

RUTGERS

New Jersey Agricultural
Experiment Station

2019

Commercial Grape Pest Control Recommendations for New Jersey



Daniel Ward (editor)
Specialist in Pomology

Thierry Besançon
Specialist in Weed Science

Anne Nielson
Specialist in Entomology

Peter Oudemans
Specialist in Plant Pathology

Rutgers Cooperative Extension

E283

Please visit the website grapepestcontrol.njaes.rutgers.edu for the most current updates.

Introduction to Grape Disease, Insect and Weed Control

Pesticide recommendations are subject to change at any time. Labels and product registrations change frequently; recommendations on this site may no longer be legal at the time you read them. It is always the pesticide applicator's responsibility, by law, to read and follow current label directions for the specific pesticide being used.

Every effort has been made to ensure that the advice and information on this site is true and accurate at the time of writing. However, neither Rutgers University, nor the authors can accept any legal responsibility for any errors or omissions that may be made. In the case of pesticides, you are instructed to consult the pesticide label.

In the United States of America, a pesticide label is the law and a legally binding document. Always read and follow the label directions before using any pesticide product. If any recommendation herein disagrees with the label, the recommendation must be disregarded.

Pest Management Introduction

This publication contains descriptions of various diseases, insect, mite, and weed pests of grapes, cultural practices to reduce incidence (IPM strategies), and chemical control tactics should they be warranted.

All spray formulations are presented in amount of formulated product per acre (Rate/A). Apply sprays so that uniform foliage coverage is achieved without excessive run-off. Sprayers must be calibrated based on the manufacturer's specifications for applications to be effective. Not all pesticide treatments recommended here are necessary to manage insect and disease problems in every field.

Always use local scouting information on insects and diseases in arriving at insecticide and fungicide spray decisions. Follow all label instructions when using pesticides.

Good management practices will improve plant health and reduce pest problems, decreasing the need for pesticides. Themes to follow for good pest management include:

- 1. Plant only disease-free vines of resistant or moderately susceptible varieties:**
 - avoid tight-clustered varieties
 - use certified planting stock where available to avoid crown gall and other systemic pathogens (certified planting stock is slowly becoming more available)
- 2. Exclude specific pests from the planting when possible:**
 - control disease hosts and vectors (weeds, insects)
 - reduce inoculum levels for indigenous or established pathogens and pests
 - remove and destroy diseased and dead plant parts
- 3. Minimize mechanical injury.**
- 4. Maintain an open leaf canopy and control vine vigor to allow more light and air circulation for reduced drying time and improved spray penetration:**
 - thin shoots, position shoots, hedge, pull leaves
 - avoid excessive nitrogen and water
 - balanced pruning = increased clusters = decreased berries per cluster and decreased berry size = looser clusters
 - prune to multiple trunk system to manage crown gall and other dieback
- 5. Walk rows and inspect plants regularly during the growing season to keep abreast of pest occurrence.**
- 6. Practice stringent pest control during critical times early in the season, from bud swell through postbloom.**

Many of these practices are good basic horticulture and can reduce the need for protectant chemicals. If you follow these practices, let your clientele know that you are utilizing a responsible program designed to minimize chemical usage.

Pesticide mixing and evaluation for compatibility. A convenient and economical method for controlling several pest problems at once is with pesticide mixtures. Fungicides and insecticides are commonly used in combination for disease and insect control. Many problems can arise from inappropriate use of mixtures. Chemicals that are physically incompatible form an insoluble precipitate that clogs nozzles and sprayer lines. Other mixtures may be phytotoxic and result in a crop loss. Mixed applications of formulations of Captan or Captec with diazinon, and other products that are emulsifiable concentrates (EC) has caused severe crop injury. Therefore, **Captan formulations should not be tank-mixed**

with any emulsifiable concentrate or oil-containing product. This type of phytotoxicity results from either a direct interaction of the active ingredients or an interaction of the inert ingredients in one formulation that enhances the toxicity of the other one. A third type of incompatibility arises when one component of the mixture reduces efficacy of the other component. When using mixtures there are several guidelines to follow:

1. Read the label and follow the manufacturer directions. A section specifically addressing compatibility is usually included on the label. If you are in doubt, contact the manufacturer, or a technical representative.
2. Obtain a compatibility chart and use it as a guideline only. Compatibility charts are frequently out of date because new pesticide formulations can alter compatibility. However, they provide useful baseline information.
3. Use a jar test to determine physical compatibility. Jar tests are conducted by mixing chemicals at approximately the same
4. Rate as specified on the labels. The volumes are scaled down to fit in a small (1 pint - 1 quart) container. Results are evaluated by observing the mixture for reactions such as formation of larger particles, the formation of layers or other changes that result in the formation of a precipitate (i.e. sludge at the bottom of the container).
5. Chemicals that are physically compatible may be phytotoxic. Therefore, mixtures of new chemicals should always be tested on a small number of plants before being sprayed on a larger area. Phytotoxicity may appear as wilting, spotting, dieback or other abnormalities in plant growth. The appearance of phytotoxicity may be environmentally controlled. For example, high temperatures may cause more severe expression of phytotoxicity. Environmental variables can play a big role in causing mixtures as well as single component sprays to perform not as predicted.
6. Use of spray additives, such as spreaders, stickers, or activators can greatly complicate chemical compatibility in mixtures. Unless recommended by the manufacturer these additives should be avoided.
7. For low-volume sprays, apply at least 5.0 gals./A of spray mix. Use a jar test to check for compatibility of pesticides.

Mixtures provide an economical and efficient method for applying different classes of pesticides. Mixtures can provide enhanced activity through synergism and in some cases reduce the chance of resistance developing in the target population. Some chemical companies market pesticides pre-mixed. Thus, appropriate use of mixtures **requires** preliminary research to determine their compatibility.

Labels can be found on the CDMS website: <http://www.cdms.net/Label-Database>

Fungicides and Insecticides with Known Phytotoxic Reactions in Grapes

The chemical compounds below are known to damage grapes. Grape varieties come from a diverse genetic background and differ widely in their susceptibility to the various phytotoxic compounds. If applying any of these chemicals to (or near) varieties of unknown susceptibility, apply to a small test area before spraying many vines.

Table 1. Phytotoxic fungicides and insecticides.

Compound	Varieties with Known Susceptibility ¹	Effect	Notes
Sulfur	Many red hybrids and some natives; Chambourcin, Chancellor, Concord, Cynthiana (Norton), De Chaunac, Ives, Maréchal Foch, Mourvèdre, Rougeon, Van Buren.	Leaf stippling, burning (necrosis), defoliation.	Sensitivity to sulfur is increased by high temperatures, intense sunlight, frost, or rain. Temperatures of 80-95° F during or immediately after application may cause damage in otherwise tolerant varieties.
Copper-fungicides	Many hybrids and some natives: Aurore, Catawba, Cayuga White, Chancellor, Chelois, Concord, De Chaunac, Delaware, Elvira, Gewürztraminer, León Millot, Maréchal Foch, Merlot, Niagara, Cynthiana (Norton), Pinot blanc, Pinot noir, Rosette, Rougeon, Seyval blanc.	Leaf “bronzing”, burning, reduced vigor.	Damage from copper-containing fungicides is increased under slow drying conditions. Cool or very humid conditions shortly after application may cause damage in otherwise tolerant varieties.
Paraffinic or Mineral oil (JMS Stylet Oil, Purespray Green)	All varieties.	Leaf burning, removes waxy “bloom” from fruit. Oil applied near veraison may lower Brix values at harvest.	Use of Captan or Sulfur within two weeks after applying oil can result in severe vine damage and death. Do not use oil with copper when fruit are present.
Trifloxystrobin (in Flint)	Concord.	Leaf burning.	
Pyraclostrobin (in Pristine)	Concord, Noiret, and related varieties such as Fredonia, Niagara, Rougeon, Steuben, Worden.	Leaf burning.	
Difenoconazole (in Revus Top, Inspire Super, and Quadris Top)	Brianna, Canadice, Concord, Concord Seedless, Frontenac, Glenora, Noiret, Skujinsh 675, St. Croix, Thomcord.	Leaf burning.	The Revus Top label cautions that: On <i>V. labrusca</i> , <i>V. labrusca</i> hybrids, and other non-vinifera (<i>sic</i>) hybrids where sensitivity is not known – the use of fungicides containing difenoconazole alone or in tank-mixtures with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects.
Carbaryl (Sevin XLR)	All varieties.	Leaf damage on tender foliage and growing tip	Damage is typically seen when application is followed by high humidity.
Captan	All varieties.	Leaf and fruit damage. In severe cases will kill entire plant.	Captan is considered a biocide and is specific to fungi only because of selective uptake. Mixing Captan with other pesticides or surfactants or spreader/stickers may increase uptake into plant tissue causing moderate to severe phytotoxicity.

¹ Not all varieties have been thoroughly tested with all chemicals. Use caution and be aware that varieties that are closely related to susceptible varieties may also be susceptible. Sources: Product labels; New York and Pennsylvania Pest Management Guidelines for Grapes.; Wine Grape Production Guide for Eastern North America. Tony Wolfe ed. NRAES-145.; Phytotoxicity in Tender Fruit and Grapes. Ontario Ministry of Agriculture, Food, and Rural Affairs.

Disease and Insect Spray Schedule Recommendations

Time	Pest	Materials	Rate / Acre
DORMANT			
	Eutypa dieback. Infected trunks should be cut off below the canker, as close to the ground as possible, when foliar symptoms become evident in June. Infected wood should be disposed of immediately by burning or burying. If possible, prune the least tolerant cultivars when inoculum levels are lowest (early spring). A multiple trunk or periodic trunk renewal system is an effective way to combat this disease. Since this disease may be confused with other stem diseases, be sure to obtain a proper diagnosis.		
	Phomopsis (Ph)	Sulfurix	1.0 gal.
		Lime-sulfur	15.0 to 20.0 gals.
	This treatment should be used when Phomopsis was severe the previous season. Prune to remove dead wood, especially canes and rachises. Use cane pruning to reduce old wood.		
	Mealybugs	Actara 25WDG	1.5 to 3.5 oz., or
		Admire Pro	1.0 to 1.4 fl. oz., or
		Applaud 70DF	9.0 to 12.0 fl. oz., or
		Assail WSP	1.1 oz., or
		Baythroid XL 1EC	2.4 to 3.2 fl. oz., or
		Belay 50WDG	6.0 fl. oz., or
		Scorpion 35SL	2.0 to 5.0 fl. oz. (foliar) 9.0 to 10.5 fl. oz. (soil), or
		Venom 70	1.0 to 3.0 oz.
	Grape scale	Dormant oil	2% solution
BUDSWELL			
	Climbing cutworms overwinter in plant trash on vineyard floors. They climb grape trunks on warm spring nights and feed on swelling buds and early new growth. After this brief period, however, they are seldom a problem. Weed control and clean cultivation can help prevent the occurrence of cutworms and flea beetles. Cutworms have been hard to find in vineyards over the past few years. However, new canes should be inspected until there are 6 inches of new growth.		
	Climbing cutworms	Altacor 35WDG	3.0 to 4.5 oz., or
		<i>Bacillus thuringiensis</i>	Rates vary, see label, or
		Baythroid XL 1EC	2.4 to 3.2 fl. oz., or
		Brigade 10WSB	8.0 to 16.0 oz., or
		Danitol 2.4EC	15.0 fl. oz., or
		Delegate 25WG	3.0 to 5.0 oz., or
		Entrust 25C	4.0 to 8.0 fl. oz., or
		Intrepid 2F	12.0 to 16.0 fl. oz., or
		Sevin XLR Plus	2.0 qts., or
	Flea beetles may become active on warm April days and are most numerous following mild winters. They cause injury by eating holes in buds, thereby destroying future canes. Flea beetles can be troublesome, particularly near woods and in vineyards containing abundant plant trash. Bud inspection is a must, at least until there is 1 inch of new growth.		
	Flea beetles	Baythroid XL 1EC	2.4 to 3.2 fl. oz., or
		Danitol 2.4EC	8.0 fl. oz., or
		Imidan 70WP	2.0 lbs., or
		Sevin 80WSP	1.25 to 2.5 lbs., or
		Sevin XLR Plus	2.0 qts.
NEW GROWTH (when new growth is 1 inch long)			
	Climbing cutworms	Altacor 35WDG	3.0 to 4.5 oz., or
		Baythroid XL 1EC	2.4 to 3.2 fl. oz., or
		Brigade 10WSB	8.0 to 16.0 oz., or
		Danitol 2.4EC	15.0 fl. oz., or
		Delegate 25WG	3.0 to 5.0 oz., or
		Entrust 25C	4.0 to 8.0 fl. oz., or
		Intrepid 2F	12.0 to 16.0 fl. oz., or
		Sevin XLR Plus	2.0 qts., or

