

Shoot Fire Blight Management with Apogee

Apogee (prohexadione calcium) inhibits gibberellin biosynthesis, resulting in an early cessation of terminal growth. Shoots with inhibited growth are less susceptible to fire blight; therefore, the potential for the build up of fire blight during the summer is reduced significantly. Consider using Apogee to reduce the threat of shoot blight on vigorous trees of susceptible varieties that have nearly filled their tree space. Apogee only decreases host susceptibility; it does not affect the pathogen directly. Apogee is not a substitute for streptomycin for blossom blight control during bloom. If needed, Apogee can be combined with streptomycin in one of the bloom sprays.

Timing. Apogee 27.5 W should be applied at full bloom to early petal fall on the king blooms for maximum effectiveness. Apogee is considerably less effective if applied too late. The decrease in blight susceptibility will not occur until about 10 days to 2 weeks after application.

Application rate and number. A rate of 36 to 48 oz of Apogee 27.5 W per acre is recommended for trees that require 300 to 400 gallons of dilute spray per acre, respectively, or 12 oz per 100 gallons of dilute spray. The effectiveness of lower per acre rates for blight control drops off

Special Problems and Pests of Apple (cont.)

quickly. In the Midwest, two applications of Apogee at 10 to 12 oz per 100 gal should be sufficient for preventing fire blight spread in the summer, but overly vigorous trees may need a third application (see label).

Additives. The non-ionic surfactant Regulaid should be used with Apogee. Follow the manufacturer's rate recommendations. If Apogee is applied in hard water (water that contains high levels of calcium carbonate), 1 lb of spray-grade ammonium sulfate should be used for each pound of Apogee.

Comments. Growth control with Apogee is not concentration dependent. There is no difference in shoot growth control between dilute and concentrate sprays, provided the total amount of chemical per acre is the same. The level of growth control with Apogee is rate dependent. The greatest and quickest reduction is obtained at the recommended rate, and the effect on growth declines as the rate is reduced.

Mating Disruption for Codling Moth Control

Isomate C-Plus, No-Mate CM, and CheckMate CM dispensers are registered for control of codling moth. They dispense the sex attractant of the codling moth and are designed to prevent male moths from locating females for mating. Sprayable formulations also are available. This strategy, termed mating disruption, is most likely to succeed in blocks of at least 5 acres where initial populations of codling moth are low. If mating disruption is used for codling moth control in smaller blocks or where infestations are greater, border sprays, or at least one or two cover sprays, will also be necessary. Controlling codling moth by mating disruption will not control other insect pests that are controlled by cover sprays (plum curculio and apple maggots, for example).

Apple Borers

The dogwood borer and American plum borer are caterpillars that attack burrknot tissue on apple trunks. Flat-headed and round-headed apple borers are beetle larvae that attack tree trunks, often in association with mechanical or other injury or generally weakened trees. Any of these borers can be treated with Lorsban 50 W at a rate of 3 lb per 100 gallons of spray applied no later than 28 days before harvest. For dogwood borer, the best insecticide timing is at peak egg hatch, which is in late June in the central Midwest. For American plum borer, the best timing is at petal fall. For flat-headed and round-headed apple borers, apply insecticide in the spring. Apply borer sprays to the trunk and lower branches, soaking the bark. DO NOT apply Lorsban to the fruit or foliage.

Pyrethroid Insecticides

Use of pyrethroid insecticides (Ambush, Asana, Danitol,

Decis, Pounce, Proaxis, or Warrior) is likely to cause mite outbreaks. These materials are highly toxic to predatory mites that feed on spider mites and have a long residual activity. Danitol is a pyrethroid that is toxic to predatory spider mites. Use of Danitol is less likely to lead to spider mite outbreaks than other pyrethroids.

Miticides for Apple

The following miticides are registered for use on apples. Refer to product label for registered uses, amount of use, harvest restrictions, and remarks for use on other crops.

Brand Name	Rate Per 100 Gal.	Rate Per Acre	Days to Harvest	MOA Group^f
"Superior oil"	2 gal	-----	(Before pink)	
Acramite 50 WS		0.75 - 1 lb	7	25
AgriMek 0.15 EC ^a	2.5 fl oz	10 fl oz	28	6
Apollo SC	1 - 2 fl oz	4 - 8 fl oz	45	10A
Carzol 92 SP	4 - 5 oz	1 - 1.25 lb	(By petal fall)	1A
Dicofol 1.6 EC	1.5 qt	4 - 10 qt	14	UN
Envidor 2 SC		16 - 18 fl oz	7	23
FujiMite 5 EC		1 - 2 pt	14	21
Kanemite 15 SC		21 - 31 fl oz	14	20B
Kelthane 50 W*	0.75 - 1.5 lb	3 - 6 lb	7	UN
M-Pede ^{bc}	1 - 2%	1.2 gal	++	
Nexter 75 WP ^d		4.4 - 10.67 oz	25	21
Pyramite 60 W ^d	2.2 - 3.3 oz	4.4 - 13.2 oz	25	21
Saf-T-Side ^b	1 - 2%	-----	++	
Savey 50 WP		3 oz	28	10A
SunSpray ^b	1 - 2%	1 - 2 gal	++	
Vendex 50 W	4 - 8 oz	1.3 lb	14	12B
Vydate L ^e	1 - 2 pt	2 - 4 pt	14	1A
Zeal 72 WDG		2 - 3 oz	28	10B

⁺⁺ Apply before waxy bloom forms on fruit.

^a Apply within 2 weeks after petal fall.

^b Do not use with Captan, Sevin, or other sulfur containing products.

Do not apply when temperatures exceed 90°F.

^c Not very effective alone. Enhances efficacy of other miticides.

^d Allow at least 30 days between sequential applications.

^e Vydate may cause fruit thinning if used within 30 days of bloom.

^{*} Not permitted for use in Wisconsin.

^f MOA is mode of action classification; for resistance management, it is best to rotate to products from a different group.

Notes on Soaps and Horticultural Oils

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

Special Problems and Pests of Apple (cont.)

A summer oil alone, at a concentration of 1 to 2 percent by volume, provides some control of mites and aphids (rosy apple aphid, apple grain aphid, green apple aphid, and spirea aphid). Limited observations suggest that aphid control is likely to be greatest if oil is applied when clusters are at the 0.25 inch green stage. M-Pede alone reduces mite, aphid, pear psylla, and white apple leafhopper populations, but control may not be satisfactory or long-lasting unless multiple sprays are applied. Unlike oils, M-Pede is not ovicidal. If applied alone, a summer oil is likely to be more effective for aphid and (especially) mite control than M-Pede. Data from Michigan indicate that adding M-Pede at 2 percent by volume to full-rate sprays of Vendex, Kelthane, and presumably other miticides, greatly enhances the control they provide.

Phytotoxicity, leaf drop, and fruit blemishes should be major concerns when deciding to use summer oil or soap. To prevent damage to foliage or fruits, never use a summer oil with Captan, Sevin, or other sulfur-containing pesticides. Allow at least 14 days between applications of sulfur-containing compounds and the use of a summer oil. Do not apply oils if temperatures exceed 90°F or drying conditions are poor. Because of concerns about fruit russetting, some authorities suggest that insecticidal soaps should be used only in nonbearing orchards. Oils and soaps must be mixed at the proper dilution (1 to 2 percent); concentrated sprays will be less effective and more phytotoxic. Deposits of large droplets or the coalescing of droplets on fruit or foliage also increases the likelihood of

Timing of First^a Insecticide Spray for Codling Moth Control on Apple and Pear

Degree-days (base 50F) after biofix ^b	Insecticide Products
50 – 75	Dimilin Rimon
100 – 200	Intrepid Confirm
150 – 250	Calypso Assail Clutch
250	Guthion Imidan Avaunt Pyrethroids (Asana, Danitol, Decis, Proaxis, Warrior) Virus (Cyd-X, Carpovirusine, Virosoft CP4)

^a A second spray should be made 10 - 14 days later.

^b Biofix is defined as the date on which pheromone traps detect sustained flight of moths.

leaf damage and fruit blemishes.

Fungicide Resistance Management

Many of our most effective fungicides have a high risk for resistance development in the fungi they control. These include Topsin-M, Scala, Vanguard, the sterol-inhibiting fungicides (Nova, Rubigan, and Procure) and the strobilurin fungicides (Sovran, Pristine and Flint). Because they all have very specific modes of action, fungi such as the apple scab and the powdery mildew pathogens can rapidly develop resistance to them. Fungicide resistance, or at least reduced sensitivity, has been observed for apple scab and powdery mildew to both the sterol-inhibitor and strobilurin fungicides in the United States.

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

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

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

Most Captan formulations (Captan 50 W, Captan 80 W, Captan 80 WDG, Captan 4 L) are currently available with a 24 hour REI. The REI was reduced from 4 days to 24 hours for apples, cherries, plums/fresh and prune, and peaches. However, some formulations produced by certain companies still have the 4 day REI. All 80 WDG formulations of Captan have the 24 hour REI. The Captan 50 W, Captan 80 W, and Captan 4 L formulations from the Drexel company have the 24 hour REI. The Captan 4 L formulation from MICROFLO has the 24 hour REI; however, the MICROFLO Captan 50 W and Captan 80 W still have the 4 day REI. Growers need to read the label of the product they plan to purchase to make sure it has the 24 hour or 4 day REI.

PEAR

About 400 gallons of dilute spray per acre are required to adequately cover an acre of mature pear trees in full leaf, 16 to 18 feet in height, and in rows 30 feet apart.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
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PEAR DORMANT TO SILVER TIP

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

Fire Blight	Bordeaux mixture	8-8-100, plus oil (see comments)		If fire blight was severe last year, a Bordeaux mixture or fixed copper spray at silver tip is suggested. Use a dilute Bordeaux spray of 8 pounds copper sulfate, 8 pounds spray lime, and 1 gallon miscible superior oil per 100 gallons of water. To mix, dissolve the copper sulfate in one-half tank of water. Once completely dissolved, add the spray lime with constant agitation as the tank fills. Add the oil last but before completely filling the tank. The mixture must be agitated continuously. Do not apply after 1/4 -inch green leaf stage or when drying conditions are slow, as severe injury can occur. Bordeaux mixture and its residue have many compatibility problems with other pesticides. There are many fixed copper fungicides registered for use on pears. Fixed coppers can be mixed with oil. However, never combine copper sulfate alone with dormant oil.
	OR Fixed Copper Fungicides (Copper hydroxide) (Copper oxychloride) (Basic copper sulfates)			

PEAR LATE DORMANT

Before buds break into green tip in the spring.

Scale Insects, European Red Mite eggs	Superior oil	2 gal		Apply when temperatures are above 40F - never during freezing weather. Do not apply within 2 weeks of a sulfur spray, within 7 days of a Captan spray, or later than delayed dormant.
European Red Mite eggs	Apollo SC OR Savey 50 WP	1 - 2 fl oz	4 - 8 fl oz 3 - 6 oz	Limit one Apollo or Savey application per year.
Pear Psylla (adults)	Ambush 25 WP OR Ambush 2 EC OR Asana XL 0.66 EC OR Danitol 2.4 EC OR Decis 1.5 EC OR Pounce 25 WP OR Pounce 3.2 EC OR Proaxis 0.5 EC OR Warrior 1 E OR Calypso 4 F OR Actara 25 WG OR Assail 70 WP OR Esteem 35 WP OR Dimilin 25 W OR Dimilin 2 L OR Surround	7.3 -12.8 fl oz	12.8 - 25.6 oz 18.8 - 25.6 oz 9.6- 19.2 fl oz 16 - 21.3 fl oz 1.9 fl oz 12.8 - 25.6 oz 8 - 16 fl oz 2.5 - 5.1 fl oz 2.5 - 5.1 fl oz 2 fl oz 8 fl oz 5.5 oz 2.3 - 3.4 oz 4 - 5 oz 2.5 - 3 lb 40 - 48 fl oz	Ambush and Pounce may be combined with 2 to 8 gallons of oil per acre for dormant through delayed dormant periods only. Apply this rate of Asana only during dormant to pre-bloom (white bud) stage only. Apply Surround every 7 to 14 days, beginning no later than green tip.

PEAR PRE-BLOOM

When blossom buds are separated in the cluster before bloom.

Pear Scab		¹ Topsin-M WSB	4 oz	1 lb	¹ Topsin-M contains the same active ingredients as Benlate and can be used in place of Benlate.
	OR	Ferbam 76 WP	1.5 lb	6 lb	
	OR	² Rubigan EC	3 - 4 fl oz	8 - 12 fl oz	² Rubigan and Procure will also control powdery mildew. Refer to the label for further information on recommended rates for use.
	OR	² Procure 50 WP	2 - 4 oz	8 - 16 oz	
	OR	³ Mancozeb 75 DF	0.75 - 1.5 lb	3 - 6 lb	
	OR	Ziram 76 DF	2 lb	6 - 8 lb	
	OR	⁴ Sovran 50 WG	1 - 1.6 oz	2 - 2.5 oz	³ See Note on EBDC products, page 3 of apple schedule, for directions on use of Mancozeb.
	OR	⁴ Flint 50 WG		2 - 2.5 oz	
	OR	⁴ Pristine 38 WG		14.5 - 18.5 oz	
	OR	Scala 5 SC		7 - 10 fl oz	
OR	Vanguard 75 WG		5 oz	⁴ Sovran, Flint and Pristine will also control powdery mildew. Refer to the label for further information.	
Pear Psylla (adults)	Same as for late dormant.				

PEAR BLOOM

Pear Scab	Same as for pre-bloom.			Mancozeb may not be applied past bloom above the 3 lb per acre rate. Do not apply within 77 days of harvest.	
Fire Blight		Streptomycin 17 W	0.5 lb	2 lb	Start fire blight sprays at the first sign of open blossoms; repeat sprays at 4- to 5-day intervals through bloom and petal fall. If warm, wet weather occurs during Fire Blight schedule, use the maximum strength of 100 ppm (0.5 lb per 100 gal).
	OR	Streptomycin 17 W	0.25 lb	1 lb	
		<i>plus</i> Regulaid	1 pt	1 pt	
Insects or Mites	SAVE THE BEES! Do not use insecticides during bloom.				

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
PEAR PETAL FALL				
Pear Scab	Same as for pre-bloom.			
Fire Blight	Same as for bloom.			Continue sprays for fire blight until the last petals have fallen.
Plum Curculio, Tarnished Plant Bug, Stink Bugs	Guthion 50 WP OR Imidan 70 WP OR Avaunt 30 WDG OR Confirm 2 F OR Danitol 2.4 EC OR Warrior 1 E OR Proaxis 0.5 EC OR Capture 2 E OR Discipline 2 EC OR Decis 1.5 EC	0.5 - 0.75 0.75 - 1 lb 5 fl oz	2 - 3 lb 2.13 - 7.1 lb 5 - 6 oz 20 fl oz 16 - 21.3 fl oz 2.5 - 5.1 fl oz 2.5 - 5.1 fl oz 2.6 - 12.8 fl oz 2.6 - 12.8 fl oz 0.9 - 1.9 fl oz	
Pear Psylla (nymphs)	Actara, Assail, Calypso, or Esteem as at late dormant (page 16) OR Provado 1.6 F OR Clutch 50 WDA OR Nexter 75 WP OR Fujimite 5 EC OR Centaur 70 WP OR Mitac 50 WP	5 fl oz	20 fl oz 4 - 6 oz 6.6 - 10.7 oz 1 - 2 pt 34.5 oz 1.5 - 3 lb	Apply Mitac now and again in 10 days at first cover. Apply only when daily maximum temperatures exceed 50F.
Pear Rust Mite	OR Agri-Mek 0.15 EC Nexter 75 WP OR Envidor 2 SC OR Carzol 92 SP OR Endosulfan 50 WP OR Endosulfan 3 EC	2.5 - 5 fl oz 4 oz 1 lb 0.7 qt	10 - 20 fl oz 5.2 - 10.7 oz 16 - 18 fl oz 1.25 lb 4 - 5 lb 2.7 - 3.3 qt	Rust mite is also controlled by Mitac.

PEAR FIRST AND SECOND COVER

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

Pear Scab	Same as for pre-bloom.			Asana, used at first cover for psylla also controls codling moth and plum curculio. Dimilin is effective against codling moth but not plum curculio. Apply Dimilin 50 - 75 degree-days after codling moth biofix (see page 14).
Codling Moth, Plum Curculio	Same as for plum curculio at petal fall. OR Assail 70 WP OR Dimilin 75 W OR Dimilin 2 L		1.7 - 3.4 fl oz 0.75 - 1 lb 12 - 16 fl oz	
Pear Psylla	OR Same as at petal fall. Agri-Mek 0.15 EC	2.5 - 5 fl oz	10 - 20 fl oz	Psylla control required for first cover only; not required for second cover. Best results found when psylla is in adult or young nymphal stage. Agri-Mek at 10 oz rate gives 3-4 weeks of control; 20 oz rate gives season-long control.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
PEAR SUMMER COVERS				
Apply at 10 to 14 days intervals observing harvest restrictions and limitations.				
Pear Scab Sooty Blotch and Flyspeck	Same as for pre-bloom except for Vangard ¹ , Scala ¹ and Mancozeb ² .			Rubigan and Procure will not control sooty blotch and flyspeck, and should not be used past second cover. Sovran, Flint and Pristine provide excellent control of summer fruit rots as well as sooty blotch and flyspeck.
Codling Moth	Guthion 50 WP	0.5 - 0.75 lb	2 - 3 lb	
	OR Imidan 70 WP	0.75 - 1 lb	2.1 - 7.1 lb	
	OR Calypso 4 F	1 - 2 fl oz	4 - 8 fl oz	
	OR Assail 70 WP		1.7 - 3.4 oz	
	OR Clutch 50 WDA		3 - 6 oz	
	OR Intrepid 2 F	4 fl oz	16 fl oz	
	OR Confirm 2 F	0.75 qt	20 fl oz	
	OR Dimilin 75 W		0.75 - 1 lb	
	OR Dimilin 2 L		12 - 16 fl oz	
	OR Asana XL	2 - 5.8 fl oz	4.8 - 14.5 fl oz	
	OR Capture 2 E		2.6 - 12.8 fl oz	
	OR Danitol 2.4 EC	5 fl oz	16 - 21.3 fl oz	
	OR Decis 1.5 EC		0.9 - 1.9 fl oz	
	OR Discipline 2 EC		2.6 - 12.8 fl oz	
	OR Proaxis 0.5 EC		2.5 - 5.1 fl oz	
	OR Warrior 1 E		2.5 - 5.1 fl oz	
	OR Sevin 80 S	0.75 - 1 lb	3.75 lb	
	OR Sevin 4 F	0.75 qt	3 qt	
	OR Sevin XLR(4EC)	0.75 qt	3 qt	
	OR SpinTor 2 SC	2 - 3.3 fl oz	6 - 10 fl oz	
	OR Entrust 80 WP		2 - 3 oz	
Pear Psylla (if a problem)	Same as at first cover.			
San Jose scale (crawlers)	Esteem 35 WP		4 - 5 oz	
	OR Diazinon 50 W	1 lb	4 lbs	
	OR Provado 1.6 F	2 fl oz	8 fl oz	
	OR Assail 70 WP		3.4 oz	
	OR Centaur 70 WP		34.5 oz	
European red mite	Savey 50 DF		3 - 6 oz	
	Apollo 1 SC		4 - 8 fl oz	
	Agri-Mek 0.15 ED	2.5 - 5 fl oz	10 - 20 fl oz	
	Acramite 50 WS		0.75 - 1 lb	
	FujiMite 5 EC		1 - 2 pt	
	Kanemite 15 SC		21 - 31 fl oz	
	Envidor 2 SC		16 - 18 fl oz	
	Nexter 75 WP		4.4 - 5.2 oz	
Mealybug	Provado 1.6 F	5 fl oz	20 fl oz	
	Actara 25 WA		4.5 - 5.5 fl oz	
	Calypso 4 F	1 - 2 fl oz	4 - 8 fl oz	

¹Vangard and Scala have a 72 day PHI. All Mancozeb products have a 77 day PHI.

