

## Diseases and Insects in Vineyards

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Additional information on pest and beneficial species identification is available on-line at <http://www.virginiafruit.ento.vt.edu/>. Application rates: The rate per acre column gives rates for low-volume or concentrate applications. Sprays may be applied as semiconcentrate (40-100 gal/A) or concentrate (10-40 gal/A) sprays. Use caution with more concentrated sprays; the smaller droplet sizes associated with low-volume application are more prone to drift. Amount of pesticide to be applied for dilute applications (usually 100 gal/A early in early season, 200 gal/A in mid season, and 300 gal/acre in late season) is usually given on the label.

**Table 3.1 - Disease and Insect Control**

Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
<i>Dormant</i>			
Anthracnose (Bird's eye rot), Powdery Mildew, Phomopsis	lime sulfur solution	10.0 gal	Only necessary where anthracnose, Phomopsis, or powdery mildew have been a serious problem. Lime sulfur can reduce overwintering inoculum of these diseases.
Mealybugs	Applaud 70DF Venom 20SG Assail WSP Assail 30SG Provado Solupak Baythroid 2EC	9.0-12.0 oz 0.44-0.66 lb 1.1 oz 2.5 oz 0.8-1.0 oz 2.4-3.2 fl oz	If a problem at harvest in the previous year. If a delayed dormant spray does not provide a adequate control, a summer application may be made. Baythroid targets only crawlers.
<i>Bud Swell</i>			
Grape flea beetle	Danitol 2.4EC or Sevin XLR Plus or Imidan 70WP or Baythroid 2EC	8.0 fl oz 2.0 qt 2.0 lb 2.4-3.2 fl oz	If adult beetles are present in damaging numbers. <b>See Table 3.4 for Restricted Entry Intervals.</b> The REI for Imidan may render it impractical for most growers.
European red mite (ERM)	superior oil (70 sec)	2.0 gal	Only where ERM is a problem. Apply as a dilute spray.
Climbing cutworms	<i>Bacillus thuringiensis</i> (Bt) or Sevin XLR Plus or Danitol 2.4EC or Intrepid 2F or SpinTor 2SC or Entrust 80WP or Delegate 25WG or Baythroid 2EC or Brigade 10WSB	Rates vary 2.0 qt 15.0 fl oz. 12.0-16.0 fl oz 8.0 fl oz 2.5 oz 3.0-5.0 oz 2.4-3.2 fl oz 8.0-16.0 oz	Spray in evening if possible. Various preparations of Bt available. Check label for rates. <b>See Table 3.4 for Restricted Entry Intervals.</b>