Time	Pest	Materials	Rate / Acre
	European red mites (ERM) and two-spotted spider mites (TSSM) are often found together in mixed populations. Spider mite populations can develop at any time after bud break; however, particular attention is needed at the new growth stage and the early postbloom period. As many as 5 to 8 generations occur each season. Heavy mite infestations can cause stunted shoots with bronzed leaves. If using Nexter, use the lower rate for European red mite control. While ERM predominates in most years, TSSM is more damaging on a per mite basis, and is harder to control with some acaricides.		
	European red mites, and Two-spotted spider mites	Acramite	0.75 to 1.0 lbs., or
		Agri-Mek 0.15EC (TSSM only ¹)	8.0 to 16.0 fl. oz., or
		Envidor 2 SC	16.0 to 18.0 oz., or
		JMS Stylet Oil	1.0 to 2.0 gals., or
		Nexter	4.4 to 10.67 oz., or
		Onager 11.8 EC	12.0 to 24 fl. oz., or
		Vendex 50WP	1.0 to 2.5 lbs., or
	¹ Add nonionic surfactant.	Zeal WP	2.0 to 3.0 oz.
	Phomopsis cane and leaf spot (PH) Begin at 1 inch shoot growth when pressure is high. These diseases produce over-wintering structures that survive in the vineyard. High disease pressure occurs when the disease was a problem during the previous season. Otherwise wait until 3-5 inches of shoot growth to make applications.		
	Phomopsis cane and leaf spot	Captan ² 50WP (weak)	3.0 to 4.0 lbs., or
	² There are many formulations see Table 2.	Mancozeb ² 80WP	3.0 to 4.0 lbs., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Black rot (BR) This early application timing for black rot is useful only when pressure is high. These diseases over-winter in mummies that survive on the vines. High disease pressure occurs when the disease was a problem during the previous season. The most important application timing begins at immediately prebloom and when conditions are conducive.		
	Black rot	Captan ² 50WP (weak)	3.0 to 4.0 lbs., or
	² There are many formulations see Table 2.	Mancozeb ² 80WP	3.0 to 4.0 lbs., or
		Ziram 76DF	3.0 to 4.0 lbs.
3-5 INCHES NEW GROWTH			
	Phomopsis cane and leaf spot	Captan ² 50WP	3.0 to 4.0 lbs., or
	² There are many formulations see Table 2.	Mancozeb ² 80WP	3.0 to 4.0 lbs., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Black rot	Captan ² 50WP	3.0 to 4.0 lbs., or
	² There are many formulations see Table 2.	Mancozeb ² 80WP	3.0 to 4.0 lbs., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Powdery mildew (PM) , unlike many other diseases, does not rely on wet weather conditions to spread throughout the vineyard. It is very common in hot, dry climates and can continue to spread regardless of moisture conditions. Good air circulation and sun exposure may reduce the spread of infection to a certain degree.		
	Powdery mildew	Abound 2.08F	11.0 to 15.5 oz., or
		Endura	4.5 oz., or
	³ Potential phytotoxicity see Table 1.	Flint ³ 50WDG	2.0 oz., or
		Inspire Super	16.0 to 20.0 fl. oz., or
		Pristine ³	8.0 to 10.5 oz., or
		Procure 50WS	4.0 to 8.0 oz., or
		Quadris Top	12 to 14 fl. oz., or
		Quintec	3.0 to 6.6 oz., or
		Rally 40WP	3.0 to 5.0 oz., or
		Revus Top	7.0 fl. oz., or
		Rubigan EC	2.0 to 5.0 fl. oz., or
		Sovran 50WG	3.2 to 4.8 oz., or
		Sulfur (many forms)	See label for specific instructions, or
		Tebuconazole	See labels, or

Time	Pest	Materials	Rate / Acre
		Torino	3.4 oz., or
		Vivando	10.3 to 15.4 fl. oz.
PREBLOOM (when new growth is 6 to 10 inches long)			
Prebloom is a critical period for PM, BR, PH, and DM	Phomopsis cane and leaf spot	Captan ² 50WP	3.0 to 4.0 lbs., or
	² There are many formulations see Table 2.	Mancozeb ² 80WP	3.0 to 4.0 lbs., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Black rot	Captan ² 50WP	3.0 to 4.0 lbs., or
	² There are many formulations see Table 2.	Mancozeb ² 80WP	3.0 to 4.0 lbs., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Powdery mildew	Abound 2.08F	11.0 to 15.5 oz., or
		Endura	4.5 oz., or
	³ Potential phytotoxicity see Table 1.	Flint ³ 50WDG	2.0 oz., or
		Inspire Super	16.0 to 20.0 fl. oz., or
		Pristine ³	8.0 to 10.5 oz., or
		Procure 50WS	4.0 to 8.0 oz., or
		Quadris Top	12 to 14 fl. oz., or
		Quintec	3.0 to 6.6 oz., or
		Rally 40WP	3.0 to 5.0 oz., or
		Revus Top	7.0 fl. oz., or
		Rubigan EC	2.0 to 5.0 fl. oz., or
		Sovran 50WG	3.2 to 4.8 oz., or
	⁴ Note: Be careful of varietal sensitivity to Sulfur.	Sulfur ⁴ (many forms)	See label for specific instructions, or
		Tebuconazole	See labels, or
		Torino	3.4 oz., or
		Vivando	10.3 to 15.4 fl. oz.
	Downy mildew (DM) Preventive management practices consist of making sure soil is well-drained, removal of overwintering debris from the vineyard, and pruning out the ends of infected shoots. Control should not be delayed beyond the prebloom stage, even in dry years. Wet weather requires earlier application of fungicides. Postveraison sprays may be needed to protect foliage during a wet season or in dew pockets.		
	Downy mildew	Abound 2.08F	11.0 to 15.5 oz., or
	² There are many formulations see Table 2.	Captan ² 50WP	3.0 to 4.0 lbs., or
		Fixed Copper	See label for specific instructions, or
		Gavel 75DF	2.0 to 2.5 lbs., or
		Mancozeb 80WP	3.0 to 4.0 lbs., or
		Phosphonate fungicides	See label for specific instructions, or
		Presidio	3.0 to 4.0 fl. oz., or
	³ Potential phytotoxicity see Table 1.	Pristine ³	8.0 to 10.5 oz., or
		Quadris Top	12 to 14 fl. oz., or
		Ranman	2.1 to 2.75 fl. oz., or
		Reason	2.7 fl. oz., or
		Revus	8.0 fl. oz., or
		Revus Top	7.0 fl. oz., or
	⁵ DO NOT apply Ridomil Gold MZ within 66 days of harvest or Ridomil Gold Copper within 42 days of harvest.	Ridomil Gold MZ ⁵	2.0 to 2.5 oz., or
		Ridomil Gold Copper	1.0 to 2.0 lbs., or
		Sovran 50WG	4.0 to 6.4 oz., or
		Zampro	11 to 14 fl. oz., or
		Ziram 76DF	3.0 to 4.0 lbs.

Time	Pest	Materials	Rate / Acre
	Grape berry moth	Altacor 35WDG	2.0 to 4.5 oz., or
		Avaunt 30WG	5.0 to 6.0 fl. oz., or
		Baythroid XL 1EC	2.4 to 3.2 fl. oz., or
		Belay	6.0 fl oz., or
		<i>Bacillus thuringiensis</i>	Rates vary, see label, or
		Brigade 10WSB	8.0 to 16.0 oz., or
		Danitol 2.4EC	10.6 fl. oz., or
		Delegate 25WG	3.0 to 5.0 oz., or
		Entrust 25C	4.0 to 8.0 fl. oz., or
		Imidan 70W	1.3 to 2.0 lbs., or
		Intrepid 2F	4.0 to 8.0 fl. oz., or
		SPLAT-GBM	1.06 g., or
	Grape leafhopper	Actara 25WDG	1.5 to 3.5 oz., or
		Admire Pro – soil applied	7.0 to 14 oz., or
		Admire Pro – foliar applied	1.0 to 1.4 fl. oz., or
		Assail 30SG	2.5 oz., or
		Danitol 2.4 EC	5.3 to 10.6 oz., or
		Malathion 8F	1.8 pts., or
		Nexter 75WP	4.4 to 5.2 oz., or
		Sevin XLR Plus	2.0 qts., or
	⁶ Note: Venom is applied to the soil	Venom 70 ⁶	1.0 to 3.0 oz.
	Redbanded leafroller	Altacor 35WDG	3.0 to 4.5 oz., or
		B.t. various products	See label, or
		Danitol 2.4EC	6.0 to 8.0 fl. oz., or
		Delegate 25WG	3.0 to 5.0 oz., or
		Entrust 25C	4.0 to 8.0 fl. oz., or
		Imidan 70W	1.3 to 2.0 lbs., or
		Intrepid 2F	10.0 to 16.0 fl. oz., or
		Sevin XLR Plus	2.0 qts.
	Grape scale	Admire Pro	1.0 to 1.4 fl. oz., or
		Applaud 70DF	9.0 to 12.0 oz., or
		Movento	6.0 to 8.0 fl. oz., or
		Assail 30SG	2.5 oz.
	Grape tumid gallmaker	Movento	6.0 to 8.0 fl. oz.
BLOOM (early-mid bloom)			
Critical period for PM, BR, Ph, DM	Botrytis bunch rot is caused by the fungus <i>Botrytis cinerea</i> . Infections occur as flowers begin to senesce in late bloom, and again as infected berries begin to touch in fruit clusters. Control consists of improving air movement within the plant and avoiding varieties that form very tight fruit clusters. Pruning out all dead tissue prior to bloom and again shortly before the berries touch in the cluster will remove sources of inoculum. With varieties having very tight fruit clusters, some thinning out of the berries in each cluster will improve air movement and reduce disease incidence. Vegetative vigor may be limited through the use of appropriate rootstocks and judicious application of nitrogen. Proper trellising and leaf removal around fruit can improve aeration and sun exposure of clusters. Protecting against disease and insect injury (especially Grape berry moth), which results in open wounds, can reduce the number of entry points for the fungus. Fields that experience heavy dew and frequent fogs should be avoided. Chemical control can only be achieved through preventive sprays. A bloom spray is important. Where bunch rot has been a problem, make an application just before bunch closing and at the beginning of fruit ripening. The fungicides listed all have high activity against the fungus. Other materials having less activity are also listed in Table 2.		
	Bunch rot (Botrytis)	Elevate 50WDG	1.0 lb., or
		Endura	8 oz., or
		Inspire Super	16.0 to 20.0 fl. oz., or
		Luna Experience	8.0 to 8.6 fl. oz., or
		Meteor	1 to 2 pts., or
		Pristine	8 to 12.5 oz., or
		Rovral 50W or 4F	1.5.0 to 2.0 lbs., or

Time	Pest	Materials	Rate / Acre
		Scala SC	18.0 fl. oz., or
		Switch	11 to 14 oz., or
		Vanguard WG	5.0 to 10.0 oz.
FIRST POSTBLOOM (immediately after bloom)			
	Black rot	Captan ² 50WP	3.0 to 4.0 lbs., or
	² There are many formulations see Table 2.	Mancozeb ² 80WP	3.0 to 4.0 lbs., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Bunch rot (Botrytis)	Elevate 50WDG	1.0 lb., or
		Endura	8 oz., or
		Inspire Super	16.0 to 20.0 fl. oz., or
		Luna Experience	8.0 to 8.6 fl. oz., or
		Pristine	8 to 12.5
		Meteor	1 to 2 pts., or
		Rovral 50W or 4F	1.5.0 to 2.0 lbs., or
		Scala SC	18.0 fl. oz., or
		Switch	11 to 14 oz., or
		Vanguard WG	5.0 to 10.0 oz.
	Downy mildew	Abound 2.08F	11.0 to 15.5 oz., or
	² There are many formulations see Table 2.	Captan ² 50WP	3.0 to 4.0 lbs., or
		Fixed Copper	See label for specific instructions, or
		Gavel 75DF	2.0 to 2.5 lbs., or
		Mancozeb 80WP	3.0 to 4.0 lbs., or
		Phosphonate fungicides	See label for specific instructions, or
		Presidio	3.0 to 4.0 fl. oz., or
	³ Potential phytotoxicity see Table 1.	Pristine ³	8.0 to 10.5 oz., or
		Quadris Top	12 to 14 fl. oz., or
		Ranman	2.1 to 2.75 fl. oz., or
		Reason	2.7 fl. oz., or
		Revus	8.0 fl. oz., or
		Revus Top	7.0 fl. oz., or
	⁵ DO NOT apply Ridomil Gold MZ within 66 days of harvest or Ridomil Gold Copper within 42 days of harvest.	Ridomil Gold MZ ⁵	2.0 to 2.5 oz., or
		Ridomil Gold Copper	1.0 to 2.0 lbs., or
		Sovran 50WG	4.0 to 6.4 oz., or
		Zampro	11 to 14 fl. oz., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Powdery mildew	Abound 2.08F	11.0 to 15.5 oz., or
		Endura	4.5 oz., or
	³ DO NOT apply Flint or Pristine to Concord or similar grapes; injury may result.	Flint ³ 50WDG	2.0 oz., or
		Inspire Super	16.0 to 20.0 fl. oz., or
		Pristine ³	8.0 to 10.5 oz., or
		Procure 50WS	4.0 to 8.0 oz., or
		Quadris Top	12 to 14 fl. oz., or
		Quintec	3.0 to 6.6 oz., or
		Rally 40WP	3.0 to 5.0 oz., or
		Revus Top	7.0 fl. oz., or
		Rubigan EC	2.0 to 5.0 fl. oz., or
		Sovran 50WG	3.2 to 4.8 oz., or
	⁴ Note: Be careful of varietal sensitivity to Sulfur. Some fungicides have activity on	Sulfur ⁴ (many forms)	See label for specific instructions, or