²See note on Mancozeb on page 3.

CHERRY

About 300 gallons of dilute spray per acre are required to adequately cover an acre of mature cherry trees in full leaf, 14 to 16 feet in height, and in rows 30 feet apart.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
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CHERRY DORMANT

Before buds break in the spring.

European Red	Superior oil	2 gal		
Mite eggs	OR Apollo SC	0.5 - 2 fl oz	1.5 - 6 fl oz	

CHERRY EARLY BLOOM

Brown Rot (Blossom Blight)	¹ Topsin-M 70 WSB <i>plus</i>	8 oz	1.5 lb	¹ Topsin-M and the sterol-inhibiting fungicides (Nova, Indar, Elite, and Orbit) should always be alternated or combined with another fungicide, such as Captan, so as to minimize the development of resistance. Topsin-M is very similar in activity to Benlate and is an excellent alternative to Benlate on labeled crops. Topsin-M is also available in a flowable formulation (4.5 FL).
	² Captan 50 WP	1.3 lb	4 lb	
	OR ² Captan 50 WP	1.3 lb	4 lb	
	OR ³ Rovral 50 WP	5 - 10.5 oz	1 - 2 lb	
	OR Wettable sulfur 95%	6 lb	18 lb	
	OR ⁴ Nova 40 WP	1.25 - 2 oz	2.5 - 6 oz	
	OR ⁵ Indar 75 WSP		2 oz	
	OR Elite 45 DF	2 oz	6 oz	
	OR ⁵ Orbit 41.8 L		4 fl oz	
	OR Procure 50 WS	3 - 4 oz	9 - 12 oz	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	
	OR Elevate 50 WG		1 - 1.5 lb	
	OR Captevate 68 WDG		3.75 lb	
				³ No more than 2 sprays of Rovral may be applied per season, and Rovral cannot be applied after petal fall on any stone fruit.
				⁴ Nova is registered for control of brown rot blossom blight, leaf spot, and powdery mildew on cherries. Do not apply more than 3.25 pounds of Nova 40 WP per acre per season, nor within 7 days of harvest.
				⁵ Apply Indar and Orbit in a minimum of 50 gallons of water per acre.

CHERRY FULL BLOOM

Brown Rot (Blossom Blight)	Same as for early bloom.
Insects or Mites	SAVE THE BEES! Do not apply insecticides during bloom.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
CHERRY PETAL FALL				
Brown Rot (Blossom Blight)	Same as for early bloom.			Rovral cannot be applied after petal fall.
Leaf Spot	Bravo	1 - 1.4 pt	3 - 4 pt	Except for sulfur, all materials listed for brown rot under early bloom may be used for both brown rot and leaf spot. Do not apply Bravo after shuck split. Do not apply more than 36 fl oz of Rubigan per acre per season.
	OR Syllit 65 WP	5.2 - 11 oz	1 - 2 lb	
	OR Rubigan EC	2 - 4 fl oz	6 - 12 fl oz	
	OR Indar 75 WSP		2 oz	
	OR Elite 45 DF	2.6 oz	8 oz	
	OR Procure 50 WS	3.3 - 5.3 oz	10 - 16 oz	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	
	OR Flint 50 WG		2 - 4 oz	
Powdery Mildew	Wettable sulfur 95%	6 lb	18 lb	
	OR Nova 40 WP	0.8 - 2 oz	2.5 - 6 oz	
	OR Rubigan EC	2 - 4 fl oz	6 - 12 fl oz	
	OR Elite 45 DF	2.6 oz	8 oz	
	OR Procure 50 WS	3.3 - 5.3 oz	10 - 16 oz	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	
Plum Curculio	Guthion 50 WP	0.5 lb	1.5 lb	Do not use Imidan on sweet cherries.
	OR Imidan 70 WP	0.75 lb	2.13 - 2.5 lb	
	OR Ambush 25 WP	1.6 - 3.2 oz	6.4 - 12.8 oz	
	OR Ambush 2 EC	1.6 - 3.2 fl oz	4.8 - 9.6 oz	
	OR Pounce 25 WP	2.1 - 4.1 oz	4.8 - 9.6 oz	
	OR Pounce 3.2 EC	1.3 - 2.7 fl oz	4 - 8 fl oz	
	OR Asana XL 0.66 EC	2 - 5.8 fl oz	4.8 - 14.5 fl oz	
	OR Warrior 1 E		2.5 - 5.1 fl oz	

CHERRY SHUCK-FALL

When shucks have split and are falling from expanding fruit.

Leaf Spot	Topsin-M 70 WSB	8 oz	1.5 lb	
	<i>plus</i>			
	¹ Captan 50 WP	1.3 lb	4 lb	¹ See note on Captan on page 14.
	OR Captan 50 WP	1.3 lb	4 lb	
	OR Nova 40 WP	0.8 - 2 oz	2.5 - 6 oz	
	OR Rubigan	2 - 4 fl oz	6 - 12 fl oz	
	OR Indar 75 WSP		2 oz	
	OR Elite 45 DF	2.6 oz	8 oz	
	OR Procure 50 WS	4 - 5.3 oz	12 - 16 oz	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	
	OR Flint 50 WG		2 - 4 oz	
	OR ² Bravo	1 - 1.4 pt	3 - 4 pt	² Do not apply Bravo after shuck-fall.
Powdery Mildew	Same as petal fall.			
Plum	Same as petal fall.			

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
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CHERRY FIRST COVER SPRAY

Ten days after shuck-fall.

Leaf Spot	Same as for shuck-fall except not Bravo.		Do not apply Bravo after shuck-fall.	
Powdery Mildew and Leaf Spot	Same as for petal fall.			
Plum Curculio and Cherry	Guthion 50 WP	0.5 lb	1.5 lb	Note: Lorsban may be used on tart cherries only; it is phytotoxic on sweet cherries. SpinTor and Provado control cherry fruit fly only.
Fruit Fly	OR Imidan 70 WP	0.75 lb	2.1 - 2.5 lb	
	OR Lorsban 50 WP	1 lb	3 lb	
	OR Lorsban 70 WG	0.33 - 0.67 lb	1 - 2.67 lb	
	OR SpinTor 2 SC	1 - 2 fl oz	4 - 8 fl oz	
	OR Asana XL 0.66 EC	2 - 5.8 fl oz	4.8 - 14.5 fl oz	
	OR Provado 1.6 F	2 fl oz	4 - 8 fl oz	
	OR Warrior 1 E		2.5 - 5.1 fl oz	
	OR Entrust 80 WP		1.25 - 1.5 oz	

CHERRY SECOND COVER SPRAY

Ten days after first cover.

Leaf Spot	Same as for shuck-fall, except not Bravo.		Do not apply Bravo after shuck-fall.
Powdery Mildew	Same as for petal fall.		
Leaf Spot	Same as for petal fall.		
Plum Curculio and Cherry Fruit Fly	Same as for first cover.		

CHERRY ADDITIONAL COVER SPRAYS

Ten days after second cover, then every 10 to 14 days.

Brown Rot	Same as for early bloom, except not Rovral.		Do not apply Rovral after petal fall.
Leaf Spot	Same as for shuck-fall, except not Bravo.		Do not apply Bravo after shuck-fall.
Powdery Mildew	Same as for petal fall.		
Cherry Fruit Fly	Guthion, Imidan, Asana, Provado, Warrior, Entrust, or SpinTor, same as first cover.		Note: Lorsban may be used on tart cherries only. It is phytotoxic on sweet cherries.
	OR Diazinon 50 WP	1 lb	3 lb
	OR Diazinon AG 600	6.5-12.7 fl oz	19.5-38.2 fl oz
	OR Sevin 80 S	1.25 lb	3.75 lb
	OR Sevin 4 F	1 qt	3 qt
	OR Sevin XLR (4EC)	1 qt	3 qt
	OR Lorsban 50 WP	1 lb	3 lb
	OR Lorsban 70 WG	0.33 - 0.67 lb	1 - 2.67 lb
Borer Control	Refer to section on borers of peach and stone fruit trees on pages 31 - 32.		

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
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CHERRY PRE-HARVEST SPRAYS

Beginning 3 to 4 weeks before harvest.

Brown Rot	Topsin-M 70 WSB	8 oz	1.5 lb	Pre-harvest use restrictions and limitations are variable according to product; refer to label for details. ¹ See note on Captan on page 14.
	<i>plus</i>			
	¹ Captan 50 WP	1.3 lb	4 lb	
	OR Captan 50 WP	1.3 lb	4 lb	
	OR Indar 75 WSP		2 oz	
	OR Elite 45 DF	2.6 oz	8 oz	
	OR Orbit 41.8 L		4 fl oz	
	OR Procure 50 WS	4 - 5.3 oz	12 - 16 oz	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	
	OR Flint 50 WG		2 - 4 oz	
OR Elevate 50 WDG		1 - 1.5 lb		
OR Captevate 68 WDG		3.75 lb		

CHERRY POST-HARVEST SPRAYS

Leaf Spot	Bravo 720 F	1 - 1.4 pt	3 - 4 pt	¹ Bravo can be applied on cherries after harvest. Make one application of Bravo to foliage within 7 days after fruit is removed. In orchards with a history of high leaf spot incidence, make a second application 10 to 14 days later.
	OR Syllit 65 WP	5.2 - 11 oz	1 - 2 lb	
	OR Nova 40 WP	0.8 - 2 oz	2.5 - 6 oz	
	OR Rubigan EC	2 fl oz	6 fl oz	
	OR Elite 45 DF	2.6 oz	8 oz	
Leaf Spot and Powdery Mildew	Nova 40 WP	0.8 - 2 oz	2.5 - 6 oz	
	OR Rubigan EC	2 - 4 fl oz	6 - 12 fl oz	
	OR Indar 75 WSP		2 oz	
	OR Elite 45 DF	2.6 oz	8 oz	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	

PEACH

About 300 gallons of dilute spray per acre are required to adequately cover an acre of mature peach trees in full leaf and 10 to 12 feet in height in rows 25 feet apart.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
PEACH DORMANT				
After leaves drop in the fall or before buds swell in spring.				
Peach Leaf Curl	Bravo	1 - 1.4 pt	3 - 4 pt	
	OR Carbamate 76 WDG	1.5 lb	4.5 lb	
	OR Ziram 76 DF	1.25 - 2.7 lb	3.75 - 8 lb	
	OR Copper hydroxide (Kocide)	4 lb	8 - 16 lb	
	OR Copper oxychloride (C-O-C-S)	4 lb	8 - 16 lb	
	OR Bordeaux mixture	6-6-100		
Mites	Superior oil	2 gal		
San Jose Scale	Esteem 35 WP		4 - 5 oz	

PEACH PINK

Brown Rot (Blossom Blight)	¹ Topsin-M 70 WSB	8 oz	1.5 lb	¹ Topsin-M, and the sterol-inhibiting fungicides (Nova, Indar, Elite, and Orbit) should always be alternated or combined with another fungicide such as Captan, so as to minimize the development of resistance. Topsin-M is also available in a flowable formulation (4.5 FL). ² See note on Captan on page 14. ³ No more than 2 applications of Rovral can be made per season, and Rovral may not be applied after petal fall on stone fruit. ⁴ Apply Orbit and Indar in a minimum of 50 gallons of water per acre.
	<i>plus</i>			
	² Captan 50 WP	1.3 lb	4 lb	
	OR Bravo 720 F	1 - 1.4 pt	3.1 - 4.1 pt	
	OR ² Captan 50 WP	2.6 lb	8 lb	
	OR ³ Rovral 50 WP	5 - 10.5 oz	1 - 2 lb	
	OR Wettable sulfur 95%	6 lb	18 lb	
	OR Ziram 76 DF	1.5 - 2.7 lb	4.5 - 8 lb	
	OR Nova 40 WP	0.8 - 2 oz	2.5 - 6 oz	
	OR ⁴ Orbit 41.8 L	1.3 fl oz	4 fl oz	
	OR ⁴ Indar 75 WSP		2 oz	
	OR Elite 45 DF	2 oz	6 oz	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	
OR Elevate 50 WDG		1 - 1.5 lb		
OR Scala 5 SC		9 - 18 fl oz		
OR Vanguard 75 WG		5 oz		

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
PEACH PINK (cont.)				
Tarnished Plant Bug and Stink Bug	Ambush 2 EC		6.4 - 9.2 fl oz	As pink begins to show, examine trees for tarnished plant bug. If present, apply insecticides. Make application before any blooms open. Use of pyrethroids (Ambush, Asana, Pounce, Warrior, or Proaxis) can cause mite outbreaks because they are persistent and kill mite predators.
OR	Ambush 25 WP		6.4 - 19.2 oz	
OR	Asana XL 0.66 EC		4.8 - 14.5 fl oz	
OR	Pounce 3.2 EC	2 - 5.8 oz	6 - 17 fl oz	
OR	Pounce 25 WP	2.1 - 8.5 oz	6.4 - 25.6 oz	
OR	Guthion 50 WP	0.65 - 0.75 lb	1.75 - 2.25 lb	
OR	Sevin 80 S	1.25 lb	3.75 lb	
OR	Sevin 4 F	1 qt	3 qt	
OR	Sevin XLR (4EC)	1 qt	3 qt	
OR	Endosulfan 50 WP	1 lb	3 lb	
OR	Endosulfan 3 EC	0.7 qt	2.7 - 3.3 qt	
OR	Carzol 92 SP	4 oz	1 - 1.25 lb	
OR	Provado 1.6 F	2 fl oz	4 - 8 fl oz	
OR	Warrior 1 E		2.5 - 5.1 fl oz	
OR	Proaxis 0.5 EC		2.5 - 5.1 fl oz	

Oriental Fruit Moth (monitoring)	Refer to petal fall.			Pheromone traps to monitor Oriental fruit moth should be in place now to determine the need for sprays at petal fall.
Oriental Fruit Moth (mating disruption)	Isomate-M 100		100 - 150 dispensers	Place dispensers in upper third of tree now. Note, pheromone traps in orchards with mating disruption are expected to catch no moths ('trap shutdown'). See page 31.
OR	CheckMate - OFM		108 - 150 dispensers	
OR	3M Sprayable Pheromone		1.7 - 2.5 fl oz	

PEACH FULL BLOOM

Brown Rot (Blossom Blight)	Same as for pink.			
Insects or Mites	SAVE THE BEES! Do not apply insecticides during bloom.			

PEACH PETAL FALL

Brown Rot	Same as for pink.			Do not apply Rovral after petal fall.
Lesser Peachtree Borer (monitoring)				If borers have been a problem (gummosis on scaffold branches), set up a pheromone trap now to monitor moth flights to determine timing of borer sprays. See comments on pages 31 - 32.
Oriental Fruit Moth, Plum Curculio, Catfacing Insects (Tarnished Plant Bug, Stink Bugs)	Ambush, Asana, Pounce, Guthion, Warrior, or Proaxis as at pink			Catfacing is worst where weed control is poorest. Keep weeds mowed regularly. See comments at pink about the use of pyrethroids.
OR	Imidan 70 WP	0.75 - 1 lb	2.13 - 4.25 lb	
Oriental Fruit Moth	OR SpinTor 2 SC	1 - 2 fl oz	4 - 8 fl oz	
	OR Entrust 80 WP		1.25 - 1.5 oz	
	OR Intrepid 2 F		10 - 16 oz	

Pest/Problem	Material	Rate/ 100 gal	Rate/ Acre	Comments
PEACH SHUCK-SPLIT				
Brown Rot and Scab	Topsin-M 70 WSB	8 oz	1.5 lb	
	<i>plus</i>			
	¹ Captan 50 WP	1.3 lb	4 lb	¹ See note on Captan on page 14.
	OR ² Bravo	1 - 1.4 pt	3.1 - 4.1 pt	² Do not apply Bravo after shuck-split.
	OR Captan 50 WP	2.6 lb	8 lb	
	OR Wettable sulfur 95%	6 lb	18 lb	
OR Ziram 76 DF	1.5 - 2.7 lb	4.5 - 8 lb		
OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz		
Powdery Mildew	Nova 40 WP	0.8 - 2 oz	2.5 - 6 oz	Do not apply Rovral after petal fall.
	OR Elite 45 DF	2.6 oz	8 oz	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	
Bacterial Spot	Mycoshield 17 WP	12 oz	36 oz	See notes about bacterial spot on page 31.
	OR Wettable sulfur 95%	6 lb	18 lb	
Plum Curculio, Catfacing Insects	Same as for petal fall.			
Oriental Fruit Moth	Same as for petal fall.			
European Red Mite	Acramite 50 WS		0.75 - 1 lb	
	OR Vendex 50 WP	4 - 8 oz	1 - 2 lb	
	OR Apollo SC		4 - 8 oz	
	OR Nexter 75 WP		4.4 - 5.2 oz	
	OR Savey 50 WP		3 - 6 oz	
	OR Envidor 2 SC		16 - 18 fl oz	
PEACH FIRST COVER				
Seven to 10 days after shuck-split.				
Brown Rot and Scab	Topsin-M 70 WSB	8 oz	1.5 lb	
	<i>plus</i>			
	¹ Captan 50 WP	1.3 lb	4 lb	¹ See note on Captan on page 14.
	OR Captan 50 WP	2.6 lb	8 lb	
	OR Wettable sulfur 95%	6 lb	18 lb	
	OR Ziram 76 DF	1.5 - 2.7 lb	4.5 - 8 lb	Do not apply Bravo after shuck-split.
OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz		
Powdery Mildew	Nova 40 WP	0.8 - 2 oz	2.5 - 6 oz	Nova can be applied on a 10- to 14-day interval for powdery mildew control until terminal growth stops.
	OR Elite 45 DF	2.6 oz	8 oz	
	OR Wettable sulfur 95%	6 lb	18 lb	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	
Plum Curculio, Catfacing Insects	Same as for shuck-split.			
Oriental Fruit Moth	Same as for petal fall.			
European Red Mite	Same as for shuck-split.			