### 3-2 Grapes: Diseases and Insects in Vineyards

**Table 3.1 - Disease and Insect Control (cont.)**

Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
<i>New Shoots: at weekly intervals or according to label until pre-bloom</i>			
Black rot, Phomopsis cane and leaf spot, Downy mildew	captan 50WP or equivalent or mancozeb 80WP or DF or Ziram or See Table 3.2	2.0-4.0 lb  2.0-4.0 lb  2.0-4.0 lb	Important to maintain protection starting at 1/2 inch to 1 inch shoot length where black rot or Phomopsis has been a problem. Add a surfactant to improve wetting of pubescent young growth.
Powdery mildew	wettable sulfur (81.25% or 92%) or Rubigan EC or See Table 3.2	2.0-5.0 lb (See label)  2.0-3.0 oz	Where powdery mildew is a severe problem. Do not make sulfur applications within two weeks of an oil spray. Do not use sulfur prior to or during periods of excessively high temperatures. Do not apply sulfur to Concord, red-fruited French-American hybrids, and other sulfur sensitive varieties. Do not make sulfur applications within 2 weeks of an oil spray, or prior to or during excessively high temperatures.
Anthracnose	copper fungicides with lime or See Table 3.2	see label	Apply at 4- to 10-inch shoot length. Repeat at 10- to 14-day intervals. Only necessary where anthracnose has been a problem.
Grape cane girdler	Danitol 2.4EC or Imidan 70WP or Baythroid 2EC	10.6 fl oz  2.0 lb  2.4-3.2 fl oz	When shoots are 4- to 6-inches long, where infesting more than 10% of shoots. Mainly a problem when training young vines. <b>See Table 3.4 for Restricted Entry Intervals.</b>
Redbanded leafroller	SpinTor 2SC or Entrust 80WP or Delegate 25WG or Intrepid 2F or Imidan 70WP or Sevin XLR Plus or <i>Bacillus thuringiensis</i> (Bt)	4.0-8.0 fl oz  1.25-2.5 oz  3.0-5.0 oz  12.0-16.0 fl oz  2.0 lb  2.0 qt  See label	Where pest has been a problem in past. Various preparations of Bt available check rates. <b>See Table 3.4 for Restricted Entry Intervals.</b> Guthion and Sniper cancelled, existing stocks may be used.
Climbing cutworms	<i>Bacillus thuringiensis</i> (Bt) or Sevin XLR Plus or Danitol 2.4EC or Intrepid 2F or SpinTor 2SC or Entrust 80WP or Delegate 25WG or Baythroid 2EC or Brigade 10WSB	See label  2.0 qt  15.0 fl oz  12.0-16.0 fl oz  8.0 fl oz  2.5 oz  3.0-5.0 oz  2.4-3.2 fl oz  3.2-6.4 oz	Spray in evening if possible. Various preparations of Bt available. Check rates. <b>See Table 3.4 for Restricted Entry Intervals.</b>

**Table 3.1 - Disease and Insect Control (cont.)**

Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
<i>Pre-Bloom - Just before blossoms open, critical spray for black rot, powdery, and downy mildew</i>			
Black rot	captan 50WP	2.0-4.0 lb	Infection occurs at 7 or more hours of leaf wetness (dew, fog, and/or rain), depending on temperature. Apply all fungicides before or between these wet periods. Spray every 10-14 days throughout the growing season according to label. Do not use sterol inhibitors (group 3, Bayleton, (Rally), Elite, Orius, Rubigan, Procure) or strobilurins (group 11, Abound, Sovran, Flint, or Pristine) continuously; rotate with other groups of fungicides.
	or		
	ferbam 76WP	2.0-4.0 lb	
	or		
	Ziram	2.0-4.0 lb	
	or		
	mancozeb 80WP or DF	2.0-4.0 lb	
	or		
	Rally (Nova) 40WSP	3.0-5.0 oz	
	or		
	Elite or Orius 45DF	4.0 oz	
	or		
Abound	10.0-15.5 fl oz		
or			
Sovran	3.2-5.6 oz		
or			
Flint	2.0 oz		
or			
Pristine	8.0-12.5 oz		
or			
Adament	4.0-7.2 oz		
Downy mildew	captan 50WP	2.0-4.0 lb	Apply 2 weeks before blossom caps begin to drop on very susceptible varieties. Downy mildew strains with resistance to Abound and Pristine are present in many Virginia locations. Rotating or tank mixing with a different anti-downy-mildew material is recommended. USA data on efficacy of Revus and Presidio are limited.
	or		
	mancozeb 80WP	2.0-4.0 lb	
	or		
	Ridomil Gold MZ	1.5-2.0 lb	
	or		
	phosphorous acid	See label	
	or		
Gavel	2.0-2.5 lb		
or			
Revus	6.0-8.0 oz		
or			
Presidio	3.0-4.0 oz		
Powdery mildew	Elite 45DF	2.0-6.0 oz	Do not use sterol inhibitors (see above under black rot) or strobilurins continuously; rotate with other groups of fungicides. Powdery mildew strains with resistance to the strobilurins (Abound, Sovran, and Flint) have been found in the eastern USA, are common in Virginia, and can cause control failure! It is recommended that strobilurins be tank mixed with sulfur or another anti-mildew material. Pristine contains a strobilurin, but also a different active chemical (group 7) and does not need to be tank mixed. Rates for sulfur can be increased to as high as 5.0 lb/100 gallons. Severe disease pressure may warrant this, but beware of possible plant injury at higher rates.
	or		
	wettable sulfur (81.25% or 92%)	2.0-4.0 lb	
	or		
	Rally (Nova) 40WSP	3.0-5.0 oz	
	or		
	Rubigan EC or Vintage	2.0-4.0 oz	
	or		
	Procure	4.0-8.0 oz	
	or		
	Pristine	8.0-12.5 oz	
or			
Endura	4.5 oz		
or			
Quintec	4.0 oz		
or			
Adament	7.2 oz		