Time	Pest	Materials	Rate / Acre
	multiple diseases; always check fungicide efficacy tables when making decisions.		
		Tebuconazole	See labels, or
		Torino	3.4 oz., or
		Vivando	10.3 to 15.4 fl. oz.
	Grape berry moth (GBM) is the most important potential pest at this time. GBM pheromone traps are reliable and reveal male flight occurrences (2, possibly 3 generations/year). The first generation male moth catches peak anytime from April to early-June, depending on the year. If an insecticide has not been applied up to this time and if the vineyard is not being monitored for pests, one should be applied 10 days postbloom. Subsequent insecticide applications are necessary only when more than 5% of the bunches show berry webbing ⁷ . Materials applied for Grape berry moth (except Delegate, Entrust, and Intrepid) will also control Grape leafhopper.		
	Grape berry moth	Altacor 35WDG	2.0 to 4.5 oz., or
		Avaunt 30WG	5.0 to 6.0 oz., or
		Baythroid XL 1EC	2.4 to 3.2 oz. or
		B.t. various products	See label, or
		Brigade 10WSB	8.0 to 16.0 oz., or
		Danitol 2.4EC	10.6 fl. oz., or
		Delegate 25WG	3.0 to 5.0 oz., or
		Entrust 25C	4.0 to 8.0 fl. oz., or
		Imidan 70W	1.3 to 2.0 lbs., or
		Intrepid 2F	4.0 to 8.0 fl. oz., or
	⁷ Note: Several populations of grape berry moth from Pennsylvania and New York have been shown to be resistant to carbaryl, the active ingredient in various Sevin formulations.		
	Scouting: Monitoring for GBM larvae is accomplished by examining 10 bunches for larval damage 10 days postbloom on each of 5 vines in 4 locations (total of 200 bunches, 2 locations at the wooded edge and 2 locations further in the vineyard. Control for wine grapes is necessary when 5% of the bunches show berry webbing and GBM larval feeding signs. Often the 0.25 inch greenish-brown, active larvae can be found within the berry. For table grape growers, the percent injury would be considerably less.		
	Grape leafhoppers first appear about this time; however they are not always an economic pest of grapes in New Jersey. Some populations in the Finger Lakes region have developed resistance to Sevin formulations. If Sevin fails to control leafhoppers, do not repeat application of the material.		
		Actara 25WDG	1.5 to 3.5 oz., or
		Admire Pro	1.0 to 1.4 oz., or
		Applaud 70DF	9.0 to 12.0 oz., or
		Assail 30SG	2.5 oz., or
		Baythroid XL 1EC	2.4 to 3.2 fl. oz., or
		Belay 50WDG	2.0 to 4.0 fl. oz., or
		Brigade 10WSB	8.0-16.0 oz., or
		Danitol 2.4 EC	5.3 to 10.6 fl. oz., or
		Malathion 8F	1.8 pts., or
		Movento	6.0 to 8.0 fl. oz., or
		Nexter 75WP	4.4 to 5.2 oz., or
		Portal 5EC	1.0 to 2.0 pts., or
		Sevin XLR Plus	2.0 qts., or
		Surround 95WP	12.5-50.0 lbs., or
	⁶ Note: Venom is applied to the soil	Venom 70	1.0 to 3.0 oz. ⁶
	Grape phylloxera , if present, commence crawling up vines at this time. Examine foliage regularly. Crawlers are lemon yellow and can be seen with a hand lens. Apply when first galls are detected; repeat application 10 to 12 days later, if fresh galls are seen on new growth. Phylloxera form pea- sized, warty galls on the upper leaf surface. Root feeding can kill susceptible vines. Be sure all <i>V. vinifera</i> and any other susceptible vines are planted to a resistant rootstock.		
	Grape phylloxera	Assail 30SG	2.5 oz., or
		Danitol 2.4EC	1.1 fl. oz., or
		Movento	6.0 to 8.0 fl. oz., or

Time	Pest	Materials	Rate / Acre
	⁸ Note: This is for a foliar application of Venom.	Venom 70	1.0 to 3.0 oz. ⁸
SECOND POSTBLOOM (7 to 10 days after first Postbloom spray)			
	Black rot	Captan ² 50WP	3.0 to 4.0 lbs., or
	² There are many formulations see Table 2.	Mancozeb ² 80WP	3.0 to 4.0 lbs., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Bunch rot (Botrytis)	Elevate 50WDG	1.0 lb., or
		Endura	8 oz., or
		Inspire Super	16.0 to 20.0 fl. oz., or
		Luna Experience	8.0 to 8.6 fl. oz., or
		Pristine	8 to 12.5
		Meteor	1 to 2 pts., or
		Rovral 50W or 4F	1.5.0 to 2.0 lbs., or
		Scala SC	18.0 fl. oz., or
		Switch	11 to 14 oz., or
		Vanguard WG	5.0 to 10.0 oz.
	Downy mildew	Abound 2.08F	11.0 to 15.5 oz., or
	² There are many formulations see Table 2.	Captan ² 50WP	3.0 to 4.0 lbs., or
		Fixed Copper	See label for specific instructions, or
		Gavel 75DF	2.0 to 2.5 lbs., or
		Mancozeb 80WP	3.0 to 4.0 lbs., or
		Phosphonate fungicides	See label for specific instructions, or
		Presidio	3.0 to 4.0 fl. oz., or
	³ Potential phytotoxicity see Table 1.	Pristine ³	8.0 to 10.5 oz., or
		Quadris Top	12 to 14 fl. oz., or
		Ranman	2.1 to 2.75 fl. oz., or
		Reason	2.7 fl. oz., or
		Revus	8.0 fl. oz., or
		Revus Top	7.0 fl. oz., or
	⁵ DO NOT apply Ridomil Gold MZ within 66 days of harvest or Ridomil Gold Copper within 42 days of harvest.	Ridomil Gold MZ ⁵	2.0 to 2.5 oz., or
		Ridomil Gold Copper	1.0 to 2.0 lbs., or
		Sovran 50WG	4.0 to 6.4 oz., or
		Zampro	11 to 14 fl. oz., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Powdery mildew	Abound 2.08F	11.0 to 15.5 oz., or
		Endura	4.5 oz., or
	³ Potential phytotoxicity see Table 1.	Flint ³ 50WDG	2.0 oz., or
		Inspire Super	16.0 to 20.0 fl. oz., or
		Pristine ³	8.0 to 10.5 oz., or
		Procure 50WS	4.0 to 8.0 oz., or
		Quadris Top	12 to 14 fl. oz., or
		Quintec	3.0 to 6.6 oz., or
		Rally 40WP	3.0 to 5.0 oz., or
		Revus Top	7.0 fl. oz., or
		Rubigan EC	2.0 to 5.0 fl. oz., or
		Sovran 50WG	3.2 to 4.8 oz., or
	⁴ Note: Be careful of varietal sensitivity to Sulfur. Some fungicides have activity on multiple diseases; always check fungicide efficacy tables when making decisions.	Sulfur ⁴ (many forms)	See label for specific instructions, or
		Tebuconazole	See labels, or

Time	Pest	Materials	Rate / Acre
		Torino	3.4 oz., or
		Vivando	10.3 to 15.4 fl. oz.
COVER SPRAYS (begin 10 to 40 days after second Postbloom spray and repeat every 10 to 14 days to Harvest)			
	Downy mildew	Abound 2.08F	11.0 to 15.5 oz., or
	² There are many formulations see Table 2.	Captan ² 50WP	3.0 to 4.0 lbs., or
		Fixed Copper	See label for specific instructions, or
		Gavel 75DF	2.0 to 2.5 lbs., or
		Mancozeb 80WP	3.0 to 4.0 lbs., or
		Phosphonate fungicides	See label for specific instructions, or
		Presidio	3.0 to 4.0 fl. oz., or
	³ Potential phytotoxicity see Table 1.	Pristine ³	8.0 to 10.5 oz., or
		Quadris Top	12 to 14 fl. oz., or
		Ranman	2.1 to 2.75 fl. oz., or
		Reason	2.7 fl. oz., or
		Revus	8.0 fl. oz., or
		Revus Top	7.0 fl. oz., or
	⁵ DO NOT apply Ridomil Gold MZ within 66 days of harvest or Ridomil Gold Copper within 42 days of harvest.	Ridomil Gold MZ ⁵	2.0 to 2.5 oz., or
		Ridomil Gold Copper	1.0 to 2.0 lbs., or
		Sovran 50WG	4.0 to 6.4 oz., or
		Zapro	11 to 14 fl. oz., or
		Ziram 76DF	3.0 to 4.0 lbs.
	Powdery mildew	Abound 2.08F	11.0 to 15.5 oz., or
		Endura	4.5 oz., or
	³ Potential phytotoxicity see Table 1.	Flint ³ 50WDG	2.0 oz., or
		Inspire Super	16.0 to 20.0 fl. oz., or
		Pristine ³	8.0 to 10.5 oz., or
		Procure 50WS	4.0 to 8.0 oz., or
		Quadris Top	12 to 14 fl. oz., or
		Quintec	3.0 to 6.6 oz., or
		Rally 40WP	3.0 to 5.0 oz., or
		Revus Top	7.0 fl. oz., or
		Rubigan EC	2.0 to 5.0 fl. oz., or
		Sovran 50WG	3.2 to 4.8 oz., or
	⁴ Note: Be careful of varietal sensitivity to Sulfur. Some fungicides have activity on multiple diseases; always check fungicide efficacy tables when making decisions.	Sulfur ⁴ (many forms)	See label for specific instructions, or
		Tebuconazole	See labels, or
		Torino	3.4 oz., or
		Vivando	10.3 to 15.4 fl. oz.
	Bunch rot (Botrytis)	Elevate 50WDG	1.0 lb., or
		Endura	8 oz., or
	⁹ Note: May be insufficient to control Botrytis at this growth stage. Supplement with 3.0 oz. Vanguard WG.	Inspire Super	16.0 to 20.0 fl. oz. ⁹ , or
		Luna Experience	8.0 to 8.6 fl. oz., or
		Pristine	8 to 12.5
		Meteor	1 to 2 pts., or
		Rovral 50W or 4F	1.5.0 to 2.0 lbs., or
		Scala SC	18.0 fl. oz., or
		Switch	11 to 14 oz., or

Time	Pest	Materials	Rate / Acre
		Vanguard WG	5.0 to 10.0 oz.
	Note: Before applying sprays, always check Hours to Re-Entry and PreHarvest Interval information (Tables 2 and 3). In wet weather, a fungicide should be used every 10 days, especially if black rot is troublesome. DO NOT use Rovral more than 4 times/season; DO NOT exceed 20.0 oz./season of Vanguard; DO NOT exceed 32.0 oz./season of Procure.		
	European red mite	Acramite 50WS	0.75 to 1.0 lb., or
		Agri-Mek SC	1.75 to 3.5 fl. oz., or
		Envior 2 SC	16.0 to 18.0 fl. oz., or
		JMS Stylet Oil	1.0 to 2.0 gals., or
		Nexter	4.4 to 10.67 oz., or
		Onager 11.8EC	12.0 to 24.0 fl. oz., or
		Portal XLO	2.0 to 3.0 pts., or
		Vendex 50WP	2.0 lbs., or
		Vendex 4L	1.0 qt., or
		Zeal WP	2.0 to 3.0 oz.
	Brown marmorated stink bug	Actara	1.5 to 3.5 oz., or
		Scorpion 35SL	2.0 to 5.0 fl. oz. (foliar)
			9.0 to 10.5 fl. oz. (soil)
	Spotted wing drosophila	Baythroid XL 1EC	2.4 to 3.4 fl. oz., or
		Danitol 2.4EC	10.66 oz., or
		Delegate	3.0 to 5.0 oz., or
		Entrust 2EC	4.0 to 8.0 fl. oz., or
		Malathion 8F	1.8 pts., or
		Mustang Maxx	4.0 oz., or
		PyGanic 1.4EC	64.0 fl. oz.
DAY BEFORE OR DAY OF HARVEST			
	Brown marmorated stink bug	Belay	6.0 fl. oz., or
		PyGanic 1.4 EC	64.0 fl. oz.
POSTHARVEST VINES ONLY			
	Mealybugs	Actara 25WDG	1.5 to 3.5 oz., or
		Applaud 70DF	9.0 to 12.0 oz., or
		Assail 70WP	1.1 oz., or
		Belay 50WDG	6.0 fl. oz., or
		Movento 25C	6.0 to 8.0 fl. oz., or
		Venom 70	1.0 to 3.0 oz.