Pest/Problem	Material	Rate/ 100 gal	Rate/ Acre	Comments
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PEACH FIRST COVER (cont.)

Lesser Peachtree Borer				Control of the first generation of lesser peachtree borer is during the time of peak moth flight, which is usually in late May or early June (see pages 31 - 32).
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PEACH SECOND COVER

Ten days after first cover.

Brown Rot and Scab	Same as for first cover.
Powdery Mildew	Same as for first cover.
Plum Curculio, Oriental Fruit Moth, Catfacing Insects	Same as for shuck-split.
Mites	Same as for shuck-split.

PEACH THIRD, FOURTH, AND ADDITIONAL COVERS

Apply at 10- to 14-day intervals.

Brown Rot and Scab	Same as for first cover.			Scab requires control until fruit is within 40 days of harvest.
Powdery Mildew	Same as for first cover.			
Oriental Fruit Moth	Same as for petal fall.			
Mites	Same as for shuck-split.			
San Jose Scale	Esteem 35 WP OR Diazinon 50 W OR Centaur 70 WP	4 - 5 oz 4 lb 34.5 oz		Time application for first activity of crawlers.
Peachtree Borer				Peachtree borer is best controlled by a trunk drench at the time of peak moth flight, usually in early August (see pages 31 - 32).

Pest/Problem	Material	Rate/100 gal	Rate/ Acre	Comments
PEACH PRE-HARVEST				
Apply according to label directions beginning 3 to 4 weeks before harvest.				
Brown Rot	Topsin-M 70 WSB	8 oz	1.5 lb	Pre-harvest use, restrictions, and limitations are variable according to product; refer to label for details. ¹ See note on Captan on page 14.
	<i>plus</i>			
	¹ Captan 50 WP	1.3 lb	4 lb	
	OR Captan 50 WP	2.6 lb	8 lb	
	OR Ziram 76 DF	1.5 - 2.7 lb	4.5 - 8 lb	
	OR Wettable sulfur 95%	6 lb	18 lb	
	OR Orbit 41.8 L		4 fl oz	
	OR Indar 75 WSP		2 oz	
	OR Elite 45 DF	2 oz	6 oz	
OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz		
Oriental Fruit Moth, Japanese Beetle, and Green June Beetle	Sevin 80 S	1.25 lb	3.75 lb	Sevin is suggested here because it can be used up to 3 days before harvest. Oriental fruit moth pheromone traps will indicate the need for control. Provado does not control Oriental fruit moth.
	OR Sevin 4 F	1 qt	3 qt	
	OR Sevin XLR (4EC)	1 qt	3 qt	
	OR Provado 1.6 F	2 fl oz	4 - 8 fl oz	

PLUM

About 300 gallons of dilute spray per acre are required to adequately cover an acre of mature trees in full leaf and 12 to 14 feet in height, in rows spaced 25 feet apart.

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
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PLUM DORMANT

Before buds break in the spring.

Black Knot				Prune out all black knots during the dormant period, making cuts 6 to 8 inches below any knots. Remove these prunings from the orchard and burn or bury them.
European Red Mite and Scale Insects	Superior oil	2 gal		Apply when temperatures are above 40F — never during freezing weather.

PLUM PRE-BLOOM

Brown Rot (Blossom Blight) and Black Knot	Topsin-M 70 WSB	8 oz	1.5 lb	Topsin-M should always be combined with another fungicide such as Captan, so as to minimize the development of resistance.
	<i>plus</i> ¹ Captan 50 WP	1.3 lb	4 lb	
	OR ² Bravo	1 - 1.4 pt	3.1 - 4.1 pt	Topsin-M is also available in a flowable formulation (4.5 FL).
	OR Captan 50 WP	2 lb	6 lb	
			¹ See note on Captan on page 14.	
				² Bravo cannot be applied after shuck-split.
Brown Rot (Blossom Blight)	Topsin-M 70 WSB	4 - 5.3 oz	0.75 - 1 lb	³ No more than two applications of Rovral can be made per season, and Rovral cannot be applied after petal fall on stone fruit.
	<i>plus</i> ¹ Captan 50 WP	1.3 lb	4 lb	
	OR ² Bravo	1 - 1.4 pt	3.1 - 4.1 pt	
	OR Captan 50 WP	2 lb	6 lb	
	OR ³ Rovral 50 WP	5 - 10.5 oz	1 - 2 lb	
	OR Wetable sulfur 95%	6 lb	18 lb	
	OR Orbit 41.8 L		4 fl oz	
	OR Pristine 38 WG	3.5 - 4.8 oz	10.5 - 14.5 oz	
	OR Elevate 50 WDG		1 - 1.5 lb	
	OR Scala 5 SC		9 - 18 fl oz	
OR Vanguard 75 WG		5 oz		

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
PLUM FULL BLOOM				
Brown Rot (Blossom Blight) and Black Knot	Same as for pre-bloom.			
Brown Rot (Blossom Blight)	Same as for pre-bloom.			
Insects or Mites	SAVE THE BEES! Do not apply insecticides during bloom.			

PLUM PETAL FALL

Brown Rot (Blossom Blight) and Black Knot	Same as for pre-bloom.			Bravo cannot be applied after shuck-split.
Brown Rot (Blossom Blight)	Same as for pre-bloom.			Rovral cannot be applied after petal fall.
Plum Curculio	Guthion 50 WP	0.5 - 0.625	1.75 - 2.5 lb	Failure to control curculio may result in an increase in brown rot.
	OR Imidan 70 WP	0.75 - 1 lb	2.13 - 4.25 lb	
	OR Asana XL	2 - 5.8 fl oz	4.8 - 14.5 fl oz	
	OR Warrior 1 E		2.5 - 5.1 fl oz	

PLUM SHUCK-SPLIT

Brown Rot and Black Knot	Same as for pre-bloom except not Bravo.			Bravo cannot be applied after shuck-split.
Brown Rot	Topsin-M 70 WSB	8 oz	1.5 lb	Rovral cannot be applied after petal fall.
	<i>plus</i>			
	¹ Captan 50 WP	1.3 lb	4 lb	¹ See note on Captan on page 14.
	OR Captan 50 WP	2 lb	6 lb	
	OR Wettable sulfur 95%	6 lb	18 lb	
	OR Bravo	1 - 1.4 pt	3.1 - 4.1 pt	
	OR Pristine 38 WG	3.5 - 4.8 fl oz	10.5 - 14.5 fl oz	
Plum Curculio	Same as for petal fall.			
Mites (if present)	OR Acramite 50 WS		0.75 - 1.0 lb	
	OR Nexter 75 W		4.4 - 5.2 oz	
	OR Vendex 50 WP	4 - 8 oz	1 - 2 lb	
	OR Savey 50 WP		3 - 6 oz	Limit one application of Savey per year.
	OR Envirdor 2 SC		16 - 18 fl oz	
	OR Agri-Mek 0.15 EC	2.5 - 5 fl oz	10 - 20 fl oz	

Pest/Problem	Material	Rate/100 gal	Rate/Acre	Comments
FIRST PLUM COVER SPRAY				
Seven to 10 days after shuck-split.				
Black Knot	Same as for pre-bloom except not Bravo or same as shuck-split.			Bravo cannot be applied after shuck-split.
Brown Rot	Same as for pre-bloom except not Bravo and Rovral or same as shuck-split.			Rovral cannot be applied after petal fall.
Plum Curculio	Same as for petal fall.			
Peachtree Borers				Refer to section on peachtree borers on page 32.

SECOND AND ADDITIONAL PLUM COVER SPRAYS

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

Brown Rot	Same as shuck-split.			
Plum Curculio	Same as for petal fall.			
Japanese Beetle	Sevin 80 S	1.25 lb	3.75 lb	
	OR Sevin 4 F	1 qt	3 qt	
	OR Sevin XLR (4 EC)	1 qt	3 qt	
	OR Provado 1.6 F	2 fl oz	4 - 8 fl oz	
	OR Warrior 1 E		2.5 - 5.1 fl oz	

PLUM PRE-HARVEST SPRAYS

Beginning 3 to 4 weeks before harvest.

Brown Rot	Topsin-M 70 WSB	8 oz	1.5 lb	Pre-harvest use, restrictions, and limitations are variable according to product; refer to label for details.
	<i>plus</i>			
	¹ Captan 50 WP	1.3 lb	4 lb	¹ See note on Captan on page 14.
	OR Captan 50 WP	2 lb	6 lb	
	OR Orbit 41.8 L	1.3 fl oz	4 fl oz	
	OR Pristine 38 WG	3.5 - 4.8 fl oz	10.5 - 14.5 fl oz	

Special Problems and Pests of Peach and Other Stone Fruit

Bacterial Spot of Peach

Bacterial spot of peach can be a serious problem in certain varieties, areas and years. The disease is favored by stormy, rainy weather during June and July. It causes the most damage in areas where the soil is sandy and where the sand is blown by strong winds. Planting cultivars that are resistant to bacterial spot provides the best control. Control programs using foliar sprays of zinc sulfate plus lime, or fall applications of copper with or without lime, have been tried in the past. None of these programs offered reliable control and, in some cases, caused foliar and twig damage. An antibiotic, oxytetracycline (Mycoshield Agricultural Terramycin, 17 percent AI), gave good control when properly applied. For best results, oxytetracycline must be used at 12 oz per 100 gallons of dilute spray. Use dilute or 2X; higher concentrates are not effective and may be phytotoxic. Once per week spraying of the entire tree is essential. If only one side of the tree is sprayed (alternate row middle), make certain the other side of the tree is sprayed within 3 to 4 days. Begin sprays at shuck-split and continue at 7-day intervals until 3 weeks before harvest. Captan and Syllit are also labeled for control of bacterial spot; see Syllit label for further information (Dodine, formerly known as Cyprex, is currently marketed as Syllit). Copper sprays, applied for peach leaf curl at leaf drop, may also aid in control of bacterial spot.

Phytophthora Root, Crown, and Collar Rots

Peach rootstocks are highly susceptible to *Phytophthora* root, crown, and collar rots. The main defense against these diseases is providing good soil drainage through proper site selection and tiling. However, Ridomil Gold EC will provide additional protection in wet years, on marginal sites, or in wetter sections of the orchard. Applications should be made just before growth starts in the spring and at 2- to 3-month intervals thereafter if soil is very wet. Apply to the soil beneath the tree canopy in sufficient water to ensure good coverage (material is moved into the soil by subsequent rain or irrigation). Ridomil Gold EC is also registered for use on cherries (sweet and sour), nectarines, plums and prunes. See label for further information and use rates.

Phosphorous Acid (phosphonates and phosphites)

Several products containing phosphorous acid are being registered in the United States as nutritional supplements and "plant conditioners." A few of these products are being registered for use as fungicides for control of root rot and collar rot on stone fruits. Agri-Fos is a systemic fungicide registered for control of root and collar rot of all stone fruit. The active ingredient is phosphorous acid. This is essentially the same active ingredient in Aliette, and the use recommendations for Aliette and

Agri-Fos are very similar. Aliette is registered for use on non-bearing trees only. Agri-Fos is registered for use on bearing and non-bearing trees. Agri-Fos is applied as a foliar spray. The active ingredients are highly systemic and will translocate down the tree to the crown and roots. No currently registered material, other than Aliette, has this type of systemic activity. The Agri-Fos label states "Use 2.5 quarts per acre. Three treatments are required: 1) spring; 2) mid-summer; and 3) fall, post-harvest." Several other fungicides containing phosphorous acid are also being introduced.

Mating Disruption for Peach Pests

Several mating disruption products are registered for control of oriental fruit moth, lesser peachtree borer, and peachtree borer. They dispense species-specific sex attractants that are designed to prevent male moths from locating and mating with females. This strategy is most likely to succeed in blocks of at least 5 acres where initial populations of these pests are low. If mating disruption is used in smaller blocks or where infestations are greater, border sprays or additional sprays may be necessary. Mating disruption will not manage other insect pests that are normally controlled by cover sprays (plum curculio, green June beetle, and plant bugs). Mating disruption has been effective against oriental fruit moth. Although Isomate-LPTB is labeled for both lesser peachtree borer and peachtree borer, efficacy for borer control is still unknown.

Borers of Peach, Cherry and Plum Trees

The peachtree borer, lesser peachtree borer, and shothole borer often infest peach, apricot, cherry and plum trees. Peachtree borers infest the trunk at the soil line, while lesser peachtree borers infest scaffold limbs and the upper trunk. The peachtree borer is primarily a pest of young trees, whereas the lesser peachtree borer is a pest of older trees. The shothole borer is often found in trees of low vigor with dead and/or diseased limbs. Moths of the two peachtree borers lay their eggs on the surface of the bark; shothole beetles lay their eggs in the inner bark. Some of the regularly applied cover sprays aid in controlling borers; however, specific trunk and scaffold branch sprays are often required. Pheromone traps are available to monitor emergence of the adult (moth) stage of lesser peachtree borer and peachtree borer. Knowledge of the time of initial moth emergence and peak emergence can aid in proper timing of insecticide applications because insecticides target the hatching eggs laid by the newly emerged moths. See "Table of Insecticides Used to Manage Borers of Peach, Cherry, and Plum Trees" on page 32.

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

Borer	Material	Rate/100 gal	Rate/Acre	Comment
Lesser Peachtree Borer	¹ Lorsban 4 EC	1.5 - 3 qt		The pheromone trap for lesser peachtree borer should be in place by peach petal fall (usually mid to late April), in time to detect the first of the two generations of this pest. Lorsban is not labeled for use on plums. Use only Pounce, Ambush, Endosulfan or Warrior on plums. Where lesser peachtree borer has been a light-to-moderate problem, apply insecticide once at the peak of the second moth flight (often mid-August, usually post-harvest). Where lesser peachtree borer has been a moderate to heavy problem, make two applications: one 7 to 14 days after emergence of first-generation moths begins (spray mid-May to early June), and the second at the peak of the second-generation moth flight (often mid-August).
	OR ² Endosulfan 3 EC	1 qt		
	OR ² Endosulfan 50 WP	1.5 lb		
	OR Asana XL 0.66 EC	2 - 5.8 fl oz	4.8 - 14.5 fl oz	
	OR Ambush 2 EC		6.4 - 19.2 fl oz	
	OR Ambush 25 WP		6.4 - 19.2 oz	
	OR Pounce 25 WP		6.4 - 25.6 oz	
	OR Pounce 3.2 EC		4 - 12 fl oz	
	OR ³ Lorsban 50 WP		2 - 3 lb	
	OR Warrior 1 E		2.5 - 5.1 fl oz	
	OR ⁴ Isomate LPTB		100 - 250	
Peachtree Borer	¹ Lorsban 4 EC	3 qt		The pheromone trap for peachtree borer should be in place by early June to detect the first emergence of the single generation of this pest where peachtree borer has been a light to moderate problem, make a single spray at the time of peak moth emergence (usually in late July or early August). Where peachtree borer has been a moderate to heavy problem, make two applications, one 7 to 14 days after moth emergence begins and another 6 to 8 weeks later.
	OR Asana XL 0.66 EC	2 - 5.8 fl oz		
	OR ² Endosulfan 50 WP	1.5 lb		
	OR ² Endosulfan 3 EC	1 qt		
	OR ³ Lorsban 50 WP		2 - 3 lb	
	OR Warrior 1 E		2.5 - 5.1 fl oz	
	OR ⁴ Isomate-p		100 - 250 dispensers	
Peachtree Borer, Preplant Dip	Lorsban 75 WG	4 lb		Dip trees several inches above the graft and plant immediately or allow to dry before returning to storage. Do not allow trees to remain in the dip solution.
	Lorsban 4 E	3 qt		
Shothole Borer	Insecticide sprays are not effective.			Maintain tree health and vigor, prune dead and dying limbs, and remove dead trees to prevent beetle problems.

¹Lorsban 4 EC: Apply as trunk spray; do not contact fruit. On peach or nectarine, do not make more than one application per season, nor within 14 days of harvest; on cherry, make two pre-harvest applications (the last one at least 6 days before harvest) and one post-harvest application.

²Thiodan 3 EC or 50 WP: Do not make more than two applications during the fruiting period, nor within 21 days of harvest of peach, nectarine, or cherry.

³Lorsban 50 W is labeled for borer control on sour cherry, but not on sweet cherry, peach, or nectarine.

⁴See Mating Disruption, page 31.

Pre-harvest Intervals and Restricted Entry Intervals (REI)* for Common Fungicides

Trade Names	Common Names	FRAC Code**	Preharvest Interval — Days					REI* (Hours)
			Apple	Pear	Peach	Cherry	Plum	
Aliette	fosetyl-AL	33	14***	14***	—	—	—	12
Agri-Fos, Phostrol, Prophyt	phosphorous acid	33	0	0	0	0	0	4
Agri-strep	streptomycin	25	50	30	—	—	—	12
Bayleton	triadimefon	3	0	0	—	—	—	12
Bravo	chlorothalonil	M	—	—	***	***	***	48
Captan	captan	M	0	—	0	0	0	****
Captivate	captan + fenhexamid	M + 17	—	—	—	0	—	24
Carbamate	ferbam	M	7	7	21	0	—	24
Dithane M-45	mancozeb	M	77***	77***	—	—	—	24
Elevate	fenhexamid	17	—	—	0	0	0	12
Elite	tebuconazole	3	—	—	0	0	—	12
Flint	trifloxystrobin	11	14***	14***	1	1	1	12
Indar	fenbuconazole	3	—	—	0	0	—	12
Manzate 200	mancozeb	M	77***	77***	—	—	—	24
Mycoshield	oxytetracycline	—	—	60	21	—	—	***
Nova	myclobutanil	3	14	—	7***	7***	—	24
Orbit	propiconazole	3	—	—	0***	0***	0***	24
Penncozeb	mancozeb	M	77***	77***	—	—	—	24
Polyram	metiram	M	77***	—	—	—	—	24
Pristine	pyraclostrobin + boscalid	11 + 7	**	**	0***	0***	0***	12
Procure	triflumizole	3	14	14	—	1	—	12
Ridomil	mefenoxam	4	***	—	0	0	0	12
Rovral	iprodione	2	—	—	***	***	***	24
Rubigan	fenarimol	3	30	30	—	0	—	12
Scala	pyrimethanil	9	72	72	2**	—	2**	12
Sovran	kresoxim-methyl	11	30***	30***	—	—	—	12
Sulfur	sulfur	M	0	0	0	0	0	24
Syllit, Cyprex	dodine	M	7	—	15***	0	—	48
Thiram	thiram	M	0	—	7	—	—	24
Topsin-M	thiophanate-methyl	1	0	1***	1	1	1	12
Vanguard	cyprodinil	9	72	72	2	2	2	12
Ziram	ziram	M	14	14	14	14	—	48

— Not registered or recommended.

* All fungicides have a REI, which 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.

** FRAC Code represents the Mode of Action of the fungicide. For fungicide resistance management, do not tank mix or alternate fungicides with the same FRAC number in spray program. M = multi-site inhibitors

*** Limited number of applications allowed or other restrictions apply - REFER TO LABEL DIRECTIONS.

**** The REI for most formulations of Captan is 24 hr; however, some product labels still have a 4 day REI. See note on Captan REI for tree fruit on page 14.

Note on Fungicide Resistance Management

For fungicide resistance management, avoid successive applications of fungicides within the same group or with the same types of chemistry.

Strobilurin fungicides include: azoxystrobin (Abound), trifloxystrobin (Flint), kresoxim-methyl (Sovran), and pyraclostrobin (Pristine).

Sterol-inhibiting fungicides include: triadimefon (Bayleton), tebuconazole (Elite), fenbuconazole (Indar), propiconazole (Orbit), and fenarimol (Rubigan).

Benzimidazole fungicide: thiophanate-methyl (Topsin-M).

The following fungicides are also at risk for resistance development: mefenoxam (Ridomil Gold), iprodione (Rovral), thiophanate-methyl (Topsin M), cyprodinil (Vanguard), and pyrimethanil (Scala).

The following fungicides are broad spectrum protectants and are not considered at risk for fungicide resistance development: captan (Captan), ferbam (Carbamate), mancozeb (Dithane, Manzate, Penncozeb), chlorothalonil (Bravo), metiram (Polyram), thiram (Thiram), ziram (Ziram), and sulfur.

Efficacy of Selected Fungicides Against Apple Diseases

Fungicide	Scab	Powdery Mildew	Rust	Black Rot & White Rot	Bitter Rot	Sooty Blotch	Flyspeck
Bayleton	P	E	E	O	O	O	O
Captan	E	O	O	G	E	F-G	F-G
Ferbam (carbamate)	F	O	G	F	P	F	F
Flint	E	G	G	G	E	E	E
Mancozeb (Dithane, Manzate, Penncozeb)	G	O	G	G	E	E	E
Nova	E	E	E	O	O	O	O
Polyram	G	O	G	G	E	E	E
Pristine	E	E	E	G	G	E	E
Procure	E	E	E	O	O	O	O
Rubigan	E	E	E	O	O	O	O
Scala	G	—	—	—	—	—	—
Sovran	E	G	E	G	G	E	E
Sulfur	F	G	O	F	—	P	P
Syllit*	E	O	P	P	O	P	P
Thiram	F	O	G	F	P	F	F
Topsin M*	E	E	O	G	P	E	G
Vanguard	G	—	—	—	—	—	—
Ziram	F	O	G	P	E	F-G	F-G

— = unknown or doesn't apply; O = none; P = poor; F = fair; G = good; E = excellent

* Many areas of the Midwest may contain strains of the apple scab and powdery mildew fungi tolerant to these chemicals. Therefore, these fungicides may not be effective in some areas.

Efficacy of Selected Fungicides Against Stone Fruit Diseases

Fungicide	Brown Rot Blossom Blight	Brown Rot Fruit Rot	Peach Leaf Curl	Peach Scab	Powdery Mildew	Cherry Leaf Spot	Black Knot of Plum
Bravo	G	—	E	G	O	E	E
Captan	G	F-G	—	G	O	G	G
Captevate	E	E	—	—	—	G	G
Elevate	E	E	—	—	—	—	—
Elite	E	E	—	—	G	G	—
Ferbam	—	F	E	—	O	F	—
Fixed copper	—	—	G	—	F	G	P
Flint	—	—	—	—	—	E	—
Indar	E	E	—	—	G	E	—
Nova	E	—	—	—	E	E	—
Orbit	E	E	—	—	—	—	—
Rovral	E	E	—	P	—	F	—
Rubigan	—	—	—	—	G	E	—
Procure	G	G	—	—	E	G	—
Pristine	G	G	—	G	E	E	—
Scala	G	G	—	—	—	—	—
Sulfur	F	P	—	G	G	P	O
Syllit*	—	P	—	—	O	G	—
Thiram	P-F	P-F	G	G	—	—	—
Topsin M*	E	E	—	G	F	G	F
Vanguard	G	G	—	—	—	—	—
Ziram	P-F	P-F	G	G	—	F	—

— = unknown or doesn't apply; O = none; P = poor; F = fair; G = good; E = excellent

* Many areas of the Midwest may contain strains of the brown rot, powdery mildew and cherry leaf spot fungi tolerant to these chemicals. Therefore, these fungicides may not be effective in some areas.

Pre-Harvest Intervals and Restricted Entry Intervals (REI) for Insecticides and Miticides

Trade Names	Common Names	Pre-Harvest Interval — Days					REI* (Hours)
		Apple	Pear	Peach	Cherry	Plum	
Acramite	bifenazate	7	7	3	—	3	12
Actara	thiamethoxam	14/35	14/35*	—	—	—	12
Agri-Mek (RUP)	abamectin	28	28	—	—	21	12
Ambush (RUP)	permethrin	*	*	14*	3*	—	12
Apollo	clofentezine	45	21	21	21	—	12
Asana (RUP)	esfenvalerate	21*	28*	14*	14*	14*	12
Assail	acetamiprid	7	7	—	—	—	12
Avaunt	indoxacarb	14	14	—	—	—	12
Calypso	thiacloprid	30	30	—	—	—	12
Capture or Discipline	bifenthrin	—	14	—	—	—	12
Carzol	formetanate hydrochloride	UPF*	UPF*	UPF*	—	—	4 -16 days
Centour	buprofezin	14	14	14	—	—	12
Clutch	clothianidin	7	7	—	—	—	12
Confirm	tebufenozide	14	14	—	—	—	4
Cyd-X	codling moth granulatorius	0	0	—	—	—	4
Danitol (RUP)	fenpropathrin	14	14	—	—	—	24
Dimethoate	dimethoate ¹	28	28	—	—	—	48
Dimilin* (RUP)	diflubenzuron	—	14	UPF	UPF	UPF	12
Diazinon 50 W (RUP)	diazinon	21	21	21	21	21	24
Dipel (OMRI)	<i>Bacillus thuringiensis</i>	0	0	0	0	0	4-12
Endosulfan, Thionex	endosulfan	21-30*	7*	21-30	21*	7*	24
Entrust (OMRI)	spinosad	7	7	14	7	7	4
Envidor	spirodiclofen	7	7	7	7	7	12
Esteem	pyriproxyfen	45	45	14	14	14	12
Fujimite	fenpyroximate	14	14	—	—	—	12
Guthion (RUP)	azinphosmethyl	14-21*	14-21	21	15	—	14 -15 days
Imidan	phosmet	7	7	14	7	7	24
Intrepid	methoxyfenozide	14	14	7	7	7	4
Kanemite	acequinocyl	14	14	—	—	—	12
Kelthane	dicofol	7-14	7	—	—	—	12
Lannate (RUP)	methomyl	14	7	4	—	—	*
Lorsban (RU,EC** only)	chlorpyrifos	Prebloom*	*	14*	14	—	4 days
Malathion	malathion	—	—	7	3	—	12-24
Metasystox-R (RUP)	oxydemetonmethyl	*	30	*	*	*	48*
Mitac	amitraz	—	7*	—	—	—	24
M-Pede	potassium salts of fatty acids	0	0	0	0	0	12
Neemix (OMRI)	azadirachtin	0	0	0	0	0	4

RUP = Restricted-use pesticide.

OMRI = Organic Materials Review Institute-approved for use in organic production

UPF = Until Petal Fall

— Not registered or recommended.

* Specific pre-harvest intervals or restricted entry intervals vary for different formulations, application rates, crops, or geographical locations. See product labels for details.

**Pre-Harvest Intervals and Restricted Entry Intervals (REI) for Insecticides and Miticides
(cont.)**

Trade Names	Common Names	Pre-Harvest Interval – Days					REI* (Hours)
		Apple	Pear	Peach	Cherry	Plum	
Nexter	pyridaben	25	7	7	300	7	12
Pounce (RUP)	permethrin	*	*	14*	3*	—	12
Proaxis (RUP)	gamma cyhalothrin	14	14	14	14	14	24
Provado	imidacloprid	7	7	10	7	7	12
Pyramite	pyridaben	25	7	7	300	7	12
Saf-T-Side	horticultural oil	0	0	0	0	0	12
Savey	hexythiazox	28	28	28	28	28	12
Sevin	carbaryl	3	3	3	3	3	12
SpinTor	spinosad	7	7	14	7	7	4
Sunspray		0	0	0	0	0	12
Superior Oil (some OMRI)		*	*	*	*	*	12
Supracide (RUP)	methidathion	*	*	*	*	*	48
Surround	kaolin	0	0	0	0	0	4
Vendex (RUP)	fenbutatin-oxide	14	14	14	14	14	48
Vydate (RUP)	oxamyl	14	14	—	—	—	48
Warrior (RUP)	lambda-cyhalothrin	21	21	14	14	14	24
Zeal	etoxazole	14	14	—	—	—	12

RUP = Restricted-use pesticide.

OMRI = Organic Materials Review Institute-approved for use in organic production

— Not registered or recommended.

* Specific pre-harvest intervals or restricted entry intervals vary for different formulations, application rates, crops or geographical locations. See product labels for details.

**Insecticide Use Restrictions on Amount Applied per Year,
Number of Applications, and/or Timing of Applications**

	Apple	Pear	Peach	Cherry	Plum	Nectarine	Apricot
Acramite 50 WS	1 app.	1 app.	1 app.	—	1 app.	1 app.	—
Actara 25WG	—	8 oz/A 1 prebloom app.	—	—	—	—	—
Ambush 25 WP	Not after petal fall	3.2 lb/A, prebloom only	6 lb/A	6 app.*	—	—	—
Ambush 2 EC	38 oz/A; not after petal fall	51 oz/A, prebloom only	96 oz/A	6 app.*	—	—	—
Apollo SC	1 app.	1 app.	1 app.	1 app.	—	1 app.	1 app.
Assail 70 WP	13.5 oz	13.5 oz	—	—	—	—	—
Asana XL	101 oz/A	72 oz/A	72 oz/A	72 oz/A	72 oz/A	72 oz/A	72 oz/A
Avaunt 30 WDG	24 oz/A	24 oz/A	—	—	—	—	—
Calypso 4 F	16 fl oz/A	16 fl oz/A	—	—	—	—	—
Capture 2 E	—	32 fl oz/A	—	—	—	—	—
Carzol 92 SP	1.25 lb/A	1.25 lb/A	1.25 lb/A	—	—	1.25 lb/A	—
Clutch 50 WDA	6.4 oz/A	6.4 oz/A	—	—	—	—	—
Confirm 2 F	120 fl oz/A	120 fl oz/A	—	—	—	—	—
Danitol 2.4 EC	2.7 pt/A	2.7 pt/A	—	—	—	—	—
Decis 1.5 EC	3.6 fl oz/A	3.6 fl oz/A	—	—	—	—	—
Diazinon 50 W	12 lb	12 lb	12 lb	12 lb	12 lb	12 lb	12 lb
Dimilin 2 EC	—	4 app.	UPF	—	UPF	UPF	UPF
Dimilin 25 W	—	4 app.	—	—	—	—	—
Entrust 80 WP	9 oz/A	9 oz/A	9 oz/A	9 oz/A	9 oz/A	9 oz/A	9 oz/A
Envidor 2 SC	1 app.	1 app.	1 app.	1 app.	1 app.	1 app.	1 app.
Esteem 35 WP	2 app.*	2 app.*	3 app.*	3 app.*	3 app.*	3 app.*	3 app.*
Fujimite 5 EC	32 fl oz	32 fl oz	—	—	—	—	—
Guthion 50 WP	8 lb/A	6 lb/A	4.5 lb/A	3 lb/A	—	4.5 lb/A	—
Intrepid 2F	64 fl oz/A	64 fl oz/A	64 fl oz/A	64 fl oz/A	64 fl oz/A	64 fl oz/A	—
Imidan 70 WP	30 lb/A	—	17 lb/A	—	—	—	—
Kanemite 15 SC	2 app.	2 app.	—	—	—	—	—
Kelthane 50 WP	2 app.	2 app.	—	—	—	—	—
Lannate 90 SP	5 app.	2 app.	6 app.	—	—	—	—
Lannate 2.4 SL	—	1 app.	—	—	—	—	—
Lorsban 4 EC	1 app.	1 app.	1 app.	3 app.	1 app.	1 app.	—
Lorsban 50 WP or 75 WG	Prebloom	—	—	8 app.	—	—	—
Metasystox-R	Non-bearing	—	Non-bearing	Non-bearing	Non-bearing	Non-bearing	Non-bearing
Mitac 50 WP	—	6 lb/A	—	—	—	—	—
Neemix 4.5	Labeled for use on all tree fruits with no limits on total number of applications						
Nexter 75 W	1 app.	1 app.	2 app.	2 app.	2 app.	2 app.	2 app.
Pounce 25 WP	2.4 lb/A; not after petal fall	3.2 lb/A, prebloom only	12 lb/A	6 app.*	—	—	—
Pounce 3.2 EC	24 oz/A not after petal fall	32 oz/A prebloom only	60 oz/A	6 app.*	—	60 oz/A	—
Proaxis 5 EC	0.96 pt	0.96 pt	1.6 pt	1.6 pt	1.6 pt	1.6 pt	1.6 pt
Provado 1.6 F	40 fl oz/A	40 fl oz/A	24 fl oz/A	24 fl oz/A	24 fl oz/A	24 fl oz/A	24 fl oz/A
Pyramite 60 W	26.4 oz	26.4 oz	26.4 oz	26.4 oz	26.4 oz	26.4 oz	26.4 oz
Savey	1 app.	1 app.	1 app.	1 app.	1 app.	1 app.	1 app.
SpinTor 2 SC	29 fl oz/A	29 fl oz/A	29 fl oz/A	29 fl oz/A	29 fl oz/A	29 fl oz/A	29 fl oz/A
Superior Oil	Delayed dormant	Delayed dormant	Delayed dormant	Delayed dormant	Delayed dormant	Delayed dormant	Delayed dormant
Supracide 25 WP	Prebloom	Prebloom	Prebloom	Prebloom	Prebloom	Prebloom	Prebloom
Thiodan 50 WP	6 lb/A*	6 lb/A or 2 app.	2 app.	6 lb/A or 2 app.	6 lb/A or 2 app.	2 app.	2 app.
Thiodan 3 EC	4 qt/A*	4 qt/A or 2 app.	2 app.	4 qt/A or 2 app.	4 qt/A or 2 app.	2 app.	2 app.
Vendex 50 WP	2 app.*	2 app.*	2 app.	2 app.	2 app.	2 app.	—
Vydate 2 L	8 pt/A	—	—	—	—	—	—
Warrior 1 EC	1.6 pt/A	1.6 pt/A	1.6 pt/A	1.6 pt/A	1.6 pt/A	1.6 pt/A	1.6 pt/A
Zeal 72 WG	1 appl.	—	—	—	—	—	—