Pest Notes

Grape root borer

Grape root borer attack larger roots and crowns below the soil surface. Severe root pruning and girdling reduces vigor and can eventually cause vines to die. Adult borers (moths) lay eggs in July and August, and tiny larvae enter the soil and migrate to larger roots. Larvae feed on roots for approximately 2 years before emerging as adults, beginning in early-July and extending well into September. Monitoring traps used within the vineyard will indicate presence of GRB in the area but not the vineyard. Only scouting the vines and herbicide strip for pupal cases or larvae will confirm presence and activity. GRB is likely more a problem in Southern NJ but we are unsure of the amount of injury caused right now. It appears that yearly control is needed in most of the former vineyards, whereas few, if any northern vineyards require treatment. Control, if needed, can be achieved by any of several means:

1. Soil mounding around the trunk. Around July 1, level soil in the row as close to the trunk as possible. Next, throw a 6- to 8-inch layer of soil back around the crown and over larger roots on or about July 10 and again in 3 weeks. This soil mounding will bury cocoons and prevent moth emergence. The mound must be pulled down before the next season.
2. Clean cultivation and weed control beneath vines facilitate soil mounding, described above, and a uniform deposit of the Lorsban spray, described below.
3. Apply Lorsban 4E to the soil surface around mid- to late-July at the rate of 4.5 pts./100 gals. of water. Apply 2.0 qts. of this mix over every 15.0 sq. ft. of soil surface. Good weed control is essential for satisfactory Lorsban

deposit on the soil surface. Apply the spray from the vine trunk out at least 18 inches on both sides. Do not allow the spray to contact fruit or foliage. Application before a predicted rain should help the Lorsban reach the root zone.

4. Apply Isomate GRB at the rate of 100 dispensers/A. Mating disruption has been proven to be effective against this pest.

Grape berry moth

Second generation grape berry moth is not an automatic pest problem in New Jersey vineyards. The need for control is determined by examining bunches for larval activity, beginning in early-July, as described in the Postbloom section. Arbitrarily, an insecticide application is warranted when 5% of the bunches display larval feeding signs. Vineyard rows closest to woods may require treatment, whereas vineyard middles may not; treat accordingly. See Postbloom for insecticide choices and rates.

Yellowjackets, hornets, and honeybees

These insects are troublesome toward the end of the growing season. They are especially bothersome in pick-your-own vineyards. Sevin 80WSP at 1.5 lbs./A should provide satisfactory control and is safe to use during the harvest season; wait 7 days before harvesting fruit. The wasp problem can increase if the fruit is damaged by birds, insects, or inclement weather. Sevin may cause mortality in honeybee hives.

European red mite (ERM) and two-spotted spider mites (TSSM)

Mites suck plant sap from leaves causing them to become bronzed and eventually nonproductive. They may become troublesome following a Sevin application. Control when needed using a miticide from Table 4. See labels for additional use restrictions. ERM overwinters on cordons and trunks so may be present in early season. TSSM overwinters in the ground cover, and is usually most common in mid-late season, especially in hot, dry years.

Japanese beetles

Japanese beetles first appear in July and, if not checked, leaf lacing can be severe. If damage is severe, Assail 30SG (2.5 oz./A), or Baythroid XL (2.4 to 3.2 oz./A), or Capture 2EC (3.2 to 6.4 oz./A), or Danitol 2.4EC (16.0 fl. oz./ A), or Imidan 70WP (2.12 lbs./A), or Sevin 80WSP (2.5 lbs./A) should provide the necessary control. Don't forget to check new plantings. While established vines can tolerate some foliar injury, young vines are very susceptible.

Note: Fixed-copper/lime can be incompatible with, or break down, certain insecticides in mid-summer. Check labels before mixing.

Angular leaf scorch

Angular leaf scorch is most likely to become a problem when high rainfall occurs during the period of early shoot growth. Fungicides such as thiophanate-methyl, mancozeb, and ziram (applied for control of mildews and black rot) have been shown to provide adequate control for angular leaf spot.

Anthracnose

This disease thrives in rainy, humid conditions. The youngest parts of the vine are most susceptible. Clusters are susceptible to infection from before flowering until veraison. In the past, Bordeaux mixture has been able to control anthracnose to the point where it has not been a serious problem. If using copper-free organic fungicides, growers should be aware of the possibility of renewed outbreaks.

Brown Marmorated Stink Bug (BMSB)

BMSB is an invasive pest that can injure grape clusters beginning at veraison. Feeding can result in deformed berries and a reduction in yield if populations are high. It can be difficult to detect BMSB in the clusters. Vines neighboring woods, peaches, apples or soybean are at highest risk. BMSB in the clusters at harvest has been shown to cause taint in Pinot Noir and Chardonnay. Clusters fed on by BMSB also are more susceptible to sour rot.

Crown gall

Crown gall is a soil-borne bacterial disease that is often transported into the vineyard on infected nursery stock. Growers should purchase pathogen-free vines and inspect carefully before planting. Crown gall normally enters healthy vines at, or around, the soil-line, through a wound in the trunk. The most common entry sites are cracks due to freezing injury and mechanical injuries caused by equipment. Once infected, infection may develop rapidly and completely girdle vines in 1 season. Infected vines should be removed immediately. Careful cultivation and chemical weed control within rows should reduce mechanical injury. Protection against freeze injury by burying vines or hilling soil around trunks can be effective, but is very labor intensive. Multiple trunk systems will not eliminate the incidence of disease, but can be used to insure against losing a crop to crown gall attack. Biological treatments and eradicans have been tried, but are largely ineffective on grapes.

Ozone

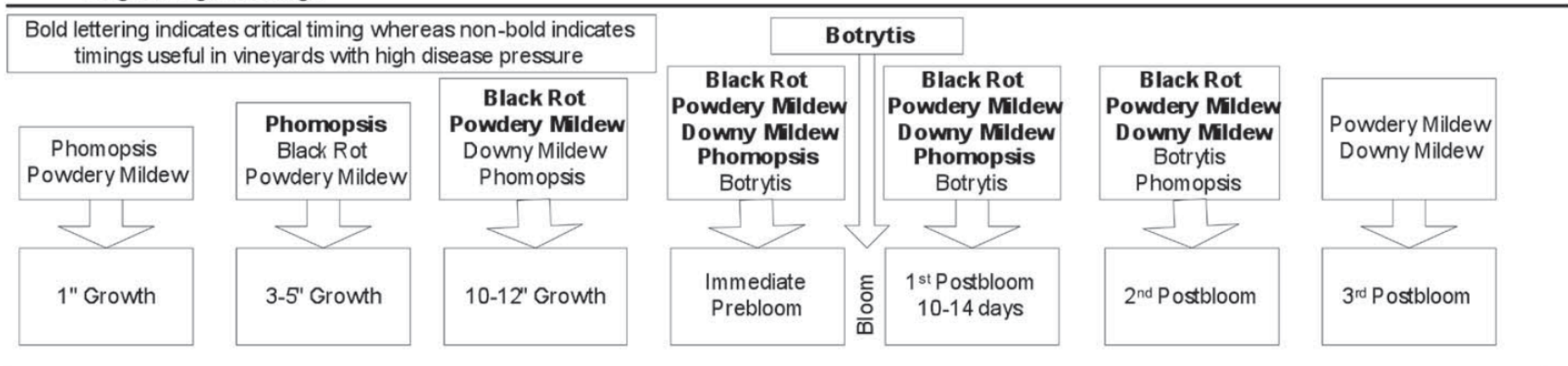
Ozone is the most common type of air pollution injury in New Jersey; many grape varieties are highly sensitive. It can adversely affect fruit set, thereby lowering yields and fruit quality. Bayleton has reportedly reduced ozone injury. Maintaining an adequate nitrogen level, good soil drainage, and the use of cover crops also have been shown to minimize ozone injury to grape foliage.

Spotted Wing Drosophila (SWD)

SWD is a vinegar fly believed to be able to infest grapes. NJ studies on wine grapes indicate that this is a minor problem. However, if berries are damaged by birds or other insects SWD can attack these clusters. Overall, it is likely a minor issue at the current time.

Grape Disease Management

Target and growth stage



Suggested materials

Captan or Mancozeb + PM material	Captan or Mancozeb + PM material	Mancozeb + PM material Or DMI fungicide	Strobilurin or Mancozeb + PM material Or Pristine alone	Strobilurin or Mancozeb + PM material Or Pristine alone	Captan or Phosphorous Acid + PM material Or Pristine alone	Captan or Phosphorous Acid + PM material
--	--	---	---	---	--	--

Notes

These applications are important only when warm wet conditions prevail and if the problem was severe in the previous season. A 7-10 day spray schedule should be followed until the target disease is risk has ended.

PM Materials
Powdery Mildew. There are a number of powdery mildew fungicides available. If sulfur is used remember that applications may need to be made more frequently.

Botrytis should be controlled during bloom in wet years. Fungicides include Elevate, Pristine, Scala, Strobilurin Fungicides include: Abound, Flint, Pristine. These should not be used in more than two successive applications.

The most critical timing for controlling fruit infections is from prebloom through the 2nd postbloom. Ensure that you emphasize uniform coverage and optimum rates for these applications. Do not skip or delay these applications

Continue the spray program emphasizing the diseases and conditions present

USE RESISTANCE MANAGEMENT – ALTERNATE WITH LOW RISK FUNGICIDES

LOW RISK FUNGICIDES

Mode of Action	Benzimidazoles	Dicarboximides	DML-fungicides	PhenylAmides	SDH Inhibitors	Anilino Pyrimidines	Qo I/Strobilurin	PhenylPyrroles	Quinolines	Hydroxylanilides	Polyoxins	Qil	Benzimidazoles	Cyanoacetamide-oxime	Phosphonates	Carboxylic Acid Amides	Pyridinylmethyl-Benzamide	Quinone X Inhibitor	phenyl-acetamide	aryl-phenyl-ketone	Copper	Sulfur	Dithiocarbamates	Phthalimides
FRAC CODE	1	2	3	4	7	9	11	12	13	17	19	21	22	27	33	40	43	45	U6	U8	M1	M2	M3	M4'
Phomopsis	+						S																+	+
Black Rot			+				+																+	F
Downy Mildew				+			+					+	+	+	+	+	+	+			+		+	+
Botrytis		+			+	+	F	+		+	+													
Powdery Mildew			+		+		+		+		+								+	+	+	+	F	
RISK	H	M	M	H	M	M	H	ML	M	ML	M	M	ML	ML	L	ML	U	H	M	M	L	L	L	L

Thiophanate Methyl
Topsin-M

Rovral

Elite
Rally
Inspire Super
Quadris Top

Ridomil

Switch
Vanguard
Inspire Super

Endura
Pristine

Abound
Tanos, Flint
Sovran
Quadris Top

Switch

Quintec

PH-D
Taveros
Captevat
Elevate

Ranman

Zampro

Presidio

Forum
Revus

Phites

Tanos

Torino

Vivando

Captan

Dithane
Penncozeb
Ziram

Kumulus
Thiolux

Champ
Cuprofix
Kocide

Efficacy

	Most members of this class are not effective
M	Moderate activity
S	Some members of this class are effective
+	Most members of this class show activity

Risk for resistance

H	High risk for resistance
M	Moderate risk for resistance
ML	Low-moderate risk for resistance
U	As yet undetermined risk for resistance
L	Low risk for resistance

Table 2. Fungicide and bactericide efficacy ratings¹ against each target disease. The ratings are general guides to aid the user in pesticide selection. Results vary among locations, years, disease pressures, vine sizes, formulations of pesticides, and application methods.

Name	Active Ingredient	Phomopsis	Black Rot	Downy Mildew	Powdery Mildew	Botrytis Rot
Abound	Azoxystrobin	+	+++	+++	+++	+
Agri-Fos	phosphorus acid	0	0	+++	0	0
Aliette	phosphorus acid	0	0	+++	0	0
Armcarb 100	potassium bicarbonate	0	0	0	++	0
Basicop	tribasic copper sulfate	+	+	+++	++	+
Bayleton 50DF	triadimefon	0	+++	0	+++	0
BlightBan A506	P. fluorescens A506	?	?	?	?	?
Bordeaux Mixture	copper	+	+	+++	++	+
Captan 50WP*	captan	+++	+	+++	0	+
Captan 80WDG*	captan	+++	+	+++	0	+
Captec 4L*	captan	+++	+	+++	0	+
Champ Dry Prill	copper hydroxide	+	+	+++	++	+
Champ Formula 2	copper hydroxide	+	+	+++	++	+
Champion WP	copper hydroxide	+	+	+++	++	+
Dithane DF	mancozeb	+++	+++	+++	+	0
Dithane DF Rainshield	mancozeb	+++	+++	+++	+	0
Dithane F45	mancozeb	+++	+++	+++	+	0
Dithane M45	mancozeb	+++	+++	+++	+	0
Eco-Mate Armcarb	potassium bicarbonate	0	0	0	++	0
Elevate	fenhexamid	0	0	0	+	+++
Elite 45WP	tebuconazole	0	+++	0	+++	+
Endura	boscalid	0	0	0	+++	++
Ferbam	ferbam	++	++	+	0	0
Flint	trifloxystrobin	+	+++	+	+++	++
Forum	dimethomorph	0	0	+++	0	0
Fosphite	phosphorus acid	0	0	+++	0	0
Gavel 75DF	zoxamide + mancozeb	?	?	+++	?	?
Inspire Super	difenoconazole cyprodinil	0	+	0	+++	++
Iprodione 4L AG	iprodione	0	0	0	0	+++
Iprodione 50	iprodione	0	0	0	0	+++
K Phite	phosphorus acid	0	0	+++	0	0
Kocide 101	copper hydroxide	+	+	+++	++	+
Kocide 2000	copper hydroxide	+	+	+++	++	+
Kocide 4.5	copper hydroxide	+	+	+++	++	+
Kocide DF	copper hydroxide	+	+	+++	++	+
KOP Hydroxide 50W	copper hydroxide	+	+	+++	++	+
KOP Hydroxide 50	copper hydroxide	+	+	+++	++	+
Kumulus DF	sulfur	+	0	0	++	0
Liquid Sulfur 6	sulfur	+	0	0	+++	0
Luna Experience	fluopyram tebuconazole	—	+++	0	+++	++
ManKocide	mancozeb	+++	+++	++	+	+
Manzate 75	mancozeb	+++	+++	+++	+	0

Table 2. Fungicide and bactericide efficacy ratings¹ against each target disease. The ratings are general guides to aid the user in pesticide selection. Results vary among locations, years, disease pressures, vine sizes, formulations of pesticides, and application methods.

Name	Active Ingredient	Phomopsis	Black Rot	Downy Mildew	Powdery Mildew	Botrytis Rot
Manzate 80WP	mancozeb	+++	+++	+++	+	0
Manzate Flowable	mancozeb	+++	+++	+++	+	0
Meteor	iprodione	–	–	–	–	+++
Micro Sulf	sulfur	+	0	0	+++	0
Rally 40	myclobutanil	0	+++	0	+++	0
Nutrol	P, K	0	0	0	++	0
Phostrol	Na-, K- and ammonium phosphites	0	0	+++	0	0
Presidio	Fluopicolide	0	0	+++	0	0
Pristine	pyraclostrobin + boscalid	++	+++	+++	+++	++
Procure 50WS	triflumazole	0	++	0	+++	0
Quintec	quinoxifen	0	0	0	+++	0
Ranman	cyazofamid	0	0	+++	0	0
Reason	fenamidone	0	0	+++	0	0
Revus	mandipropamid	0	0	+++	0	0
Revus Top	mandipropamid difenoconazole	0	?	+++	+++	0
Ridomil Gold Copper	mefanoxam + copper hydroxide	+	+	+++	0	0
Ridomil MZ	mefanoxam + mancozeb	+	++	+++	0	0
Rovral	iprodione	0	0	0	0	+++
Rovral 4F	iprodione	0	0	0	0	+++
Scala SC	pyrimethanil	0	0	0	0	+++
Sovran	kresoxim-methyl	+	+++	++	+++	++
Switch 62.5WG	Cyprodinil + fludioxonil	0	0	0	++	+++
Tanos	Cymoxanil +famoxadone	0	0	+++	0	0
Tennocop 5E	copper salts of fatty and rosin acids	+	+	+++	++	+
Thiolux	sulfur	+	0	0	+++	0
Topsin M 70WP	thiophanate-methyl	++	+	0	0	0
Torino	cyflufenamid	0	0	0	+++	0
Trilogy	neem oil	0	0	0	++	0
Vangard WG	cyprodinil	0	0	0	0	+++
Vivando	metrafenone	0	0	0	+++	0
Zampro	Ametoctradin + dimethomorph	0	0	+++	0	0
Ziram	zinc dimethyl dithiocarbamate	++	+++	++	0	0

¹Rating of +++ indicates highly effective, ++ indicates moderately effective, + indicates slightly effective, 0 indicates no effect, and ? indicates that the material has not been tested and no data exists for efficacy.

Table 2a. Site-specific medium to high risk fungicides registered for grape disease control.

Trade Name	EPA Reg. #	Chemical Name	REI(h)	PHI (d)	FRAC Group
Nufarm T-Methyl 70 WSB	228-655	Thiophanate-methyl	48	7	1
Thiophanate Methyl 85-WDG	66222-145	Thiophanate-methyl	168	14	1
Topsin M 70WDG	73545-18-70506	Thiophanate-methyl	168	14	1

Topsin M 70WP	73545-11-70506	Thiophanate-methyl	48	7	1
Topsin M WSB	73545-16-70506	Thiophanate-methyl	48	7	1
Iprodione 4I AG	66330-297	Iprodione	48	7	2
Meteor	70506-243	Iprodione	48	7	2
Nevado 4F	66222-144	Iprodione	48	7	2
Rovral 4 Flowable	279-9564	Iprodione	48	7	2
Rovral 4 Flowable	264-482	Iprodione	48	7	2
Rubigan E.C.	10163-273	Fenarimol	12	21	3
Vintage SC	10163-275	Fenarimol	24	21	3
Rally 40WSP	62719-410	Myclobutanil	24	14	3
Elite 45-WP	264-749	Tebuconazole	12	14	3
Orius 20AQ	66222-128	Tebuconazole	12	14	3
Tebuzol 45 DF	70506-113	Tebuconazole	12	14	3
Procure 480SC	400-518	Triflumizole	12	7	3
Endura	7969-197	Boscalid	12	14	7
Scala SC	264-788	Pyrimethanil	12	7	9
Vanguard WG	100-828	Cyprodinil	12	7	9
Abound	100-1098	Azoxystrobin	4	14	11
Reason 500 SC	264-695	Fenamidone	12	30	11
Sovran	7969-154	Kresoxim-methyl	12	14	11
Flint	264-777	Trifloxystrobin	12	14	11
Quintec	62719-375	Quinoxifen	12	14	13
Elevate 50 WDG	66330-35	Fenhexamid	12	0	17
Ph-D WDG	66330-56	Polyoxin D zinc salt	4	0	19
Tavano 5%SC	68173-4-70051	Polyoxin D zinc salt	4	0	19
Torino	8033-103-10163	Cyflufenamid	4	3	U6
Vivando	7969-284	Metrafenone	12	14	U8

Table 2b. Site-specific medium-to-high risk fungicides marketed as mixtures and registered for grape disease control.

Trade Name	EPA Reg. #	Chemical Name	REI(h)	PHI (d)	FRAC Group
Quadris Top	100-1313	Difenoconazole	12	14	3
		Azoxystrobin			11
Revus Top	100-1278	Difenoconazole	12	14	3
		Mandipropamid			40
Unicorn	70905-2	Tebuconazole	24	14	3
		Sulfur			M3
Ridomil Gold/Copper	100-804	Mefenoxam	48	42	4
		Copper hydroxide			M1
Ridomil Gold MZ WG	100-1269	Mefenoxam	48	66	4
		Mancozeb			M3
Zampro	7969-302	Ametoctradin	12	14	45
		Dimethomorph			40
Pristine	7969-199	Boscalid	12 ¹	14	7
		Pyraclostrobin			11
Luna Experience	264-1091	Fluopyram	12 ¹	14	7
		Tebuconazole			3
Switch 62.5 WG	100-953	Cyprodinil	12	7	9
		Fludioxonil			12
Inspire Super	100-1317	Cyprodinil	12	14	9

		Difenconazole			3
Gavel 75DF	10163-6414	Zoxamide	48	66	22
		Mancozeb			M3
Tanos	352-604	Cymoxanil	12	30	27
		Famoxadone			11

¹ 120 h re-entry (REI) during cane tying and turning. See label for details.

Table 2c. Site-specific fungicides registered specifically for downy mildew control.

Trade Name	EPA Reg. #	Chemical Name	REI (h)	PHI (d)	FRAC Group
Ridomil Gold EC	100-801	Mefenoxam	12		4
Ridomil Gold SL	100-1202	Mefenoxam			4
Ranman	71512-3-279	Cyazofamid	12	30	21
Aliette WDG	264-516	Fosetyl-Al	12	15	33
Confine Extra	1381-244	Phosphorous acid, mono- and dipotassium salts	4	0	33
Fosphite	68573-2	Potassium phosphite	4	0	33
Fungi-Phite	83472-1	Potassium phosphite	4	0	33
Helena Prophyt	42519-22-5905	Potassium phosphite	4	0	33
K-Phite 7lp AG	73806-1	Phosphorous acid, mono- and dipotassium salts	4	0	33
Nutrol	70644-1	Potassium phosphate	4	0	33
Phostrol	55146-83	Phosphorous acid, mono- and dibasic sodium,	4	0	33
Rampart	34704-924	Potassium phosphite	4	0	33
Reveille	42519-22-5905	Potassium phosphite	4	0	33
Forum	241-427	Dimethomorph	12	14	40
Revus	100-1254	Mandipropamid	4	14	40
Presidio	59639-140	Fluopicolide	12	21	43

Table 2d. Broad-spectrum fungicides in the low-risk FRAC group M1. Check label for the correct REI and PHI of the specific product you are using.

Trade Name	EPA Reg. #	Chemical Name	FRAC Group
Champ DP Dry Prill	55146-57	Copper hydroxide	M1
Champ Formula 2 Flowable	55146-64	Copper hydroxide	M1
Champ WG	55146-1	Copper hydroxide	M1
Copper Sulfate Crystals	56576-1	Copper sulfate pentahydrate	M1
Copper-Count-N	10465-3	Copper diammonia diacetate complex	M1
Cueva	70051	Copper octanoate	M1
Cuprofix-Ultra 40 Disperss	70506-201	Basic Copper sulfate	M1
Cuproxat	35935-3	Basic Copper sulfate	M1
Kentan DF	80289-2	Copper hydroxide	M1
Kocide 3000	352-662	Copper hydroxide	M1
Kocide-2000	352-656	Copper hydroxide	M1
Kocide-DF	352-688	Copper hydroxide	M1
Mastercop	55272-18-66222	Copper sulfate pentahydrate	M1
Nordox 30/30 WG	48142-7	Cuprous oxide	M1
Nordox 75 WG	48142-4	Cuprous oxide	M1
Nu Cop 50 WP	45002-7	Copper hydroxide	M1
Nu-Cop 3 L	42750-75	Copper hydroxide	M1
Nu-Cop 50 DF	45002-4	Copper hydroxide	M1

Quimag Copper Sulfate Crystal	73385-1	Copper sulfate pentahydrate	M1
Badge SC	80289-3	Copper hydroxide Copper oxychloride	M1
Badge X2	80289-12	Copper hydroxide Copper oxychloride	M1

Table 2e. Broad spectrum fungicides in the low-risk FRAC- group M2.

Trade Name	EPA Reg. #	Chemical Name	REI(h)	PHI (d)	FRAC Group
DustingSulfur	2935-48	Sulfur	24	0	M2
Kumulus Df-Acaricide	51036-352-66330	Sulfur	24	0	M2
MicroSulf	55146-75	Sulfur	24	0	M2
Microfine Sulfur	6325-13-34704	Sulfur	24	0	M2
Microthiol Disperss	70506-187	Sulfur	24	0	M2
Wettable Sulphur	5905-289	Sulfur	24	0	M2
Yellow Jacket Dusting Sulfur	6325-17	Sulfur	24	0	M2
Yellow Jacket Wettable Sulfur	6325-13	Sulfur	24	0	M2

Table2f. Broad-spectrum fungicides in the low-risk FRAC group M3.

Trade Name	EPA Reg. #	Chemical Name	REI (h)	PHI (d)	FRAC Group
Dithane-F45 Rainshield	62719-396	Mancozeb	24	66	M3
Dithane-M45	62719-387	Mancozeb	24	66	M3
Manzate Flowable	70506-236	Mancozeb	24	66	M3
Manzate Max	70506-194	Mancozeb	24	66	M3
Manzate Pro-Stick	70506-234	Mancozeb	24	66	M3
Penncozeb 75DF	70506-185	Mancozeb	24	66	M3
Penncozeb 80WP	70506-183	Mancozeb	24	66	M3
Roper DFF Rainshield	34704-1063	Mancozeb	24	66	M3
Ziram 76DF	70506-173	Ziram	48	21	M3

Table 2g. Broad-spectrum fungicides in the low-risk FRAC group M4.