*see label for additional detail

Efficacy of Selected Insecticides and Acaricides Against Apple Insects and Mites

Products	Mode of Action Group (IRAC)	Predator Mites	Codling Moth	Plum Curculio	Apple Maggot	Oriental Fruit Moth	Redbanded Leafroller	Oblique-banded Leafroller	Plant Bugs	Periodical Cicada	Rosy Apple Aphid	Green Aphids	Woolly Apple Aphid	Leafhoppers	Spotted Tentiform Leafminer Adults	Spotted Tentiform Leafminer Larvae	Japanese Beetle	San Jose Scale	European Red Mite	Two spotted Mite
Organophosphates																				
Diazinon	1B	ST	F	F	G	G	G	F	P	-	F	G	G	F	-	F	-	G	-	-
Guthion	1B	ST	E	E	E	E	G	G	P	P	P	P	F	P	-	-	F	F	-	-
Imidan	1B	ST	G	G	E	E	G	G	F	P	P	P	P	F	-	-	G	F	-	-
Lorsban	1B	MT	-	-	-	-	G	-	G	G	G	P	-	-	-	-	-	E	-	-
Supracide	1B	MT	-	-	-	-	E	-	F	-	E	F	-	-	-	-	-	E	-	-
Neonicotinoids																				
Actara	4A																			
Assail	4A	MT	E	G	G	E	-	-	-	-	E	E	-	E	F	F	G	F	-	-
Calypso	4A	MT	E	G	G	G	-	-	-	-	-	E	-	-	-	-	-	-	-	-
Clutch	4A																			
Provado	4A	MT	-	-	-	-	-	-	-	-	G	G	G	E	-	E	F	G	-	-
Insect Growth Regulators																				
Confirm	18A	ST	F	-	-	P	E	F	-	-	-	-	-	-	-	F	-	-	-	-
Esteem	7C	ST	F	-	-	-	-	-	-	-	E	-	-	-	-	G	-	E	-	-
Intrepid	18A	ST	G	-	-	G	E	E	-	-	-	-	-	-	-	G	-	-	-	-
Neemix, AzaDirect	18A	ST	-	-	-	-	-	-	-	-	-	G	-	-	-	-	G	-	-	-
Pyrethroids																				
Asana	3	HT	E	G	E	E	G	E	E	E	F	F	P	G	E	P	G	F	-	-
Danitol	3	MT	G	G	G	E	E	E	E	E	G	-	-	E	-	E	-	-	F	-
Decis	3																			
Permethrin	3																			
Proaxis	3	HT	G	G	G	G	E	E	E	-	-	G	-	E	E	P	-	-	-	-
Warrior	3																			
Carbamates																				
Carzol	1A	HT	-	-	-	-	-	-	G	-	-	-	-	E	G	-	-	-	G	G
Lannate	1A	HT	G	F	F	G	E	E	G	G	G	G	P	E	G	E	F	F	-	-
Sevin	1A	HT	G	G	G	G	F	F	-	G	F	G	P	G	-	F	E	F	-	-
Vydate	1A	HT	-	-	-	-	-	-	G	G	G	G	P	G	-	G	-	-	G	G
Other																				
Avaunt	22	MT	F	G	F	G	G	F	-	-	-	-	-	F	-	P	-	-	-	-
B.T. (Dipel, etc.)	11 B2																			
Cyd-X																				
SpinTor/Entrust	5	ST	G	P	F	F	G	G	-	-	-	-	-	-	E	-	-	-	-	-
Surround		MT	P	F	P	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-
Endosulfan, Thiodex	2A	ST	F	F	F	E	G	F	G	-	G	G	E	F	E	P	-	F	-	-
Miticides																				
Acramite	25	ST	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	G
Agri-Mek	6	MT	-	-	-	-	-	-	-	-	-	-	-	G	-	E	-	G	E	E
Apollo	10A	ST	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E	E
Envidor	23																			
FujiMite	21																			
Kanemite	20 B																			
Kelthane		HT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F
Nexter	21	HT	-	-	-	-	-	-	-	-	-	F	-	G	-	-	-	-	E	G
Savay	10A	ST	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E	E
Vendex	12 B	ST	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	F
Zeal	10 B	ST	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E	E

- = unknown or doesn't apply; P = poor; F = fair; G = good; E = excellent
ST = slightly toxic; MT = moderately toxic; HT = highly toxic

Orchard Vole Control

Mice, known as voles, can cause serious damage to fruit plantings. Frequently, damage occurs but is not noticed until trees become weak, die or are removed. Damage can be anticipated each year, particularly from late summer to early spring, as mice eat bark from the base of small saplings. Such damage can result in girdling death of the tree. Apple trees are most susceptible, but hungry voles will attack other fruit trees. Apple trees on dwarfing root stocks are particularly palatable to these mice.

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. *No single material or technique is effective for complete control of voles.* It is, therefore, suggested that both the materials and the methods of control vary during the season.

General Orchard Management Practices

Several general orchard management practices can be employed to reduce risk of injury and improve effectiveness of control.

Tree guards can be constructed from “hardware cloth” or similar materials with 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). Pea-sized gravel or cinders, when placed around the trees, 4 to 6 inches wide and deep, also tend to discourage meadow voles from attacking crowns of trees, but do not discourage other mouse species. To proliferate, voles need abundant amounts of cover. Thus, maintaining a clean area 1- to 2-foot wide around the base of trees discourages surface feeding. This will also regulate vole populations in the long term. Chemical weed control in early spring significantly reduces the amount of labor involved in keeping the area around the tree clean.

The orchard cover or sod should be mowed short in late August and again after harvest to reduce runway cover and aid baiting. Cleaning out drainage ditches and fence rows and picking up or crushing all dropped fruit discourages large mouse populations.

Orchard Mouse Control Program

Essential Knowledge

Determine species of voles (with snap traps). Three species may be found: Meadow Mouse (*Microtus pennsylvanicus*), Prairie Mouse (*Microtus ochrogaster*), and Pine Mouse (*Pitymys pinetorum*). Materials for control may be the same, but control methods differ. Quick field identifications for both juveniles and adults are based on the length of the tail.

Pine Vole: tail length about same as the hind foot.

Meadow and Prairie Vole: tail length about twice that of the hind foot.

Determine timing and site of infestations (with snap traps). Knowing when and where mice are most abundant makes control easier.

Control

Control of mice in orchards can be accomplished using either zinc phosphide or chlorophacinone baits. Both baits must be used according to label directions.

Zinc phosphide is an acute bait that causes the death of mice within 24 hours. It is available as either 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™), an anticoagulant bait, is available in some states (check your state regulations) as a weather-resistant pellet style bait. This bait is highly accepted by rodents, but death is delayed for several days. For effective control, a second application of chlorophacinone is needed within 20 to 40 days.

Baits can be attractive to other wildlife including birds and domestic pets. Bait must be applied 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, while zinc phosphide is more effective against meadow voles than pine voles. Consistent use of one of these chemicals will result in shifts of vole population from one 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.

Techniques for Baiting

1. Machine baiting: Expose bait in artificial trail (Trail Builder).
2. Trail baiting: Expose bait in natural, active runways only.
3. Broadcast baiting: (NOT RECOMMENDED FOR PINE VOLE CONTROL). Broadcast bait by hand, cyclone type seeder, or tractor drawn equipment at recommended rates. 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.*

Orchard Vole Control (cont.)

Percentage Comparison of Control Methods

Method	Meadow or Prairie Voles	Pine Voles
Machine	90-95%	80-85%
Trail	80-85%	70-75%
Broadcast	78%	Not recommended

Timing

Apply on a sunny day in late fall when mice are active. Mice begin to build up in early August, but baiting should be delayed to as late as possible in the fall. The most effective period for application is just before snow cover after the grass cover has been reduced by frost 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

Application of poisoned bait before harvest to prevent mouse damage to fruit in cold storage is not a sound practice for the following reasons:

1. The recommended methods of orchard mouse control do not always result in 100% control. Therefore, some mice survive the pre-harvest control and enter into boxes of fruit on the ground which will be carried into cold storage.
2. The pre-harvest poison application will reduce the population of mice in the orchard, competition among survivors will be greatly reduced, and food and cover will be ample. Under these favorable conditions, survivors breed, and there might be eight young per litter. In a very short time, populations may recover to original levels, and will not be exposed to poisoned baits applied during the normal control season.
3. The recommended control season for mice 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

1. Before Harvest
 - a) Poison rats and mice in storage one month before picking; keep storage area baited and free of debris.
 - b) Clean up outside debris, especially near loading area, one week before picking.
 - c) Rodent-proof storage; seal all holes and cracks. Mice can fit through a hole the size of a dime.
2. During Harvest
 - a) Move filled boxes into storage quickly; any box left overnight may have mice.
 - b) 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

Bait stations can be prepared 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 2 to 3 weeks before adding the bait.

Suggestions for Growth Regulators

Ethephon on Apples

Ethephon, which is available as a 21.3% formulation of 2-chloroethylphosphonic acid (ETHREL or CEPHA), may (a) promote early color development and maturity, (b) loosen fruit for easier harvesting by hand or machine, and (c) increase fruit bud formation and early bearing on young trees.

Promotion of Early Color Development and Maturity.

To obtain increased red coloration and early maturity, apply 14 to 21 days prior to anticipated harvest at a concentration of 150 to 300 ppm (0.5 to 1 pt. per 100 gal water). For concentrate sprays, use 2.5 pints per acre in 50 to 100 gallons of water. Use lower dosage ranges for late maturing varieties. Red color development should be apparent in about 7 days. Ethephon is most effective under weather conditions that favor color development.

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

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

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

For Early Bearing on Young Trees

To increase fruit bud development on young, non-bearing trees, apply a foliar spray of ethephon 1 to 2 weeks after full bloom, using a dosage of 1000 ppm (3.33 pt per 100 gal of water). For spur-type trees, the rate should be reduced to 500 ppm (1.66 pts. per 100 gal of water). *Caution:* Do not use this treatment on trees that have started to bear fruit because the application may de-fruit trees completely.

Stop-Drop Sprays

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

Naphthaleneacetic Acid or NAA (Fruitone N) should be applied before the beginning of fruit drop (7 to 14 days before harvest) at the rate of 5 ppm for summer varieties and 10 ppm for late varieties. It should normally prevent fruit drop for 7 to 10 days. A second application of NAA should be made within 7 to 10 days of the first application if fruits were not harvested. Do not use more than 2 NAA applications. Do not apply within 2 days of harvest. NAA works best as a dilute spray.

Concentration and Timing of Stop-Drop Application

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

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

ReTain

The active ingredient in ReTain, aminothoxy-vinylglycine (AVG), is a natural inhibitor of ethylene synthesis. Ethylene gas is normally produced by ripening fruit and promotes further ripening and pre-harvest drop in some varieties. After treatment with ReTain, fruit produce less ethylene, which slows the ripening process and reduces pre-harvest drop. Growers who have large plantings of a variety may consider applying ReTain to some of the planting as a harvest management tool to allow a later harvest of treated trees.

Timing. Best results are obtained when ReTain is applied before the first visible signs of ripening. Research has shown that ReTain should be applied 4 weeks prior to the optimum harvest date.

Application rate and number. ReTain should be applied as a single application: multiple applications have no additional benefit. The label rate is one pouch (0.73 lb) per acre, but rates as low as 0.44 lb per acre can also be effective in optimal application conditions. The higher rate helps fruit retain their firmness during storage. ReTain should be diluted in at least 100 gal of water per acre. Best results are obtained when applied under slow drying conditions. Thorough wetting and coverage are essential for optimum effectiveness. Although ReTain seems to be compatible with other materials, it should be applied alone.

Suggestions for Growth Regulators (cont.)

Additives. The inclusion of a silicone-based spreader sticker (e.g. Stylwet L-77) is absolutely critical for good results.

Comments. ReTain is expensive; therefore, it should be used only on high value, productive blocks with good fruit quality. Treated fruit should be stored separately.

Apogee

Apogee is mainly used on trees that are overly vigorous due to crop loss, inappropriate rootstock, or tree spacing. Apogee can decrease the length of shoots by 30-60%. Reduced shoot growth, following Apogee treatment, can reduce susceptibility to fire blight. See page 13 for more details.

Sprout and Sucker Control on Apple and Pear

Tre-Hold Sprout Inhibitor A112 can be used to inhibit sprouting when applied to pruning cuts on scaffold limbs and trunk bases and to rootstock suckers on bearing and non-bearing trees.

To make 1 gallon of spray mixture, add 10 fl oz of Tre-Hold to 1 gallon of water. For sunscald protection, 1 to 4 pt. of interior white latex paint may be substituted for an equal volume of water. One gallon of dilute spray will treat 50 to 100 trees.

Tre-Hold RTU Sprout Inhibitor, a ready to use formulation (1.15% Ethyl, 1-NAA), is also available to control sprouts and sucker growth on apples and pears. Follow manufacturer's label for use.

The herbicide Rely may be used to control suckers on apple. Follow manufacturer recommendations and precautions.

Pro-Gibb on Cherries

The active ingredient in Pro-Gibb is a natural plant hormone, gibberellin A₃. It can be used to maintain and extend high fruiting capacity of bearing tart cherry trees and to reduce occurrence of "blind" nodes by stimulating lateral vegetative buds and a more productive balance of lateral shoots and spurs. Apply 4 to 8 fluid ounces of Pro-Gibb 4% in 100 gal finished spray, from 14 to 28 days after bloom, in 50 to 150 gal per acre. Do not spray within one month of harvest.

To reduce flowering and fruiting in young tart and sweet cherry trees, and to minimize the competitive effect of early fruiting on tree development, apply 20 to 40 oz of Pro-Gibb 4% in 100 gal of water, 2 to 4 weeks after bloom. Under low vigor, two applications are recommended with at least a 7-day interval between sprays. Since Pro-Gibb acts on buds that will flower the following growing year, responses will not begin to be visible until the year after application. Do not spray trees during the year of planting.

Pro-Vide on Apples

Russetting

Applications of Pro-Vide, a mixture of gibberellins A₄ and A₇, reduces, but does not eliminate, russetting on 'Golden Delicious'. Pro-Vide should be applied 3 to 4 times, beginning at petal fall and continuing at 7- to 10-day intervals. The rate is 10 to 13 oz applied in 100 gal of solution per acre. Do not use surfactants with Pro-Vide because of the potential of some surfactants to cause russetting. No more than 40 oz of Pro-Vide should be applied per season.

Stayman Cracking

Pro-Vide applications should start 2-3 weeks before cracking begins, normally by mid-June to mid-July. Apply 3 to 4 consecutive sprays at 12- to 16-day intervals at an application rate of 16 to 32 ounces of Pro-Vide per acre, per application. Because cracking is influenced by weather changes and because it can occur over extended periods, multiple applications have given the best response.

Promalin on Apples

Promalin contains 1.8% 6BA N-(phenylmethyl)-1 H-purine-6-amine and 1.8% gibberellins A₄ and A₇. A single application to 'Delicious' during the period from full bloom to early petal fall of the king bloom elongates the fruit and encourages development of more prominent calyx lobes. The rate of application is 1 pint per acre in 50 to 200 gal of spray mixture. Some thinning may occur from the use of Promalin, particularly if applied late. Do not apply Promalin when air temperatures are lower than 40°F or greater than 90°F.

Chemical Thinning of Apples

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

NAA (naphthalene acetic acid), NAD (naphthalene acetamide), Sevin (1-naphthyl-N-methylcarbamate) and Accel (benzyl-adenine) are suggested. Apply NAA to fall and winter varieties when king fruit are 11-13 mm in diameter. For fruit larger than 13 mm, Sevin is more effective than NAA. Sevin gives uniform results from petal fall to 21 days later.

NAD is most effective when applied from late bloom to petal fall. NAD is milder than NAA, and is less likely to cause over-thinning.

The combination of NAA plus Sevin should be applied on

fall and winter varieties when king fruit are 11-13 mm in diameter, and on summer varieties (Wealthy and Earliblaze) at petal fall.

Use of NAA on early summer varieties may result in excessive foliage injury, fruit cracking and premature ripening.

In the warmer parts of the Midwest, concentrations of NAA that successfully thin frequently cause pygmy apples on spur-type Red Delicious. These small seedless apples persist through harvest and are a nuisance. Sevin is preferred for thinning spur-type Red Delicious. In some experiments, Sevin has over-thinned Rome and Gallia Beauty, and should not be used on these varieties. NAA is not successful in thinning Fuji, as this often results in pygmy apples. Honeycrisp is easy to overthin and combinations should not be used.

Recommended Chemical Thinners for Apple¹

Cultivars	NAD ^{2,3,4} (PPM)	NAA ^{2,4} (PPM)	NAA ² + W.A. ⁵ Sevin (PPM)	XLR Plus ^{2,6,7} (qts/100 gal)	MaxCel ⁷	Accel ⁹ (fl oz/acre)	Combinations ^{2,3,7,8} (PPM + qts/100 gal)
Summer Varieties	35-50	—	—	—	E	—	NAA 5-10+Sevin 1/2-1
Paulared	—	5-10	3-5	1/2-1	M	—	—
Gala	—	5-10	3-5	1/2-1	E	—	—
Jonamac	—	5-10	3-5	1/2-1	M	—	—
McIntosh	35-50	7 1/2-12	3-5	1/4-1/2	E	35.5	—
Jonathan	35-50	7 1/2-12	3-5	1/4-1/2	E	35.5	—
Spartan	—	10-15	5-7 1/2	1/2-1	?	—	—
Cortland	35-50	7 1/2-12	3-5	1/4-1/2	E	—	—
Grimes Golden	35-50	5-10	5-7 1/2	—	?	—	NAD 25-50+Sevin 1/2-1
Red Delicious/non-spur	—	5-10	3-5	1/2-1	E	—	—
Red Delicious/spur	—	10-15	5-7 1/2	1/2-1	M	—	—
Honeycrisp	—	3-5	—	1/4-1/2	?	—	N.R.
Empire	—	10-15	5-7 1/2	1/2-1	E	35.5	—
Golden Delicious	—	10-20	5-10	1/2-1	M	—	NAA 5-10+Sevin 1/2-1
Blushing Golden	—	—	—	1/4-1/2	?	—	—
Firmgold	—	—	—	1/4-1/2	?	—	—
Idared	—	—	—	1/2-1	E	—	—
Winesap	35-50	7 1/2-10	3-5	1/2-1	E	—	—
Stayman & Turley	35-50	7 1/2-10	3-5	1/2-1	M	—	—
Rome & Gallia	50-60	15-20	7 1/2-10	N.R. ⁹	E	—	—
Fuji ⁸	—	N.R. ⁹	—	—	H	—	Accel 35.5 fl oz/acre + Sevin 1

¹ See: Apple Thinning Guide by P. Schwallier, Great Lakes Publishing (616) 887-9008.

² Lower concentrations suggested when conditions are favorable for thinning.

³ Applications of NAD (Amid-Thin) should be made from late bloom to petal fall.

⁴ Applications of NAA or Sevin or the combination should be made of fall and winter varieties when king fruits are 11-13 mm in diameter. On summer varieties, such as Wealthy and Earliblaze, the combination should be applied at petal fall.