Trade Name	EPA Reg. #	Chemical Name	REI (h)	PHI (d)	FRAC Group
Captan 4I Flowable	42750-236	Captan	72	1	M4
Captan 50 Wettable Powder	66330-234	Captan	72	1	M4
Captan 50W (Drexel)	19713-235	Captan	72	1	M4
Captan 50WP	42750-235	Captan	72	1	M4
Captan 80 WDG	42750-231	Captan	72	1	M4
Captan 80-WDG	66222-58-66330	Captan	72	1	M4
Captan 80WDG	66222-58	Captan	72	1	M4
Captec 4 L	66330-239	Captan	72	1	M4

Note on Fungicide Mixtures

Fungicides are more commonly being sold as prepackaged mixtures for a variety of reasons. Fungicides with different modes of action also have different spectra of action meaning they are effective against different diseases. By packaging them as a mixture, more diseases can be controlled with one product. In certain cases, mixtures may also exhibit synergism where the combined effect is greater than the sum of the components. Finally, mixtures can also help reduce the development of fungicide resistance. For resistance management, fungicides with overlapping spectra of action are typically mixed.

Prepackaged mixtures commonly used in vineyards are shown in Table 3. To understand the efficacy of mixtures you need to understand the spectrum of action of each of the components. For example, Luna Experience contains a Group 7 and a Group 3. Group 7 fungicides have good activity against Botrytis and Powdery Mildew. Group 3 fungicides have good activity against Black Rot and Powdery Mildew. So, with the mixture, you are able to combat three diseases.

You should ensure that you are applying the same amount of fungicide with the mixture as you would with the standalone product. For example, by comparing labels you find that the 4.0 oz. rate of Elite (active ingredient is tebuconazole) is equivalent to the 8.6 fl. oz. rate of Luna Experience.

Table 3. Some common prepackaged fungicide mixtures labeled for grapes.

Trade Name	Manufacturer/EPA Reg. #	Common Chemical Names	FRAC Group
Luna Experience	Bayer CropScience	Fluopyram	Group 7
	264-1091	Tebuconazole	Group 3
Inspire Super	Syngenta Crop Protection, LLC	Cyprodinil	Group 9
	100-1317	Difenoconazole	Group 3
Quadris Top	Syngenta Crop Protection, LLC	Azoxystrobin	Group 11
	100-1313	Difenoconazole	Group 3
Pristine	BASF Ag Products	Boscalid	Group 7
	7969-199	Pyraclostrobin	Group 11
Tanos	DuPont Crop Protection	Cymoxanil	Group 27
	352-604	Famoxadone	Group 11
Switch 62.5WG	Syngenta Crop Protection, LLC	Cyprodinil	Group 9
	100-953	Fludioxonil	Group 12
Revus Top	Syngenta Crop Protection, LLC	Difenoconazole	Group 3
	100-1278	Mandipropamid	Group 40
Sanction	Loveland Products, Inc.	Potassium phosphate	Group 33
	34704-1040	Sulfur	Group M2

Table 4. Insecticides and miticides labeled for use on grapes.

Trade Name	Chemical Name	EPA Reg. #	REI (h)	PHI (days)	A.I. (%)	Category ¹
Acramite	Bifenazate	400-503	12 h	14	50	M
Actara 25WDG	Thiamethoxam	100-938	12	5	25	I
Admire Pro	Imidacloprid	264-827	12	0	70	I
Agri-Mek SC	Abamectin	100-1351	12 h ²	28	8	I, M
Altacor 35 WDG	Chlorantraniliprole	352-730	4 h	14	35	I
Assail 30SG	Acetamiprid	8033-36-4581	12 h	7	30	I
Assail 70WP	Acetamiprid	8033-36-4581	12 h	7	30	I
Avaunt 30DG	Indoxacarb	352-597	12 h	7	30	I
Baythroid XL 1EC	Cyfluthrin	264-840	12 h	3	25	I
Belay	clothianidin	59639-150	12 h	0	50	I
Brigade	Bifenthrin	279-3313	12 h	30	25.1	I
Danitol 2.4EC	Fenprothrin	59639-35	1 d	21	30.9	I, M
Delegate 25WG	Spinetoram	62719-541	4 h	7	25	I
Entrust 2EC	Spinosad	62719-621	4 h	7	22	I
Envior 2 SC	Spirodiclofen	264-831	12 h ³	14	22.3	M
FujiMite 5EC	Fenpyroximate	71711-19	12 h	14	5	I, M
Imidan 70WP	Phosmet	10163-169	14 d	14	70	I
Intrepid 2F	Methoxyfenozide	62719-442	4 h	30	22.6	I
JMS Stylet Oil	paraffinic oil	65564-1	12 h	0	99.1	I, M
Lorsban 75WG	Chlorpyrifos	62719-301-10163	1 d	35	75	I
Lorsban 4E	Chlorpyrifos	62719-220	1 d	35	44.9	I
Nexter	Pyridaben	81880-4-10163	12 h	7	75	I, M
Onager	Hexythiazox	10163-277	12 h	28	11.8	M
Portal XLO	Fenpyroximate	71711-40	12 h	15	5	I, M
PyGanic	pyrethrins	1021-1771	12	0	1.4	I
Scorpion 35SL	dinotefuran	10163-317	12 h	1 (foliar)	35	I
				28 (soil)		
Sevin XLR Plus	Carbaryl	264-333	12 h	7	44.1	I
Surround WP	Kaolin	61842-18	4 h	0	95	I
Vendex 50WP	fenbutatin-oxide	352-658	2 d	28	50	I
Venom	Dinotefuran	59639-135	12 h	28	20	I
Zeal WP	Etoazole	59639-123	12 h	14	72	M

¹ I=insecticide, M=miticide

² 4 day re-entry (REI) for vine girdling, cane turning, or cane tying. See label for details.

³ 6 day re-entry (REI) for vine girdling, cane turning, or cane tying. See label for details.

Table 5. Relative effectiveness ratings¹ of selected insecticides and acaricides in grapes. Effectiveness ratings are from Virginia Cooperative Extension publication 456-017. The ratings are given as general guides to aid the user in pesticide selection. Results vary among locations, years, pest pressures, vine sizes, formulations of pesticides, and application methods.

Insecticides and Acaricides																															
Insects and mites	Acramite	Actara	Agri-Mek	Applaud	Assail	Avaunt	Baythroid	Bt	Belay	Brigade	Danitol	Delegate	Diazinon	Entrust	Envior	Imidan	Intrepid	Lannate	Lorsban	Malathion	Movento	Nexter	Onager	PyGanic	Sevin	Spinosad	StyletOil	Surround	Vendex	Venom	Zeal
Brown marmorated stinkbug	-	G	-	-	-	-	-	-	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cutworms	-	-	-	-	-	-	G	G	-	G	G	G	-	G	-	-	G	-	-	-	-	-	-	-	G	G	-	-	-	-	-
Drosophila flies	-	-	-	-	-	-	-	-	-	-	-	-	E	E	-	-	-	-	-	E	-	-	-	G	-	-	-	-	-	-	-
Grape berry moth	-	-	-	-	-	G	E	F	G	E	E	G	G	G	-	G	E	G	-	-	-	-	-	-	G	G	-	-	-	-	-
Grape cane girdler	-	-	-	-	-	-	E	-	-	-	E	-	-	-	-	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grape flea beetle	-	-	-	-	-	-	E	-	-	-	E	-	-	-	-	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grape leafhopper	-	G	-	E	E	-	E	-	G	E	E	-	G	-	-	G	-	G	-	G	-	G	-	-	E	-	-	G	-	-	-
Grape rootworm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grape root borer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-	-	-	-	-	-
Grape scale	-	-	-	E	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-	-	-	-
Japanese beetle	-	G	-	-	F	G	-	-	G	-	E	-	-	-	-	-	-	-	-	G	-	-	-	-	G	-	-	E	-	-	-
June beetle	-	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	G	-	-	-	-	-	-
Mealybugs	-	G	-	E	G	-	G	-	G	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-	-	-	-
Phylloxera (leaf form)	-	-	-	-	-	-	-	-	-	-	E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Redbanded leafroller	-	-	-	-	-	-	-	G	-	-	-	F	-	E	-	G	E	-	-	-	-	-	-	-	-	F	E	-	-	-	-
Rose chafer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-
Sharpshooter	-	-	-	-	G	-	-	-	G	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spider mites	G	-	G	-	-	-	-	-	-	-	E	-	F	-	E	-	-	-	-	F	-	E	E	-	-	-	G	-	G	-	G
Spotted wing drosophila	-	-	-	-	-	-	G	-	-	G	-	G	-	F	-	-	-	-	-	F	-	-	-	F	-	-	-	-	-	-	-
Wasp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-

¹ E=Excellent, G=Good, F=Fair, P=Poor, - = information lacking or not registered

Weed Control in Vineyards

THE LABEL IS THE LAW

Identify the weeds in each vineyard and select recommended herbicide. More information is available in the “Herbicide Effectiveness Ratings” tables 3-4 and 3-5 listed below.

Herbicide-resistant Weeds

A number of weed species that were once susceptible to certain herbicides have developed resistance. These weeds are no longer controlled by applications of previously effective herbicides. More information about herbicide-resistant weeds and herbicide modes of action can be found at weedsociety.org. The Weed Science Society of America (WSSA) developed a grouping system based on herbicide mode of action. Herbicides with the same group number kills weeds using the same mode of action. Rotating herbicide with differing group numbers is important for minimizing the risk of developing herbicide-resistant weeds. **Bolded group numbers in tables below are herbicides at higher risk for selecting resistant weed populations.**

Recommended Preemergence Herbicides

Soil-applied (aka residual) are applied to the soil surface. Rainfall or overhead irrigation before weeds emerge is needed to move the herbicide into the soil and make it available to the weeds. Use a postemergence herbicide if weeds are present or if they emerge soon after a preemergence herbicide is applied, unless the preemergence herbicide will also work on weeds that have emerged.

Table 6-1. Comments on preemergence herbicides for grapes

Targeted Weeds	Herbicide, WSSA Group, and Formulation ¹	Commercial Product Rate/A	Precautions and Remarks
Annual broadleaf and grass weeds plus some perennial weeds (Canada thistle, bindweed, goldenrod, asters, yellow nutsedge)	dichlobenil, Group 20 (Casoron) 4 G (Casoron) 1.4 CS REI: 12 hours PHI: N/A	100 to 150 lbs 1.4 to 2.8 gal	Casoron 4G: for bearing and non-bearing vineyards. Casoron 4G: do NOT apply until 4 weeks after transplanting. Casoron CS: for established vineyards ONLY. Do NOT exceed 150 lbs/A or 2.8 gal/A per crop cycle. Do NOT use Casoron CS on sandy soils. Apply in late fall/early winter to control labeled perennial, biennial and annual weeds or in late winter/early spring, to control labeled annual weeds. Casoron is volatile in warm temperatures and must be applied when daily high temperatures does not exceed 55°F. Irrigate or mechanically incorporate immediately after application.

Targeted Weeds	Herbicide, WSSA Group, and Formulation ¹	Commercial Product Rate/A	Precautions and Remarks
Annual broadleaf and grass weeds	diuron, Group 7 (Karmex) 80 DF (Direx) 4 L REI: 12 hours PHI: N/A	2 to 3 lbs 1.6 to 2.4 qt	For vineyards established a minimum of 3 years. Do NOT use on sandy loam or coarser soil. Do not exceed 10 lbs/A or 8 qt/A per year. Do NOT apply more than twice per year. Do NOT exceed 5 lbs/A or 4 qt/A as a single use rate. Do NOT sequentially apply closer than 90 days apart. Applications in vineyards with less than 2% organic matter may cause injury if heavy rainfall occurs soon after application. Apply in late fall or spring before bud break to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Tank-mixing with pendimethalin, oryzalin, norflurazon, or napropamide at one-half the labeled diuron use rate alone for the soil type will improve crop safety and the range of weeds controlled.
	simazine, Group 5 (Princep Caliber 90) 90 WDG (Princep) 4 L REI: 48 hours PHI: N/A	2.2 to 4.4 lbs 2 to 4 qt	For vineyards established a minimum of 3 years. Do NOT exceed 4.4 lbs/A or 4 qt/A per year. Do NOT exceed one application per year Apply in late fall or spring before bud break to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Tank-mixing with pendimethalin, oryzalin, norflurazon, or napropamide at one-half the labeled simazine use rate alone for the soil type will improve crop safety and the range of weeds controlled.
	indaziflam, Group 29 (Alion) 1.67 SC REI: 12 hours PHI: 14 days	3.5 to 5 fl oz	For vineyards established a minimum of 3 years and on vines having good growth and vigor. Do NOT use on sandy soil. Do NOT use on soils with 20% or more gravel content. Do NOT sequentially apply closer than 90 days apart. Rate is soil texture dependent. See label for details. Grapes must have a 6" barrier between the soil surface and a major portion of the vine's root system. Apply in late fall or early spring to weed free soil or add a postemergence herbicide to kill existing vegetation. Alion controls many annual grasses and broadleaf weeds through harvest the next year.
Annual broadleaf weeds	isoxaben Group 21 (Gallery, Trellis) 75 DF (Gallery SC, Trellis SC) 4.16 SC REI: 12 hours PHI: 60 days	1 to 1.33 lbs 23 to 31 fl oz	Gallery: for non-bearing vineyards ONLY. Trellis: for bearing and non-bearing vineyards. Do NOT apply more than twice per crop year. Do NOT exceed 1.33 lbs/A or 31 fl oz/A per crop year. In newly planted vineyards, allow the soil to settle and fill any depressions around the vines before application. Apply in late-fall or early-spring to weed-free soil to control many broadleaf weeds. Add a postemergence herbicide to improve the control of emerged weeds. Tank-mix with pendimethalin or oryzalin to control annual grasses.