⁵ WA=Wetting Agent: Tween 20, Regulaid or Amway Wetting Agent at 0.75 to 1 pint per 100 gallons.

⁶ The addition of NAA at 2.5 to 4 ppm to Sevin stimulates the initiation of fruit buds for return bloom. This low NAA rate should not thin fruit or cause pygmy apples on Red Delicious.

⁷ The Sevin XLR Plus formulation is most commonly used for thinning and is the only formulation labeled for early use (petal fall to 6 mm diameter). Consult the label if other Sevin formulations are used.

⁸ Variety ease of thinning with MaxCel, E=Easy; M=Moderate; H=Hard. See MaxCel Recommendation Table for suggested rates of Maxcel and Sevin for thinning.

⁹ Experience with adequate rates of Accel across many varieties is limited.

¹⁰ N.R. = not recommended

Chemical Thinning of Apples (cont.)

Variability of results and excessive foliage injury, often experienced with NAA, may be avoided by using it at 1/3 to 1/2 of the rates recommended on the label in combination with 0.75 pint of “Tween 20” per 100 gal. The addition of the “Tween 20” increases the rate of foliar absorption and decreases the effects of seasonal factors, such as temperature, relative humidity and wind, on the drying rate and amount of material entering the leaf. The elimination of foliage wilting and tree “shock” results in better fruit size at harvest than the same amount of fruit thinning obtained by the full dosage of NAA alone. Wetting agents other than “Tween 20” that have been used successfully in tests in Illinois and Indiana include Regulaid and Amway Wetting Agent or Ortho X 77.

Accel is a post-bloom (10 mm fruit size) chemical thinner for apples. Accel has worked well with small-fruited varieties and has increased fruit size. Accel has not been a successful thinner for Red Delicious. Refer to the product label for additional information.

MaxCel Recommendation Table.

Thinning Difficulty ¹	Desired Thinning Strength		
	Aggressive	Moderate	Slight
Hard to thin	100-150 ppm + Sevin + oil	100ppm + Sevin	100 ppm
Moderate to thin	100ppm + Sevin	75-100 ppm + Sevin	75 ppm
Easy to thin	75-100ppm +Sevin	75 ppm	50-75 ppm

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

Important Reminders About Chemical Thinning

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

Thorough spraying and uniform coverage are necessary for satisfactory results. However, if you want to reduce the

degree of thinning or are afraid of over-thinning, reduce the concentration, but not amount per tree.

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

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

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

Chemical thinners are generally more effective under the following conditions: (1) low vigor trees, (2) light pruning, (3) heavy bloom, (4) poor pollination, (5) high humidity before spraying, (6) slow drying of spray, (7) poor air drainage and (8) cloudy, cool weather preceding or following the bloom period.

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

Defruiting Young Apple Trees

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

NAA formulations

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

NAA Formulations for Chemical Thinning of Apples

Trade Name	Chemical	Formulation	Acid equivalent (% of active ingredient)	Amount of formulation per 100 gallons to make 10 ppm.
Amid-Thin W	1 Naphthaleneacetamide	WP	8.4	1.6 oz
Fruitone N	1-Naphthaleneacetic acid, sodium salt (3.5%)	WP	3.1	4.0 oz
Kling-Tite 256	1-Naphthaleneacetate, potassium salt (8.3%)	liquid	8.6	1.9 fluid oz
K-salt Fruit Fix 800	1-Naphthaleneacetic acid, potassium salt (24.2%)	liquid	20.2	0.63 fluid oz
K-salt Fruit Fix 200	1-Naphthaleneacetic acid, potassium salt (6.25%)	liquid	5.18	2.47 fluid oz

Chemical Weed Control

Controlling weeds is increasingly important as the number of trees per acre increases, particularly in hedge rows. Herbicides can provide good weed control with little labor and frequency at a low cost. Herbicides, when used properly, improve plant or tree growth, and control insects, diseases and mice.

Proper Application

To be effective, herbicides must be properly selected for the weeds they are to control. They must be applied at the proper time, at the proper rate, and with the proper equipment. The degree of weed control depends largely on the skill of the operator.

In most cases, the herbicide rates given are for overall coverage (broadcast rates). For band treatment, common in tree fruit plantings, reduce the amounts according to the portion of area treated. For example, if a grower wants to control weeds in a 4-foot-wide band beneath a crop planted in rows 10 feet apart, the rate of herbicide needed per acre of crop will be 4/10 of the broadcast rate per acre.

Herbicides can injure fruit trees if used improperly. Therefore sprayer adjustment and calibration should be as precise as possible to assure accurate and uniform applications. Use a nozzle appropriate for herbicide application at low pressures (15 to 25 pounds) on a fixed-boom type applicator, unless the label has a specific recommendation. This type of sprayer is easily calibrated and, when designed properly, will deposit herbicide uniformly over the row. Consider using one of the recently introduced low-drift nozzles such as Turbo TeeJet Nozzle or Turbo-Drop 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. Do not attempt to apply pre-emergence herbicides around fruit plants with hand guns on weed and back-pack sprayers.

Calibrate the sprayer carefully and apply herbicides according to the suggested rates. Note that when applying many herbicides to the soil, rates should be adjusted according to soil characteristics. Generally, lower rates should be used on sandy soil with low organic matter and higher rates on heavier-textured soil and those high in organic matter.

With some herbicides, no rate changes are suggested. If you are unsure about a herbicide's effectiveness or possible crop damage, test it on a small portion of the planting before using extensively. Continued use of the same herbicide can lead to resistance development in weeds or establishment of tolerant weeds. When possible, rotate herbicides to avoid these problems and improve weed control.

Tank Mixes

Certain herbicides can be tank mixed with other herbicides to increase the spectrum of weed species controlled. Consult herbicide labels for specific information.

Use Restrictions

Herbicide use is controlled by federal regulations which prescribe crops upon which herbicides can be used, as well as the timing and rates of application. Use only registered materials at the recommended rates. Product labels are the final authority. Follow them carefully.

Herbicide labels are often complicated. Always refer to the specific label for detailed directions, precautions, and restrictions.

Good Rules to Remember

1. Use a fixed spray boom, uniform speed, flat fan nozzles, and low pressure for even applications without drift.
2. Follow restrictions for herbicide use on young trees. Allow trees to become well established and soils well-settled before applying.
3. Follow rate suggestions based upon soil type.
4. Use herbicide sprayers for herbicides only.
5. Clean sprayers thoroughly when changing herbicides, especially when 2,4-D has been used.
6. Store herbicides as carefully as you would any other pesticide.
7. Dispose of excess spray material carefully; avoid damage to shrubbery, lawns, etc.
8. Do not graze treated areas.
9. READ THE LABEL. UNDERSTAND IT THOROUGHLY. FOLLOW DIRECTIONS.

Herbicide Resistance Management

Avoid using the same product, or chemically-related products, for several consecutive years to avoid a buildup of herbicide-resistant weed biotypes. Rotate herbicides and include non-chemical controls whenever possible to reduce dependence and avoid weed resistance.

Herbicide Recommendations for Apple and Pear

Weed Controlled	Material & Rate	Notes and Comments
<i>Preemergence</i>		
Annual grasses and small-seeded broadleaves	Devrinol 50 DF at 8 lb/acre and Devrinol 10 G at 40 lb/acre	Apply under trees in late fall to spring on weed-free soil or supplement with a postemergence herbicide. Do not apply to frozen ground. If no rainfall occurs within 24 hours after treatment, cultivate or irrigate to incorporate. Do not allow spray to contact fruit or foliage. Approved tank mix: Gramoxone extra.
	Karmex 80 DF at 4 lb/acre	Apples and pears must be established at least 1 year. On pears, do not treat varieties grafted on the most-dwarfing rootstocks. When applied in combination with Sinbar, the use rate is 1 to 2 lb/acre. Make one application per year as a directed spray, avoiding contact with foliage and fruit. Karmex has postemergence activity.
	Prowl 3.3 EC at 2.4 qt preemergence for short-term weed control to 4.8 qt for long-term weed control in a minimum of 20 gal of water per acre	Apply as directed spray to weed-free soil. Do not allow spray to contact leaves, shoots or buds. If no rainfall occurs within 21 days of treatment, irrigate to incorporate. Do not allow in new plantings until soil around trunk has settled. Not effective on muck soils. Another registered product is Pentagon DG.
	Princep 4 L at 2-4 qt/acre and Princep Caliber 90 at 2.2-4.4 lb/acre	Use lower rate on sandy or light-colored soils and higher rate on heavy or dark-colored soils in at least 20 gal of water per acre. Apply under trees in spring. Apply alone to weed-free soil or in labeled tank mixes with a burndown or postemergence product. Avoid contact with fruit, foliage, or stems. Make only one application per year. Trees must be established at least 1 year.
	Surflan 4 AS at 2-6 qt/acre	Apply under trees in spring prior to weed emergence or to clean cultivated soil. Use low rate for short-term control and high rate for long-term control. Allow soil to settle around young plants prior to treatment. A single 0.5 to 1 inch rainfall or irrigation is required to activate Surflan. A shallow cultivation (1 to 2 inches) will destroy existing weeds and place Surflan in the zone of weed seed germination. Tank mix with Roundup or Gramoxone Extra to control established weeds.
Annual broadleaves and grasses	Chateau 51 WDG (flumioxazin 0.51 lb ai/lb) at 6 - 12 oz in 10 - 30 gal of water. Use higher rate for soils high in clay content.	Use on non-bearing fruit trees. Use preemergence for residual weed control of susceptible weeds or postemergence for additional burndown when used with Roundup or Gramoxone Extra with an adjuvant (crop oil or non-ionic surfactant) at 0.25% v/v. Maximum rate = 12 oz/acre/application and 24 oz/acre/season. Do not incorporate. Do not apply to trees less than 1 year old, unless protected by non-porous wraps, grow tubes, or waxed containers. Do not allow drift to contact foliage or green bark. Allow a 30 day minimum interval between sequential applications. Do not harvest fruit within 1 year of application.
	Solicam 80 DF at 2.5 lb/acre on light-colored soils and 5 lb/acre on heavy or dark-colored soils in at least 20 gal of water per acre	Apply to soil surface from fall to early spring before weeds emerge. Rainfall or irrigation within 4 weeks of application is necessary for product activation. Multiple applications may be used, but do not exceed rate and soil texture restrictions (see label). Pears must be established at least 12 months. Do not use on coarse textured soils such as sand, loamy sand or gravelly sand. Avoid spray contact with fruit or foliage. Tank mix with Roundup or Gramoxone Extra to control established weeds.

Herbicide Recommendations for Apple and Pear (cont.)

Weed Controlled	Material & Rate	Notes and Comments
<i>Preemergence</i>		
Annual and perennial grasses and broadleaves	Casoron 4G (granular) at 100-150 lb/acre	For control of perennial weeds, use 150 lbs per acre. Soil surface application – apply from November 15 to February 15. Incorporated treatment – Apply in late fall or early spring before May 1 and incorporate immediately. Regrowth usually occurs in late summer. Avoid over-dosage on young trees. Do not apply until 4 weeks after transplanting.
	Kerb 50WP at 2 lb/acre on sandy or light-colored soils to 8 lb/acre on heavy or dark-colored soils in 40-50 gal of water per acre	Apply in the fall after fruit is harvested, but prior to leaf drop and before soil freeze up. Make only one application per year. Trees must be established 6 months. <u>Restricted Use Pesticide.</u>
<i>Postemergence</i>		
Annual broadleaves, especially winter annuals	Goal 1.6 EC at 2.5-10 pt/acre postemergence (weeds up to 4 inches), and 6-10 pt/acre preemergence	Do not apply more than 10 pt/acre/year. Goal must be applied during dormancy and before bud swell. Use directed spray to avoid plant contact.
Most annual grasses and broadleaves	Sinbar 80 WP at 2 lb/acre on light-colored soils and 4 lb/acre on heavy or dark-colored soils in at least 20 gal of water per acre	<u>Apple only:</u> Make a single band or broadcast application as a directed spray. Do not contact foliage or fruit with spray or mist. Apply either in the spring before weeds emerge or during early stages of seedling regrowth or after harvest in the fall. Trees must be established 3 years or more. Do not apply within 60 days of harvest. Do not use on soils with less than 1% organic matter. <u>Newly-Planted and Non-Bearing Trees:</u> Use 0.5 - 1 lb/A after a rainfall or irrigation when ground around trees has settled. Make 1 - 2 applications per season. Maximum rate is 1 lb/acre/year.
Most annual and perennial grasses (postemergence only)	Poast 1.5 EC at 1.5 - 2.5 pt/acre	Add crop oil concentrate at 1 qt in 25 gal of water per acre. Apply as a directed spray at lower rates to actively growing annual grasses up to 12 inches or at higher rates to perennial grasses early in the growth cycle. On apple and pear, do not apply within 14 days of harvest. The maximum rate per application is 2.5 pt and the maximum rate per season is 7.5 pt/acre. Do not tank mix with other herbicides. Rate and time of application depend on species of grass.
Annual and some perennial broadleaves	Amine 4 or Saber (2,4-D) at 3 pt/A	Apply in 20-50 gal of water per acre. Apply as directed spray when annuals are 1 to 2 inches high and when perennial weeds are in pre-bud to early bud stage. Do not allow spray to contact leaves, fruit or limbs of tree. Use coarse spray and low pressure to avoid drift. Non-bearing trees must be established 1 year. On bearing trees, spray before or after bloom.

Herbicide Recommendations for Apple and Pear (cont.)

Weed Controlled	Material & Rate	Notes and Comments
<i>Preemergence</i>		
Most annual weeds and top kill of perennial weeds	Gramoxone Extra 2.5 L at 2-3 pt/acre in 10-20 gal of water for weeds less than 6 inches in height, and 20-30 gal if greater than 6 inches	Apply as directed, spray when weeds are growing rapidly and before they reach maturity. Repeat applications will be necessary to give sustained control. Use low pressure to produce a coarse spray. Always add nonionic surfactant (1 -2 pt/100 gal as directed on label) or crop oil concentrate (1 gal/100 gal). <i>Caution:</i> do not allow spray to contact leaves, fruit or green stems. <u>Restricted Use Pesticide.</u>
Annuals and some perennial grasses and broadleaves	Glyphosate (many brands)	See note at end of table and refer to product for specific state restrictions on use.
	Touchdown 5 EC at up to 5.33 pt in 10-30 gal of water per acre per year	See label for details regarding specific rates on weed species. May also be used for spot treatment or as a wiper application. An approved surfactant or wetting agent containing at least 75 percent active ingredient at 2 qt per 100 gal is required to improve coverage of weed foliage. Apply postemergence as a directed spray when weeds are actively growing. Do not allow spray, mist or drift to contact any part of the plant as serious injury may result. Can be applied during site preparation and up to one year prior to harvest. Does not provide residual control; can be mixed with labeled preemergence herbicides for residual control.
	Rely 1 L from 3 qt/acre for weeds less than 6 inches to 6 qt/acre for weeds greater than 8 inches	Apply as a broadcast application in a minimum of 20 gal of water per acre. For spot application, mix 1.5 - 4 fl oz per gal of water. Best results when applied postemergence to young, actively growing weeds. Rely does not provide residual control. Do not allow spray to contact foliage or green or uncallused bark on young trees. PHI = 14 days. Do not use on trees within one year of transplanting. May be mixed with suitable residual herbicides. Use two applications of 4 qt/acre 4 weeks apart before suckers reach 12 inches tall.

Herbicide Recommendations for Peach, Plum and Cherry

Weed Controlled	Material & Rate	Notes and Comments
<i>Preemergence</i>		
Annual grasses and small-seeded broadleaves	Devrinol 50 DF at 8 lb/acre and Devrinol 10G at 40 lb/acre	Apply under trees in late fall to spring on weed-free soil or supplement with a postemergence herbicide. Do not apply to frozen ground. If no rainfall occurs within 24 hours after treatment, cultivate or irrigate to incorporate. Do not allow spray to contact fruit or foliage. Approved tank mix: Gramoxone extra.
	Karmex 80 DF at 4 lb/acre	Apples and pears must be established at least 1 year. On pears, do not treat varieties grafted on the most-dwarfing rootstocks. When applied in combination with Sinbar, the use rate is 1-2 lb/acre. Make one application per year as a directed spray, avoiding contact with foliage and fruit.
	Prowl 3.3 EC at 2.4 qt preemergence for short-term weed control to 4.8 qt for long-term weed control in a minimum of 20 gal of water per acre	Apply as directed spray to weed-free soil. Do not allow spray to contact leaves, shoots or buds. If no rainfall occurs within 21 days of treatment, irrigate to incorporate. Do not allow in new plantings until soil around trunk has settled. No effective on muck soils. Other registered product is Pentagon DG.
	Princep 4 L at 2-4 qt/acre and Princep Caliber 90 at 2.2 - 4.4 lb/acre for sour cherry, and 0.6 - 4 qt/acre, or Princep Caliber 90 at 1.75 - 4.4 lb/acre for peach, plum, and sweet cherry	Use lower rate on sandy or light-colored soils and higher rate on heavy or dark-colored soils in at least 20 gal of water per acre. Apply under trees in spring (sour cherry) and in late fall to early spring (peach, plum, sweet cherry) prior to weed emergence. Apply alone to weed-free soil or in labeled tank mixes with a burndown or postemergence product. Avoid contact with fruit, foliage, or stems. Make only one application per year. Trees must be established at least 1 year.
	Surflan 4 AS at 2 - 6 qt/acre	Apply under trees in spring prior to weed emergence or to clean cultivated soil. Use low rate for short-term control and high rate for long-term control. Allow soil to settle around young plants prior to treatment. A single 0.5-1 inch rainfall or irrigation is required to activate Surflan. A shallow cultivation (1-2 inches) will destroy existing weeds and place Surflan in the zone of weed seed germination. Tank mix with Roundup or Gramoxone Extra to control established weeds.
Annual broadleaves and grasses	Chateau 51 WDG (flumioxazin 0.51 lb ai/lb) at 6 - 12 oz in 10 - 30 gal of water. Use higher rate for soils high in clay content.	Use on non-bearing fruit trees. Use preemergence for residual weed control of susceptible weeds or postemergence for additional burndown when use with Roundup or Gramoxone Extra with an adjuvant (crop oil or non-ionic surfactant) at 0.25% v/v. Maximum rate = 12 oz/acre/application and 24 oz/acre/season. Do not incorporate. Do not apply to trees less than 1 year old, unless protected by non-porous wraps, grow tubes, or waxed containers. Do not allow drift to contact foliage or green bark. Allow a 30 day minimum interval between sequential applications. Do not harvest fruit within 1 year of application.
	Solicam 80 DF at 2.5 lb/acre on light-colored soils and 5 lb/acre on heavy or dark-colored soils in at least 20 gal of water per acre	Apply to soil surface from fall to early spring before weeds emerge. Rainfall or irrigation within 4 weeks of application is necessary for product activation. Multiple applications may be used, but do not exceed rate and soil texture restrictions (see label). Plums and prunes must be established at least 12 months. Cherries must be established at least 18 months. Do not use on coarse textured soils such as sand, loamy sand or gravelly sand. Avoid spray contact with fruit or foliage. Tank mix with Roundup or Gramoxone Extra to control established weeds.