Targeted Weeds	Herbicide, WSSA Group, and Formulation ¹	Commercial Product Rate/A	Precautions and Remarks
Annual grasses and some small seeded broadleaf weeds	napropamide, Group 15 (Devrinol DF-XT) 50 DF (Devrinol 2-XT) 2 EC REI: 24 h PHI: 70 days	4 to 8 lbs 4 to 8 qt	For bearing and non-bearing vineyards. Do NOT exceed 8 lbs/A or qt/A per crop cycle. Apply as a directed spray in late fall and/or early spring before bud break to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. At least ½ inch sprinkler irrigation or rainfall is necessary within 48 hours of application for activating the herbicide. Tank-mix with simazine plus a postemergence herbicide in late fall or reduced rates of simazine, diuron, or terbacil in spring, if planting has been established for at least one year, to control annual broadleaf weeds.
	oryzalin, Group 3 (Oryzalin, Surflan) 4 AS REI: 24 hours PHI: N/A	2 to 4 qt	For bearing and non-bearing vineyards. Do NOT exceed 12 qt/A per year. Do NOT sequentially apply closer than 2.5 months apart. Apply in late fall and/or early spring before bud break to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Tank-mix with simazine plus a postemergence herbicide in late fall or reduced rates of simazine, diuron, or terbacil in spring, if planting has been established for at least one year, to control annual broadleaf weeds.
	pendimethalin, Group 3 (Prowl H ₂ O) 3.8 AS REI: 24 hours PHI: 90 days	2 to 6.3 qt	For bearing and non-bearing vineyards. Do NOT apply to newly transplanted vines until ground has settled and no cracks are present Do NOT exceed 6.3 qt/A per year. Do NOT sequentially apply closer than 30 days apart. Use ONLY during dormancy Use 2 to 4 qt/A in nonbearing grapes and 3 to 6.3 qt/A in bearing grapes. Apply in late fall and/or early spring before bud swell to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Tank-mix with simazine plus a postemergence herbicide in late fall or reduced rates of simazine, diuron, or terbacil in spring, if planting has been established for at least one year, to control annual broadleaf weeds.

Targeted Weeds	Herbicide, WSSA Group, and Formulation ¹	Commercial Product Rate/A	Precautions and Remarks
Annual broadleaf weeds and suppression of annual grasses	flumioxazin, Group 14 (Chateau) 51 SW (Tuscany) 4 SC REI: 12 hours PHI: 60 days	6 to 12 oz 6 to 12 fl oz	For bearing and non-bearing vineyards. Do NOT apply to grapes established less than 2 years unless they are trellised at least 3 feet from the soil surface or are protected from spray contact by non-porous wrap, grow tube, or waxed containers. Do NOT apply to grapes that are not trellised or staked unless they are free standing. Do NOT exceed 24 oz/A per 12-month period. Do NOT exceed 6 oz/A per application where the soil contains more than 80% sand until plants have been in the field for 3 years. Do NOT apply within 300 feet of trees or shrubs that are not dormant. Do NOT tank mix with glyphosate when applying flumioxazin after bud break due to increased injury potential. Do NOT apply after flowering unless hooded or shielded application equipment is used and the applicator can ensure that spray drift will not contact the crop's fruit or foliage. Do NOT sequentially apply closer than 30 days apart. Apply in the late fall after leaf drop or in early spring before bud break. Add crop oil concentrate (COC) at 1% v/v. Tank-mix with an appropriate postemergence herbicide for broad-spectrum control of emerged weeds or with a residual grass herbicide to improve annual grass control.
	oxyfluorfen Group 14 (Goal 2XL, Galigan) 2 EC REI: 24 hours PHI: N/A	5 to 8 pt	For bearing and non-bearing vineyards. Do NOT apply after bud swell. Do NOT apply to grapes established less than 3 years unless vines are on a trellis wire a minimum of 3 feet above the soil surface. Do NOT apply to grapes that are not staked or trellised unless vines are free standing. Do NOT incorporate into the soil with a disk or other implement, or reduced weed control may result. Apply in early spring before bloom. Add an appropriate postemergence herbicide to kill existing vegetation. Tank-mix with pendimethalin, oryzalin, or napropamide to improve length of annual grass control.

Targeted Weeds	Herbicide, WSSA Group, and Formulation ¹	Commercial Product Rate/A	Precautions and Remarks
Annual broadleaf weeds and yellow nutsedge	rimsulfuron Group 2 (Matrix, Solida) 25 WDG REI: 4 hours PHI: 14 days	4 oz	For vineyards established a minimum of 1 year. Do NOT apply more than twice per year Do NOT exceed 4 oz/A per year. pH of the spray solution should be in the range of 4 to 8. Apply in spring, or split the application and apply rimsulfuron in late fall or spring, and repeat in early summer. Add nonionic surfactant (NIS) at 0.25% v/v. Rimsulfuron is a group 2 herbicide with a single site of action in susceptible weeds, which makes it a high risk for weed resistance development. Use rimsulfuron in combination with other herbicides with a different mode of action in your annual weed control program.
	sulfentrazone Group 14 (Zeus XC) 4 L REI: 4 hours PHI: 3 days	8 to 12 fl oz	For vineyards established a minimum of 3 years. Do NOT exceed 12 fl oz/A per year on a broadcast application basis. Do NOT apply more than twice per year Do NOT tank-mix with Chateau (flumioxazin). Do NOT sequentially apply closer than 60 days apart. Apply in the spring before bud break to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Tank-mix with pendimethalin or oryzalin to control annual grasses.
Annual grasses, rushes, and sedges (including yellow nutsedge)	norflurazon Group 12 (Solicam) 78.6 DF REI: 12 hours PHI: 60 days	2.5 to 5 lbs	For vineyards established a minimum of 6 months. Do NOT apply more than once per 12-month period. Rate is soil texture dependent. See label for details. Apply in late fall or spring before bud break to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Tank-mix with simazine plus a postemergence herbicide in late fall or reduced rates of simazine, diuron, or terbacil in spring, if planting has been established for at least one year, to control annual broadleaf weeds.
Annual broadleaf weeds (chickweed, red sorrel) and some annual and perennial grasses	pronamide Group 3 (Kerb SC) 3.3 SC (Kerb 50-W) 50 WP REI: 24 hours PHI: 60 days	2.5 to 9.5 pt 4 to 8 lbs	For vineyards established a minimum of 6 months. Do NOT apply more than 8 lbs/A or 9.5 pt/A per application. Do NOT apply more than once per year. Rate is soil texture dependent. See label for details. Spring transplanted grapes should be at least 6 months in the field, and fall transplanted grapes should be in the field for 12 months prior to treatment. Apply in the fall or winter when soil temperature is between 35° and 55° F. Tank-mix pronamide with simazine for enhanced residual broadleaf weed control.

¹ REI = Restricted Entry Interval; PHI= Preharvest Interval

Recommended Postemergence Herbicides

Postemergence herbicides kill weeds through their leaves rather than through the roots. They can be safely used in vineyards by carefully applying the herbicide to the weeds without allowing it to contact the crop. The herbicide should be applied when weeds are growing rapidly. Do not treat weeds that are dormant or under stress from drought, extreme

heat, cold, or other adverse growing conditions. The optimum stage of growth depends on the herbicide used and the weed species. Most herbicides that enter the plant through the leaves need a minimum rain-free period of at least 8 hours after application for maximum effectiveness. Postemergence herbicides may be selective or nonselective, and work only where they contact the plant or translocate throughout the plant.

Table 6-2. Comments on postemergence herbicides for grapes

Targeted Weeds	Herbicide, WSSA Group, and Formulation ¹	Commercial Product Rate/A	Precautions and Remarks
SELECTIVE Annual and perennial grasses hard to control (quackgrass, hard fescue, orchardgrass, bermudagrass, wirestem muhly, and bluegrass)	clethodim, Group 1 (Select) 2 EC (Select Max) 1 EC REI: 24 hours PHI: N/A	6 to 8 fl oz 9 to 16 fl oz	For non-bearing vineyards ONLY. Select 2 EC: Do NOT exceed 8 oz/A per application. Select 1 EC: Do NOT exceed 64 fl oz/A per year or 16 fl oz/A per application. Do NOT apply within 12 months of harvest. Do NOT sequentially apply closer than 14 days apart. Do NOT tank-mix Select with any other pesticide. Do NOT apply to grasses under stress condition. Use the lower rate to control annual grasses and the higher rate to control perennial grasses listed to the left. Repeat the application if regrowth occurs. Allow 14 days between applications. Consult the label for additional information on recommended size of grasses for treatment. Add a nonionic surfactant (NIS) at 0.25% v/v. See label for rates and timings for specific grasses
SELECTIVE Emerged annual and some perennial grasses	sethoxydim Group 1 (Poast) 1.5 EC REI: 12 hours PHI: 50 days	1 to 2.5 pt	For bearing and non-bearing vineyards. Do NOT exceed 5 pt/A per 12-month period or 2.5 pt/A per application. Do NOT sequentially apply closer than 14 days apart. Do NOT tank-mix Poast with any other pesticide. Do NOT apply to grasses under stress condition. Consult label for optimal growth stage and rate for specific grass species. Add crop oil concentrate (COC) at 2 pt/A or methylated seed oil (MSO) at 1.5 pt/A. Use the lower rate to control annual grasses less than 6" tall. Use the higher rate to control annual grass 6 to 12" tall and to control perennial grasses.
	fluazifop-P-butyl Group 1 (Fusilade DX) 2 EC REI: 12 hours PHI: 50 days	12 to 24 fl oz	For bearing and non-bearing vineyards. Do NOT apply more than 72 fl oz/A per year or 24 fl oz/A per application. Do NOT apply more than three times per year. Do NOT sequentially apply closer than 14 days apart. Do NOT tank-mix Fusilade DX with any other pesticide. Do NOT apply to grasses under stress condition. Consult label for optimal growth stage and rate for specific grass species. Add crop oil concentrate (COC) at 1% v:v or nonionic surfactant (NIS) at 0.25-0.5% v:v. Use the lower rate on most annual grasses less than 6" tall and to control johnsongrass. Use the higher rate to control other perennial grasses, crabgrass, and annual grasses more than 6" tall.
SELECTIVE	bentazon Group 6	1.5 to 2 pt	For non-bearing vineyards ONLY.