Herbicide Recommendations for Peach, Plum and Cherry (cont.)

Weed Controlled	Material & Rate	Notes and Comments
<i>Preemergence</i>		
Annual and perennial grasses and broadleaves	Casoron 4 G (granular) at 100-150 lb/acre	For control of perennial weeds use 150 lbs per acre. For soil surface application, apply from November 15 to February 15. For incorporated, apply in late fall or early spring before May 1 and incorporate immediately. Regrowth usually occurs in late summer. Avoid over-dosage on young trees. Do not apply until 4 weeks after transplanting. Do not apply within one month of harvest on stone fruits. <i>Note:</i> Casoron is no longer labeled for peaches, plums or prunes.
	Kerb 50 WP at 2 lb/acre on sandy or light-colored soils to 8 lb/acre on heavy or dark-colored soils in 40-50 gal of water per acre	Apply in the fall after fruit is harvested, but prior to leaf drop and soil freeze up. Make only 1 application per year. Trees must be established 6 months. <u>Restricted Use Pesticide.</u>
<i>Postemergence</i>		
Annual broadleaves, especially winter annuals	Goal 1.6 EC at 2.5-10 pt/acre postemergence (weeds up to 4"), and 6-10 pt./A preemergence	Do not apply more than 10 pt/acre/year. Goal must be applied during dormancy and before bud swell. Use directed spray to avoid plant contact.
Most annuals and broadleaves	Sinbar 80 WP at 2 lb/A on light-colored soils and 4 lb/acre on heavy or dark-colored soils in at least 20 gal of water per acre	<u>Bearing Peach only:</u> Make a single band or broadcast application as a directed spray. Do not contact foliage or fruit with spray or mist. Apply either in the spring before weeds emerge or during early stages of seedling regrowth or after harvest in the fall. PHI = 60 days. Trees must be established 3 years or more. <u>Newly-planted and non-bearing:</u> Use 0.5 lb/A after a rainfall or irrigation when ground around trees has settled. Make 1 - 2 applications per season. Maximum rate is 1 lb/acre/year.
	Karmex 80 DF at 2 lb/acre on sandy or light-colored soils and 5 lb/acre on heavy or dark-colored soils in 25-40 gal of water per acre	Apply in spring before weeds emerge. PHI = 3 months. Peaches must be established at least 3 years. When applied in combination with Sinbar, the use rate is 1-2 lb/acre, depending on soil texture. Make one application only per year as a directed spray, avoiding contact with foliage and fruit.
Most annual and perennial grasses (postemergence only)	Poast 1.5 EC at 1.5-2.5 pt/acre	Add crop oil concentrate at 1 qt in 25 gal of water per acre. Apply as a directed spray at lower rates to actively growing annual grasses up to 12 inches or at higher rates to perennial grasses early in the growth cycle. For peach, nectarines, and plum, do not apply within 25 days of harvest. The maximum rate per application is 2.5 pt and the maximum rate per season is 7.5 pt/acre. Do not tank mix with other herbicides. Rate and time of application depend on species of grass.


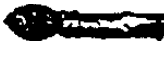




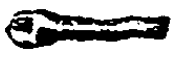



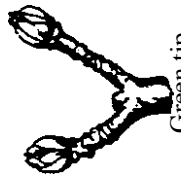

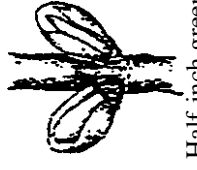




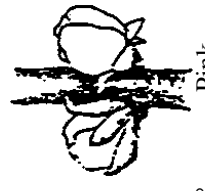

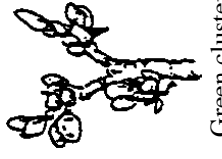
Herbicide Recommendations for Peach, Plum and Cherry (cont.)

Weed Controlled	Material & Rate	Notes and Comments
<i>Postemergence</i>		
Most annual and perennial grasses (postemergence only)	Fusilade DX 2 EC at 6-12 oz/acre plus crop oil concentrate or non-ionic surfactant in 25 gal of water per acre	Apply as directed spray when grass is actively growing and before tillering or seed head formation. PHI = 14 days. The maximum rate per season is 72 fl oz. Do not tank mix with other herbicides. Rate and time of application depend on species.
Annual and some perennial broadleaves	Amine 4 or Saber (2,4-D) at 3 pt/acre in 20-50 gal of water per acre	Apply as directed, spray when annuals are 1-2 inches high and when perennial weeds are in pre-bud to early bud stage. Do not allow spray to contact leaves, fruit or limbs of tree. Use coarse spray and low pressure to avoid drift. On bearing trees, spray before or after bloom.
	Stinger 3 EC at 0.33-0.66 pt/acre in min. 10 gal of water	Make one to four applications/crop/year, not to exceed a total of 0.66 pt/acre. PHI = 30 days. Stinger may be tank mixed with other herbicides labeled for stone fruits.
Most annual weeds and top kill of perennial weeds	Gramoxone Extra 2.5 L at 2-3 pt/acre in 10 - 20 gal of water for weeds less than 6" in height and 20 -30 gal if greater than 6 inches	Apply as directed, spray when weeds are growing rapidly and before they reach maturity. Repeat applications will be necessary to give sustained control. Use low pressure to produce a coarse spray. Always add nonionic surfactant (1-2 pt/100 gal as directed on label) or crop oil concentrate (1 gal/100 gal). <i>Caution:</i> do not allow spray to contact leaves, fruit or green stems. <u>Restricted Use Pesticide.</u>
Annuals and some perennial grasses and broadleaves	Glyphosate (many brands)	See note at end of table and refer to product for specific state restrictions on use.
	Touchdown 5 EC at up to 5.33 pt in 10-30 gal of water per acre per year	See label for details regarding specific rates on weed species. May also be used for spot treatment or as a wiper application. An approved surfactant or wetting agent containing at least 75% active ingredient at 2 qt per 100 gal is required to improve coverage of weed foliage. Apply postemergence as a directed spray when weeds are actively growing. Do not allow spray, mist or drift to contact any part of the plant as serious injury may result. Can be applied during site preparation and up to one year prior to harvest. Does not provide residual control; can be mixed with labeled preemergence herbicides for residual control.
	Rely 1 L from 3 qt/acre for weeds less than 6 inches to 6 qt/acre for weeds greater than 8 inches	Apply as a broadcast application in a minimum of 20 gal of water per acre. For spot application, mix 1.5 - 4 fl oz per gal of water. Best results when applied postemergence to young, actively growing weeds. Rely does not provide residual control. Do not allow spray to contact foliage or green or uncalledus bark on young trees. PHI = 14 days. Do not use on trees within one year of transplanting. May be mixed with suitable residual herbicides. Use two applications of 4 qt/acre 4 weeks apart before suckers reach 12 inches tall.

Herbicide Recommendations for Non-Bearing Fruit Trees Only

Weed Controlled	Material & Rate	Notes and Comments
<i>Postemergence</i>		
Most annual and perennial grasses	Prism 0.94 EC at 13-17 fl oz/A for annual grasses or 17-34 fl oz/acre for perennial grasses or Select 2 EC at 2-8 fl oz/acre.	Do not apply more than 34 fl oz/acre per year. PHI = 1 year.
	Fusilade DX 2EC at 16-24 oz/acre plus crop oil concentrate or non-ionic surfactant in 25 gal of water per acre	<u>Apple and Pear:</u> Apply as directed, spray when grass is actively growing and before tillering or seed head formation. PHI = 1 year. Do not tank mix with other herbicides. Rate and time of application depend on species.
Annual grasses and small-seeded broadleaves	Prowl 3.3 EC at 2.4 qt preemergence for short-term weed control to 4.8 qt for long-term weed control in a minimum of 20 gal of water per acre	Apply as directed, spray to weed-free soil. Do not allow spray to contact leaves, shoots or buds. If no rainfall occurs within 21 days of treatment, irrigate to incorporate. Do not allow in new plantings until soil around trunk has settled. Not effective on muck soils. Other registered product is Pentagon DG.
Annual and some perennial broadleaves	Amine 4 or Saber (2,4-D) at 3 pt/acre in 20-50 gal of water per acre	Apply as directed, spray when annuals are 1 to 2 inches high and when perennial weeds are in pre-bud to early bud stage. Do not allow spray to contact leaves, fruit or limbs of tree. Use coarse spray and low pressure to avoid drift. Non-bearing trees must be established 1 year.
Annuals and some perennial grasses and broadleaves	Touchdown 5 EC at up to 5.33 pt in 10-30 gal of water per acre per year	See label for details regarding specific rates on weed species. May also be used for spot treatment or as a wiper application. An approved surfactant or wetting agent containing at least 75% active ingredient at 2 qt per 100 gal is required to improve coverage of weed foliage. Apply postemergence as a directed spray when weeds are actively growing. Do not allow spray, mist or drift to contact any part of the plant as serious injury may result. Can be applied during site preparation and up to one year prior to harvest. Does not provide residual control; can be mixed with labeled preemergence herbicides for residual control.
	Rely 1L from 3 qt/acre for weeds less than 6 inches to 6 qt/acre for weeds greater than 8 inches	Make broadcast applications in a minimum of 20 gal of water per acre. For spot application, mix 1.5 - 4 fl oz per gal of water. Best results when applied postemergence to young, actively growing weeds. Rely does not provide residual control. Do not allow spray to contact foliage or green or uncallused bark on young trees. Do not use on trees within one year of transplanting. May be mixed with suitable residual herbicides. Use two applications of 4 qt/A 4 weeks apart before suckers reach 12 inches tall.

Table 1. Floral Development States for Fruit Crops and Critical Temperatures for Flower Bud Kill

Stage	Apple	Pear	Peach	Tart Cherry	Plum and Prune
1	 <p>Dormant</p>	 <p>Dormant</p>	 <p>Dormant</p>	 <p>Dormant</p>	 <p>Dormant</p>
	°F 10% Kill	°F 90% Kill	°F 90% Kill	°F 90% Kill	°F 90% Kill
2	 <p>Silver Tip</p>	 <p>Swollen bud</p>	 <p>Swollen bud</p>	 <p>Bud burst</p>	 <p>Swollen bud</p>
	15°	2°	1°	2°	5°
3	 <p>Green tip</p>	 <p>Bud burst</p>	 <p>Half-inch green</p>	 <p>Green tip</p>	 <p>Bud burst</p>
	18°	10°	7°	5°	14°
4	 <p>Half-inch green</p>	 <p>Green cluster</p>	 <p>Pink</p>	 <p>Tight cluster</p>	 <p>Green cluster</p>
	23°	15°	15°	18°	17°
	Half-inch green	15°	25°	26°	26°
	15°	26°	25°	18°	16°
	Green cluster	Green cluster	Half-inch green	Green tip	Bud burst
	10°	20°	23°	5°	3°
	20°	15°	18°	17°	1°
	26°	25°	26°	14°	14°
	26°	25°	26°	18°	1°
	Green cluster	Green cluster	Half-inch green	Green tip	Bud burst
	15°	26°	25°	18°	3°
	Half-inch green	Green cluster	Pink	Tight cluster	Green cluster
	15°	26°	25°	18°	16°

5



27° Tight cluster

21°



26° White bud

22°



27° Bloom

24°



27° Swollen bud

24°



26° White bud

21°

6



28° Pink

25°



28° Bloom

23°



28° Petal fall

25°



28° Bloom

25°



27° Bloom

23°

7



28° Bloom

25°



28° Petal fall

24°



28° Fruit set—shucks on 25°

28°



28° Petal fall

25°



28° Petal fall

24°

8



28° Petal fall

25°



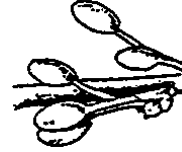
28° Fruit set

24°



28° Fruit set — shucks off 25°

28°



28° Fruit set

25°



28° Fruit set

24°

9



28° Fruit set

25°

Record Keeping Requirements for Production Chemicals

The following list contains trade name, common name, manufacturer, EPA registration number, restricted entry interval, runoff potential and leaching potential. The list was prepared to provide growers a convenient place to find information for pesticide recordkeeping requirements. This is a partial list of the commonly used pesticides on fruit crops in Michigan and is not intended to be a complete list. The registration of pesticides may vary from state to state. It is the grower's responsibility to confirm the registration number and Restricted Entry Interval (REI) for the specific pesticide used by checking the label attached to the package. The information continued herein does not supersede the label directions. To protect yourself, others and the environment, always read the label before applying any pesticides.

FUNGICIDES/BACTERICIDES

Trade Name	Common Name	Manufacturer	EPA Reg #	REI ¹ (hours)	Runoff/Leach Potential ²	Oral LD50	Dermal LD50	Class
Abound	azoxystrobin	Syngenta	100-1098	4	1/3	>5000	>4000	strobilurin
Agri-Mycin 17 Ag	streptomycin	Syngenta	100-899	12	-/-	>5000	>2000	antibiotic
Aliette 80 WDG	fosetyl-Al	Aventis	264-516	12	3/3	2860	>2000	organophosphorus
Armcarb 100	potassium bicarbonate	Helena	5905-541	4	-/-	2700	>5000	salt/inorganic
Auxigro	GABA+L-Glutamic Acid	Emerald Bio	70810-1	4	-/-	>5000	>5000	organic
Bayleton 50 DF	triadimefon	Bayer	264-737	12	3/2	812-1470	>2000	conazole
Botran 75 W	dicloran	Gowan	10163-189	12	2/3	>4640	>6320	aromatic
Bravo WeatherStik	chlorothalonil	Zeneca	50534-188-10182	48	2/3	9000	>2000	aromatic
Bravo WeatherStik	chlorothalonil	Syngenta	50534-188-100	48	2/3	9000	>2000	aromatic
BSP Sulforix	lime sulfur	BSP	66196-3	48	-/-	820	>2000	inorganic
Cabrio	pyraclostrobin	BASF	7969-187	12-24	-/-	>2000	>2000	strobilurin
Captan 50 WP	captan	Micro-Flo	51036-166	24	3/3	>5000	>2000	phthalimide
Captan 80 WP	captan	Micro-Flo	51036-168	24	3/3	>5000	>2000	phthalimide
Captan 80 WDG	captan	Arvesta	66330-29	24-72 ³	3/3	>2000	>5000	phthalimide
Captan 80 WDG	captan	Micro Flo	66222-58-51036	24-72 ³	3/3	>2000	>5000	phthalimide
Captec 4 FL	captan	Micro-Flo	51036-181	24-96	3/3	>5000	>2000	phthalimide
Captevat	fenhexamid+captan	Arvesta	66330-48	24-72	3/3	>2000	>5000	analide phthalimide
Champ Formula 2	copper hydroxide	Agtrol/NuFarm	55146-64	24	1/3	1630	>5000	copper
Champ DP	copper hydroxide	Agtrol/NuFarm	55146-57	24	1/3	1346	>5000	copper
Copper Sulfate	copper sulfate	ChemOne Ltd	56576-1	24	1/3	300	-	copper
Cuprofix Disperss	basic copper sulfate	Cerexagri	4581-396	24	1/3	>2000	>4000	copper
Dithane M-45	mancozeb	DowAgrosciences	62719-387	24	1/3	>5000	>5000	dithiocarbamate
Elevate	fenhexamid	Arvesta	66330-35	12	3/3	>2000	>2000	analide
Elite 45 DF	tebuconazole	Bayer	264-749	12	1/2	2593-4865	>2000	conazole
Endura	boscalid	BASF	7969-197	12	-/-	>2000	>2000	pyridine
Ferbam Granuflo	ferbam	Taminco, Inc.	45728-7	24	3/2	>5000	>4000	dithiocarbamate
Flint	trifloxystrobin	Bayer	264-777	12	2/3	>5050	>2000	strobilurin
Indar	fenbuconazole	DowAgrosciences	62719-421	12	1/3	4000	>2000	conazole
JMS Stylet Oil	paraffinic oil	JMS Flower Farms	65554-1	4	-/-	10000	-	organic
Kocide 101	copper hydroxide	Griffin	1812-288	24	1/3	833	>5000	copper
Lime Sulfur Solutions	lime sulfur	Miller	72-19	48	-/-	820	>2000	inorganic
Kumulus DF	sulfur	Micro-Flo	51036-352	24	1/1	>2200	>2000	inorganic
Maneb 75 DF	maneb	Cerexagri	4581-371	24	1/3	>5000	>2000	dithiocarbamate
Maneb 80 W	maneb	Cerexagri	4581-255	24	1/3	>5000	>2000	dithiocarbamate
Mertect 340-F	thiabendazole	Syngenta	100-889	12	1/3	>5000	>2000	thiazole
Messenger	harpin protein	Eden Bioscience	69834-2	4	-/-	>5000	>6000	organic
Microthiol Disperss	sulfur	Cerexagri	4581-373	24	1/1	>2000	>2000	inorganic
Mycoshield Ag Terramycin	oxytetracycline	Syngenta	100-900	12	3/2	>5000	>2000	organic
Nova 40 W	myclobutanil	DowAgrosciences	62719-411	24	2/2	1870-2090	>5000	conazole
Orbit	propiconazole	Syngenta	100-702	24	1/2	1310	>5000	conazole
Oxidate	hydrogen dioxide	Biosafe Systems	70299-2	0	-/-	330	1410	organic
Penncozeb 80 WP	mancozeb	Cerexagri	4581-358	24	1/3	>5000	>2000	dithiocarbamate
Penncozeb 75 DF	mancozeb	Cerexagri	4581-370	24	1/3	>4470	>2000	dithiocarbamate
Phostrol	phosphoric acid	NuFarm	55146-83	4	-/-	>5000	>5000	-
Polyram 80 DF	metiram	UAP Platte	7969-105-34704	24	2/3	>5000	>2000	dithiocarbamate
Pristine	boscalid+pyraclostrobin	BASF	7969-199	12-24	-/-	>2000	>2000	pyridine/strobilurin
Procure 50 WS	triflumizole	Uniroyal	400-431	12	3/2	2230	>2000	conazole
ProPhyt	potassium salts	Helena	42519-22-5905	4	-/-	>5000	>4000	-
Quintec	quinoxifen	DowAgrosciences	62719-375	12	-/-	>2000	>2000	quinoline
Ridornil Gold GR	metalaxyl-M	Syngenta	100-798	48	2/1	>5000	>2000	anilide
Ridornil Gold EC	metalaxyl-M	Syngenta	100-801	48	2/1	1172	>2020	anilide
Ridornil Gold MZ	metalaxyl-M/mancozeb	Syngenta	100-803	48	1/1	>5000	>2000	anilide/dithiocarbamate
Ridornil Gold/Copper	metalaxyl-M/copper	Syngenta	100-804	48	2/1	550	>2020	anilide/copper
Rovral 50 WP	iprodione	Aventis	264-453	24-48	3/3	>5000	>2000	dicarboximide
Rovral 4 F	iprodione	Aventis	264-482	24-48	3/3	1170	>2000	dicarboximide
Rubigan 1 EC	fenarimol	Gowan	10163-273	12	2/1	1057-1270	>2000	pyrimidine
Scala	pyrimethanil	Bayer	264-788	12-24	-/-	4150-5971	>5000	pyrimidine
Scholar	fludioxonil	Syngenta	100-969	12	-/-	>5050	>2020	pyrrole
Serenade	Bacillus subtilis	Agraquest	69592-7	4	-/-	>5000	<2000	-
Sovran	kresoxim-methyl	BASF	7969-1 54	12	3/3	>5000	>2000	strobilurin
Switch	cyprodinil+fludioxonil	Syngenta	100-953	12	-/-	>5000	>2000	pyrimidine/pyrrole
Syllit 65 W	dodine	Platte	55260-5-34704	48	2/3	2330	>5000	aliphatic nitrogen
Thiram Granuflo	thiram	Taminco, Inc.	45728-21	24	3/3	2400	>2000	dithiocarbamate
Thiram 65 WSB	thiram	Taminco, Inc.	45728-24	24	3/3	2400	>2000	dthiocarbamate
Topsin-M 70 WP	thiophanate-methyl	Cerexagri	4581-403	12	2/3	>5000	>2000	benzimidazole/
Vanguard WG	cyprodinil	Syngenta	100-828	12	1/3	>5000	>2000	carbamate
Wettable Sulfur 90 WP	sulfur	Micro-Flo	51036-14		1/1	>5000	>2000	pyrimidine
Ziram 76 DF	ziram	Cerexagri	4581-140	3/2		1889	>5000	inorganic
Ziram Granuflo	ziram	Taminco, Inc.	45728-12	3/2		2700	>2000	dithiocarbamate