Targeted Weeds	Herbicide, WSSA Group, and Formulation ¹	Commercial Product Rate/A	Precautions and Remarks
Emerged annual broadleaf weeds, yellow nutsedge, Canada thistle	(Basagran Herbicide) 4 SL REI: 48 hours PHI: N/A		See label, not all bentazon formulation are labeled for grape. Do NOT spray or allow drift on green bark or foliage. Do NOT exceed 2 pt/A per application. Do NOT exceed 4 pt/A per calendar year. See supplemental label for specific rates based on weed size and growth stage. Apply as a directed shielded spray at a minimum of 20 GPA to burn down emerged weeds up to 3" tall. Add crop oil concentrate (COC) at 2 pt/A.
SELECTIVE Emerged annual broadleaf weeds	carfentrazone-ethyl Group 14 (Aim) 2 EC REI: 12 hours PHI: 3 days	1 to 1.6 fl oz	For bearing and non-bearing vineyards. Do NOT spray or allow drift on green bark or foliage. Do NOT exceed 7.9 fl oz/A of Aim per year or 2 fl oz/A of Aim per application. Apply as a directed shielded spray at a minimum of 20 GPA to burn down emerged weeds up to 4" tall. Combine with recommended preemergence herbicide(s) for residual weed control. Add nonionic surfactant (NIS) at 0.25% v:v.
	pyraflufen-ethyl Group 14 (Venue) 0.17 EC REI: 12 hours PHI: 0 day	3 to 4 fl oz	For bearing and non-bearing vineyards. Do NOT spray or allow drift on green bark or foliage. Do NOT sequentially apply closer than 30 days apart. Do NOT make more than 3 applications per year. Apply as a directed shielded spray at a minimum of 20 GPA to burn down emerged weeds up to 4" tall. Combine with recommended preemergence herbicide(s) for residual weed control. Add crop oil concentrate (COC) at 1% to 2% v:v.
NON-SELECTIVE Up to 3" tall emerged annual grasses and broadleaf weeds. Suppression of emerged perennial weeds	paraquat, Group 22 (Gramoxone SL 2.0) 2 SL (Firestorm) 3 SL REI: 24 hours PHI: N/A	2.5 to 4 pt 1.7 to 2.7 pt	<u>DANGER: Do NOT breathe spray mist. READ LABEL FIRST.</u> For bearing and non-bearing vineyards. Do NOT spray or allow drift on green bark or foliage. Do NOT make more than 5 applications per year. Contact killer only; no translocation or residual activity. Sucker control: treat when sucker growth is no more than 8" long. Combine with recommended preemergence herbicide(s) for residual weed control. Add nonionic surfactant (NIS) to be 0.25% v:v or a crop oil concentrate (COC) or methylated seed oil (MSO) at 1% v:v. Use shields, such as grow tubes or paper milk cartons to reduces the risk of injury in young plantings.
NON-SELECTIVE Most emerged annual broadleaf weeds and grasses plus some perennial weeds	Glufosinate Group 10 (Rely 280, Cheetah, Lifeline, Reckon) 2.34 SL REI: 12 hours PHI: 14 days	48 to 82 fl oz	For bearing vineyards ONLY. Do NOT spray or allow drift on green bark, foliage, or suckers. Do NOT exceed 82 fl oz/A of Rely 280 per application. Do NOT make more than 3 applications per calendar year. Do NOT exceed 246 fl oz/A per calendar year. Apply as a directed shielded spray to 1-6" tall weeds at a minimum of 20 GPA and 30 PSI. The use of ammonium sulfate (AMS) will enhance glufosinate activity on tough

Targeted Weeds	Herbicide, WSSA Group, and Formulation ¹	Commercial Product Rate/A	Precautions and Remarks
			to control weeds. Additional surfactants or crop oil are not needed and/or may increase potential for crop injury.
	Glyphosate Group 9 (various brand and formulations) REI: see label PHI: 14 days	See label	For bearing vineyards ONLY. Do NOT spray or allow drift on green bark, foliage, or suckers. Do NOT apply on weeds under stress. Do NOT use, mix, or store in a galvanized container. It is a translocated, slow-acting herbicide with no residual activity. Optimum rate and time of application depend on weed species and growth stage. See label for specific rates for herbicide and surfactant.

¹ REI = Restricted Entry Interval; PHI= Preharvest Interval

Table 7. Crop safety ratings¹ of herbicides used in grapes.

Herbicide	Vineyard age	
	Non-bearing	Bearing
Preemergence (residual)		
Alion	–	L
Chateau ²	F/G	G
Devrinol	-	G
Gallery	G	–
Goal 2XL / Galligan	G	G
Karmex / Direx ²	–	F/G
Matrix / Solida	–	G
Kerb	–	G
Casoron	L	G
Princep ²	–	F/G
Prowl H ₂ O	G	G
Solicam	F/G	G
Surflan	G	G
Trellis	G	G
Zeus XC ²	–	G
Postemergence (selective)		
Fusilade DX	G	G
Poast	G	G
Select	G	–
Postemergence (nonselective)		
Basagran ²	F/G	–
Aim EC ²	G	G
Venue ²	G	G
Paraquat products ²	G	G
Glufosinate product ²	G	G
Glyphosate products ²	G	G

¹ G = Good, F=Fair (use with care), P=Poor (not recommended), L = Labeled (data insufficient or not recommended), – = NOT LABELED (**DONOTUSE**)

²Do **NOT** allow spray to contact young or green (living) bark or leaves.

Table 8-1. Herbicide effectiveness ratings¹ on major summer annual weeds in grapes².

Herbicide	Barnyardgrass	Crabgrass, large	Fall panicum	Foxtail spp.	Goosegrass	Johnsongrass (seedlings)	Annual sedge	Carpetweed	Cocklebur, common	Galinsoya, hairy	Jimsonweed	Lambsquarter, common	Morning glory spp.	Nightshade, eastern black	Shepherds-purse	Pigweed spp.	Purslane, common	Ragweed, common	Smartweed, Pennsylvania	Velvetleaf
Preemergence (residual)																				
Alion	G	G	G	G	G	-	-	G	-	G	G	F/G	F/G	G	G	G	G	F/G	F/G	G
Casoron	F/G	F/G	F/G	F/G	F/G	F/G	G	-	-	-	-	G	-	-	G	G	-	G	-	-
Chateau	F	F	F	F	-	-	P	G	G	G	G	G	G	G	G	G	G	G	G	G
Devrinol	G	G	G	G	G	G	P/F	G	N	F/P	N	F/G	N	N	-	G	F	P/F	P	N
Gallery	N	N	N	N	N	N	N	F	-	G	G	G	G	G	G	G	G	G	G	G
Goal 2XL / Galligan	F	F	F	F	-	-	P	G	-	G	G	G	G	G	G	G	G	G	G	G
Karmex / Direx	G	F/G	G	G	F/G	N	F/G	G	-	G	G	G	G	G	G	G	G	G	F	G
Kerb	G	G	G	G	G	-	N	G	N	P	N	G	-	-	-	G	G	P	-	P
Matrix / Solida	G	F	F	G	P	-	G	-	F/G	-	F	F	F	P	G	G	F	P	P/F	F
Princep	F	P/F	F	G	F/G	P	F/G	-	F/G	G	G	G	G	G	G	F	G	G	G	-
Prowl	G	G	G	G	G	G	P	G	-	N	N	F/G	P	-	-	F/G	F/G	-	-	F/G
Solicam	G	G	G	G	G	-	F/G	P	P	-	F	F	-	-	-	F	G	F/G	-	F
Surflan	G	G	G	G	G	G	N	F/G	N	N	N	F/G	N	P	N	F/G	F/G	N	P	P
Trellis																				
Zeus XC																				
Postemergence (selective)																				
Fusilade DX	G	F/G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Poast	G	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Select	G	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Postemergence (nonselective)																				
Basagran	N	N	N	N	N	N	G	-	G	-	G	G	N	N	-	F	-	G	G	G
Aim EC	N	N	N	N	N	N	N	F/G	G	P	G	G	G	F/G	G	G	G	N	G	G
Venue	N	N	N	N	N	N	N	F/G	-	-	-	G	-	-	G	-	-	-	-	-
Paraquat products	F/G	F/G	F/G	G	F/G	-	G	-	G	G	G	F/G	F/G	-	-	G	F/G	G	-	-
Glufosinate products	G	G	G	G	G	F/G	F/G	G	G	G	G	G	F	F/G	G	G	G	F	G	G
Glyphosate products	G	G	G	G	G	G	F	G	G	G	G	G	F	G	G	G	G	F	G	G

¹ G = Good F = Fair P = Poor N = None — = Insufficient data

² Herbicide effectiveness is affected by weather, soil type, herbicide rate, weed pressure, and other factors. These ratings indicate ONLY relative effectiveness in tests conducted by the University of Maryland and Rutgers, The State University of New Jersey, on coarse- to medium-textured soils. Actual performance may be better or worse than indicated in this table.

Table 8-2. Herbicide effectiveness ratings¹ on major winter annual and perennial weeds in grapes².

Herbicide	Annual Bluegrass	Annual Bromegrass	Chickweed spp.	Corn Chamomile	Groundsel	Henbit	Horseweed	Mustard spp.		Bermudagrass	Quackgrass	Yellow Nutsedge	Aster spp.	Bindweed spp.	Canada Thistle	Goldenrod spp.	Hemp Dogbane	Red Sorrel	Mulberry	Poison Ivey	Virginia Creeper
Preemergence (residual)	Winter Annuals									Perennials											
Alion	G	G	G	G	G	G	G	G		N	N	P	N	N	N	N	N	-	N	N	N
Casoron	F	G	G	G	G	G	G	G		F	F	F/G	F/G	F/G	F/G	F/G	F/G	F/G	P	P	P
Chateau	P/F	P/F	G	G	G	G	G	G		N	N	P	P	P	P	P	P	P/F	N	N	N
Devrinol	G	G	F	P	N	P	N	P		N	N	P	N	N	N	N	N	N	N	N	N
Gallery	G	G	G	G	G	G	-	G		N	N	P	P	P	P	P	P	P	N	N	N
Goal 2XL / Galigan	P/F	P/F	G	G	G	G	G	G		N	N	P	P	P	P	P	P	P/F	N	N	N
Karmex / Direx	G	F	G	G	P	G	G	G		N	P	P	P	P	P	P	P	P	N	N	N
Kerb	G	G	N	N	N	N	N	N		P	G	N	N	N	N	N	N	N	N	N	N
Princep	F	F	G	G	P	G	G	G		N	P	P	P	P	P	P	P	P	N	N	N
Matrix / Solida																					
Prowl	G	G	F	P	N	P	P	P		N	P	P	N	N	N	N	N	N	N	N	N
Solicam	G	G	F	F	P	F	P/F	F		P	F	F	P	P	P	P	P	P	P	P	P
Surflan	G	G	F	P	N	P	P	P		P	P	N	N	N	N	N	N	N	N	N	N
Trellis																					
Zeus XC																					
Postemergence (selective)																					
Fusilade DX	P	G	N	N	N	N	N	N		G	G	N	N	N	N	N	N	N	N	N	N
Poast	P	G	N	N	N	N	N	N		G	G	N	N	N	N	N	N	N	N	N	N
Select	G	G	N	N	N	N	N	N		G	G	N	N	N	N	N	N	N	N	N	N
Postemergence (nonselective)																					
Basagran	N	N	G	-	-	-	P	-		N	N	G	-	F	F	-	N	F	N	N	N
Aim EC	N	N	G	-	-	G	-	G		N	N	N	P/F	P/F	N	N	N	N	N	N	N
Venue	N	N	G	-	-	-	-	-		N	N	N	P/F	P/F	N	N	N	N	N	N	N
Paraquat products	G	G	G	G	F	G	F	G		P	P	P	P	P	P	P	P	P	P	P	P
Glyphosate products	G	G	G	G	G	G	P/G	G		F	G	G	G	G	G	G	G	G	G	G	G
Glufosinate products	G	G	G	G	G	G	G	G		P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P	P	P

¹ G = Good F = Fair P = Poor N = None — = Insufficient data² Herbicide performance is affected by weather, soil type, herbicide rate, weed pressure, and other factors. These ratings indicate ONLY relative effectiveness in tests conducted by the University of Maryland and Rutgers, The State University of New Jersey, on coarse- to medium-textured soils. Actual performance may be better or worse than indicated in this table.

Table 9. Recommended preemergence herbicide rates (in Active Ingredients) for common soil types.

	Soil type												
	Sand		Loamy Sand		Sandy Loam			Loam		Silt Loam		Clay Loam	
Herbicide	0.0-1.0	1.0-2.0	0.0-1.0	1.0-2.0	0.0-1.0	1.0-2.0	2.0-4.0	1.0-2.0	2.0-4.0	1.0-2.0	2.0-4.0	1.0-2.0	2.0-4.0
Alion	—	—	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
Casoron	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0
Chateau	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38
Devrinol ¹	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0
Gallery	0.75	0.75	0.75	0.75	0.75	0.75	1.0	0.75	1.0	1.0	1.0	1.0	1.0
Goal 2XL/ Galigan	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Karmex / Direx ²	—	—	—	—	—	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0
Kerb	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	3.0	3.0	3.5	3.5	4.0
Matrix / Solida	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
Princep ²	—	—	—	—	—	2.0	2.0	2.0	3.0	2.0	3.0	3.0	4.0
Prowl	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0
Solicam	—	—	—	2.0	—	2.0	2.5	2.5	2.5	2.5	3.0	3.0	4.0
Surflan ¹	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0
Trellis													
Zeus XC													

¹ Use the lower recommended rate when tank-mixing with another preemergence herbicide, unless annual grass pressure is severe.

² Use one-half the recommended rate when tank-mixing with another preemergence herbicide.

— = NOT LABELED (DO NOT USE).

© 2019 Rutgers, The State University of New Jersey. All rights reserved. Revised: March 2019

Mention or display of a trademark, proprietary product, website link, or firm in text or figures does not constitute an endorsement by Rutgers University, and does not imply approval to the exclusion of other suitable products or firms. Written permission from owners of all photography has been granted for use in this document, and is not transferable.

Cooperating Agencies: Rutgers, The State University of New Jersey, U.S. Department of Agriculture, and County Boards of Chosen Freeholders. Rutgers Cooperative Extension, a unit of the Rutgers New Jersey Agricultural Experiment Station, is an equal opportunity program provider and employer.