*Restricted use pesticides

1: REI = Restricted Entry Interval, SL = See Label. Some REIs vary by crop, always check the label.

2: 1= high, 2=intermediate, 3=low. These leaching/runoff potential ratings are from the NRCS WIN-PST Pesticide Properties Database <http://www.wcc.nrcs.usda.gov/pestmgt/winpst.html>.

3: The REI for most formulations of Captan is 24 hours; however, some product labels still have a 4 day REI. See note on Captan REI for tree fruit on page 15.

Taken from Michigan Extension bulletin E-154 (used with permission)

Record Keeping Requirements for Production Chemicals (cont.)

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HERBICIDES

Trade Name	Common Name	Manufacturer	EPA Registration #	REI ¹ (hours)	Runoff/Leach Potential ²	Oral LD50	Dermal LD50	Class
Casoron 4 G	dichlobenil	Uniroyal	400-168	12	2/2	>5000	-	nitrile
Devrinol 50 DF	napropamide	United Phosphorus	10182-258-70506	12	2/2	>5000	>2000	amide
Evital 5G	norflurazon	Amvac	5481-506	12	2/2	>5000	>2000	pyridazinone
Formula 40	2,4-D	Riverdale	228-357	48	3/2	866-1058	>2000	phenoxy
Fusilade DX	fluzifop-P	Syngenta	100-1070	12	2/3	>5000	>2000	phenoxy
Gallery 75 DF	isoxaben	DowAgrosciences	62719-145	12	1/3	>5000	>5000	amide
Goal 2XL	oxyfluorfen	DowAgrosciences	62719-424	24	2/3	2985-4594	>4000	nitrophenyl ether
*Gramoxone Extra	paraquat	Syngenta	100-1043	12-24	1/3	283	>2000	quaternary ammonia
Karmex 80 DF	diuron	Griffin	1812-362	12	2/2	6100	>5000	urea
*Kerb 50 WP	pronamide	DowAgrosciences	62719-397	24	2/1	>5000	>2000	amide
Poast	sethoxydim	BASF	7969-58	12	3/3	4100	>5000	cyclohexene oxime
Princep 90 WDG	simazine	Syngenta	100-603	12	2/1	>5000	>2000	triazine
Princep 4 L	simazine	Syngenta	100-526	12	2/1	>5000	>2500	triazine
Prowl 3.3 EC	pendimethalin	BASF	241-337	24	1/3	3956	>2200	dinitroaniline
Rely	glufosinate	Bayer	264-652	12	3/3	3570	>2000	organophosphate
Roundup	glyphosate	Monsanto	524-445	12	1/3	>5000	>5000	organophosphate
Roundup Ultra	glyphosate	Monsanto	524-475	4	1/3	5108	>5000	organophosphate
Select 2EC	clethodim	Valent	59639-3	24	3/3	2920-3610	>5000	cyclohexene oxime
Sinbar 80 WP	terbacil	DuPont	352-317	12	2/1	500-2784	>5000	uracil
Snapshot 80 DF	isoxaben + oryzalin	DowAgrosciences	62719-174	12	1/3	>5000	-	amide+
Solicam 80 DF	norflurazon	Syngenta	100-849	12	2/2	1140	>2000	dinitroaniline
Surflan AS	oryzalin	DowAgrosciences	627 19-112	24	3/3	5000	>5000	dinitroaniline
Stinger	clopyralid	DowAgrosciences	62719-73	12	3/1	>5000	>5000	pyridine
Touchdown 6 F	glyphosate	Syngenta	100-1117	12	1/3	>5000	>5000	organophosphate
Velpar L	hexazinone	DuPont	352-392	24	2/1	1200	>5000	triazinone
Weedar 64	2,4-D	Nufarm	71368-1	48	3/2	1161	1544	phenoxy

INSECTICIDES/MITICIDES

Acramite 50WS	bifenazate	Crompton-UniRoyal	400-503	1-5 days	2/3	>5000	>5000	unclassified
Actara 25WG	thiamethoxam	Syngenta	100-938	12	2/1	>5000	>2000	nitroguanidine
*Agri-Mek 0.15 EC & abamectin	avermectin B1	Syngenta	100-898	12	2/3	300	>1800	antibiotic
*Ambush 2 EC	permethrin	Syngenta	100-985	12	2/3	2305	1912	pyrethroid
*Ambush 25 WP	permethrin	Amvac	5481-502	12	2/3	>5000	>2000	pyrethroid
Apollo SC	clofentezine	Makhteshim-Agan	66222-47	12	1/3	>5000	>2400	growth regulator
*Asana XL	esfenvalerate	DuPont	352-515	12	2/3	458	>2000	pyrethroid
Assail 70WP	acetamiprid	Aventis	264-609	12	3/2	1064	>2000	pyridylmethylamine
Avaunt 30WG	indoxacarb	DuPont	352-597	12	1/3	687-1867	>5000	oxadiazine
Aza-Direct	azadirachtin	Gowan	71908-1-10163	4	2/1	>5000	>2000	botanical
*Azinphos-Methyl 50	azinphos-methyl	Micro-Flo	51036-1 64	7-15 days	2/3	14	>2000	organophosphate
Biobit HPWP	Bt var kurstaki	Valent	73049-54	4	-/-	>5000	>2500	biological
*Brigade WSB	bifenthrin	FMC	279-3108	12	2/3	335	>2000	pyrethroid
Calypso	thiocloprid	Bayer	264-806	12	-/-	300-500	>4000	-
*Capture	bifenthrin	FMC	279-3069	12	2/3	262	>2000	pyrethroid
Carbaryl 4 L	carbaryl	Platte	34704-447	12	3/3	590	2000	carbamate
Carbaryl 80	carbaryl	Drexel	19713-50	12	3/3	281	>2000	carbamate
Confirm 2F	tebufenozide	DowAgro	62719-420	4	2/1	>5000	>5000	molting hormone agonist
*Danitol 2.4 EC	fenpropathrin	Valent	59639-35	24	2/3	66	>2000	pyrethroid
Deliver	Bt Kurstaki	Certis	70051-69	4	-/-	>5000	-	biological
*Diazinon 50 WP	diazinon	Platte	100-460-34704	24	1/3	1960	>2020	organophosphate
*Diazinon AG 600	diazinon	Platte	100-784-34704	24	1/3	1600	>2020	organophosphate
*Diazinon 50 W	diazinon	Micro-Flo	51036-108	24	1/3	>2000	>2000	organophosphate
Dimethoate 400	dimethoate	Platte	34704-207	48	3/2	425	2020	organophosphate
Dimethoate 267 EC	dimethoate	Micro-Flo	51036-198	48	3/2	750	>2000	organophosphate
Dipel	Bt var kurstaki	Valent	73049-17	4	-/-	>5050	>5050	biological
Ecozin	azadirachtin	Amvac	5481-476	12	2/1	>5050	>5050	botanical
Entrust	Spinosad	DowAgrosciences	62719-282	4	2/3	>5000	>2000	macrocyclic lactone
Endosulfan 50 WSB	endosulfan	Microflo	51036-91	24	1/3	50	150	organochloride
Esteem 35 WP	pyriproxyfen	Valent	59639-115	12	2/3	>5000	>5000	IGR
Evergreen	pyrethrin + piperonyl butoxide	MGK	1021-1770	12	2/3	>5000	>2000	pyrethroid

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INSECTICIDES/MITICIDES (cont.)

Trade Name	Common Name	Manufacturer	EPA Registration #	REI ¹ (hours)	Runoff/Leach Potential ²	Oral LD50	Dermal LD50	Class
GF-120 NF	spinosad	DowAgrosciences	62719-498	4	2/3	>5000	>5000	macrocyclic lactone
*Guthion 2 L	azinphos-methyl	Bayer	3125-102	2-21days	2/3	55-75	350	organophosphate
*GuthionSolupak50WP	azinphos-methyl	Bayer	3125-301	2-21days	2/3	12.3-24.7	>2000	organophosphate
Imidan 70 WP	phosmet	Gowan	10163-169	24	3/3	126-681	>4.64	organophosphate
Intrepid 2F	methoxyfenozide	DowAgrosciences	62719-442	4	-/-	>5000	>2000	molting hormone agonist
Javelin WG	Bt kurstaki	Certis	70051-66	4	-/-	>5100	>5000	-
Kelthane MF	dicofol	DowAgrosciences	62719-405	12	1/3	1835-5022	>5000	bridged diphenyl
*Lannate 90 SP	methomyl	DuPont	352-342	2-7 days	3/1	30-34	>2000	carbamate
*Lannate 2.4 LV	methomyl	DuPont	352-384	2-7 days	3/1	49-89	>2000	carbamate
Lorsban 50 WP	chlorpyrifos	Gowan	62719-221-10163	1-4 days	2/3	382	>2000	organophosphate
*Lorsban 4 EC	chlorpyrifos	DowAgrosciences	62719-220	1-4 days	2/3	300-776	>5000	organophosphate
Malathion 8 Flowable	malathion	Gowan	10163-21	12-24	3/3	370	4100	organophosphate
Malathion 57EC	malathion	UAP Platte	34704-108	12	3/3	550	>2000	organophosphate
M-Pede	fatty acids	Mycogen	53219-6	12	-/-	>5000	>2000	-
Methoxychlor 2 EC	methoxychlor	Platte	34704-102	12	1/3	5000-6000	>2820	organochlorine
Neemix 4.5	azadirachtin	Certis	70051-9	12	2/1	>5000	-	botanical
Nexter	pyridaben	BASF	7969-106	12	1/3	1930	>2000	unclassified
*Pounce 25 WP	permethrin	FMC	279-3051	12	2/3	1100	>2000	pyrethroid
*Pounce 3.2 EC	permethrin	FMC	279-3014	12	2/3	1030	>2000	pyrethroid
Provado	imidacloprid	Bayer	3125-457	12	2/1	1858-2591	>2000	nitroguanidine
Pyganic	pyrethrins	MGK	1021-1771	12	2/3	-	-	pyrethroid
Pyramite 60 WP	pyridazinone	BASF	7969-125	12	-/-	1930	>2000	-
Savey 50 DF	hexythiazox	Gowan	10163-250	12	2/3	>5000	>5000	growth regulator
Sevin 80 S	carbaryl	Bayer	264-316	12	3/3	281	>2000	carbamate
Sevin XLR Plus	carbaryl	Bayer	264-333	12	3/3	649	>2000	carbamate
Sevin 4 F	carbaryl	Bayer	264-349	12	3/3	590	>2000	carbamate
Spintor 2 SC	spinosad	DowAgrosciences	62719-294	4	2/3	>5000	>5000	macrocyclic lactone
Sulforix	calcium polysulfide	Miller	66196-3-72	48	-/-	820	>2000	inorganic
Sunspray Ultra-fine Spray Oil	superior oil	Sun Company	862-28	4	-/-	>15000	-	-
*Supracide 25 WP	methidathion	Gowan	10163-244	2-14 days	3/3	53	>2020	organophosphate
Surround WP	kaolin	Engelhard	70060-14	4	-/-	>5000	-	clay
Thiodan 3 EC	endosulfan	FMC	279-2924	24	1/3	45	256	organochlorine
Thiodan 50 WP	endosulfan	FMC	279-1380	24	1/3	41	>2000	organochlorine
*Vendex 50 WP	fenbutatin-oxide	Griffin	1812-413	48	1/3	>5000	>2000	organotin
*Vydate L	oxamyl	DuPont	352-372	48	3/3	9-10	>5000	carbamate
Warrior	lambda-cyhalothrin	Syngenta	100-1112	24	2/3	351	>2000	pyrethroid
Zeal	etoxazole	Valent	59639-123	12	-/-	>5000	>5000	unclassified

PLANT GROWTH REGULATORS

Accel	6BA + GA4+7	Valent	73049-29	12	-/-	>3000	>2000	cytokinin+gibberellin
Apogee	Prohexadione-Cacalcium	BASF	7969-188	12	3/2	>5000	>2000	unclassified
Amid-Thin-W	NAD	Amvac	5481-426	48	3/2	>10000	>5000	auxin
Ethrel	ethephon	Aventis	264-267	48	2/3	>5000	>2000	ethylene releaser
Fruitone N	NAD	Amvac	5481-427	48	3/2	>10000	>5000	auxin
K-Salt Fruit Fix 800	NAD	Amvac	5481-413	24	3/2	>5050	>2020	auxin
K-Salt Fruit Fix 200	NAD	Amvac	5481-414	24	3/2	>5050	>2020	auxin
MaxCel	6-benzyladenine	Valent	73049-407	12	-/-	>5000	>5000	cytokinin
Pro-Gibb	gibberellic acid (GA3)	Valent	73049-15	12	-/-	>5000	>2000	gibberellin
Pro-Gibb	gibberellic acid (GA3)	Valent	73049-15	12	-/-	>5000	>2000	gibberellin
Pro-Vide	gibberellic acid	Valent	73049-3	12	-/-	2100	>2000	Gibberellin
Promalin	6BA+GA4+7	Valent	73049-41	4	-/-	>5050	>5050	cytokinin+gibberellin
ReTain	AVG	Valent	73049-45	12	-/-	>7000	>5000	ethylene inhibitor
Sucker-Stopper	NAD	Lawn & Garden	548 1-429-54705	12	3/2	5585	>5000	auxin

NEMATOCIDES

*Nemacur 3 S	fenamiphos	Bayer	264-731	48	2/1	10.6-24.8	71.5-75.7	organophosphate
*Nemacur 15G	fenamiphos	Bayer	264-726	48	2/1	10-14	>2000	organophosphate
*Telone II	dichloropropene	DowAgrosciences	627 19-32	5 days	3/2	224-300	333	unclassified
*Telone C-17	dichloropropene and chloropicrin	DowAgrosciences	62719-12	5 days	3/2	304-519	200-500	unclassified
Vapam	metam-sodium	Amvac	5481-466	48	3/2	812	>2020	unclassified
*Vydate L	oxamyl	DuPont	352-372	48	3/3	9-10	>5000	carbamate

*Restricted use pesticides

1: REI = Restricted Entry Interval, SL = See Label. Some REIs vary by crop, always check the label.

2: 1= high, 2=intermediate, 3=low. These leaching/runoff potential ratings are from the NRCS WIN-PST Pesticide Properties Database <http://www.wcc.nrcs.usda.gov/pestmgmt/winpst.html>.

3: The REI for most formulations of Captan is 24 hours; however, some product labels still have a 4 day REI. See note on Captan REI for tree fruit on page 15.

Taken from Michigan Extension bulletin E-154 (used with permission)

2006 Commercial Tree Fruit Spray Guide

This publication is one of a series of publications for fruit growers in the Midwest developed by the Midwest Fruit Workers Group. Other publications include the Midwest Small Fruit Pest Management Handbook, Midwest Commercial Small Fruit and Grape Spray Guide, and Midwest Tree Fruit Pest Management Handbook. Contact your local Cooperative Extension office for information on these publications.

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