### 3-4 Grapes: Diseases and Insects in Vineyards

**Table 3.1 - Disease and Insect Control (cont.)**

Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
<i>Pre-Bloom - Just before blossoms open, critical spray for black rot, powdery, and downy mildew (cont.)</i>			
Grape berry moth	Intrepid 2F	12.0-16.0 fl oz	Use higher rate of SpinTor or Entrust for more intensive infestations and larger larvae, where pest has been a problem in past. Mating disruption Isomate is registered for GBM. Use full labeled rate and consult a grape entomologist before use. In low-risk vineyards (no wild grapes within 300 yards), use 200 dispensers/A. Spray edge rows with insecticides. <b>See Table 3.4 for Restricted Entry Intervals.</b>
	or		
	SpinTor 2SC	4.0-8.0 fl oz	
	or		
	Entrust 80WP	1.25-2.5 oz	
	or		
	Delegate 25WG	3.0-5.0 oz	
	or		
	Altacor 35 WDG	2.0-4.5 oz	
	or		
	Imidan 70WP	2.0 lb	
	or		
	Diazinon 500AG	1.0-2.0 pt	
	or		
	Lannate SP	0.5-1.0 lb	
	or		
Isomate-GBM Plus	400 dispensers		
or			
Danitol 2.4EC	10.6 fl oz		
or			
Baythroid 2EC	2.4-3.2 fl oz		
or			
Brigade 10 WSB	8.0-16.0 fl oz		
or			
Avaunt 30DG	5.0-6.0 oz		
or			
Sevin XLR	2.0 qt		
or			
<i>Bacillus thuringiensis</i> (BT)	Rates vary		
Grape leafhopper	Assail WSP	1.1 oz	Use a treatment threshold of 5 nymphs/leaf before July 15, 10/ leaf thereafter. Apply Surround at least 2 or 3 times at 7- to 14-day intervals throughout infestation; not recommended for table grapes because of visible residues. Nexter may be applied up to twice per season. Use 8.8-10.67 oz/A in vineyards with dense foliage. <b>See Table 3.4 for Restricted Entry Intervals.</b>
	or		
	Assail 30SG	2.5 oz	
	or		
	Provado Solupak 75WP	0.75-1.0 oz	
	or		
	Imidan 70WP	2.0 lb	
	or		
	malathion 8EC	2.7 pt	
	or		
	Danitol 2.4EC	5.3-10.6 fl oz	
	or		
	Surround 95WP	12.5-50.0 lb	
	or		
Sevin XLR Plus	2.0 qt		
or			
Nexter 75WP	4.4-5.2 oz		
or			
Baythroid 2EC	2.4-3.2 fl oz		
or			
Brigade 10WSB	8.0-16.0 oz		

**Table 3.1 - Disease and Insect Control (cont.)**

Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
<i>Bloom</i>			
Botrytis	Rovral 75WG or 4F	0.67-1.33 lb or	Materials may be applied at early mid-bloom and again before bunch closing, if needed. Botrytis strains with reduced sensitivity to iprodione have been found in Virginia vineyards.
	or	1.5-2.0 pt	
	Vangard	5.0-10.0 oz	
	or		
	Scala	9.0-18.0 oz	
	or		
	Elevate	1.0 lb	
	or		
	Endura	8.0 oz	
	or		
	Pristine	18.5-23.0 oz	Note 5- day REI for cane work.
<i>Post-Bloom: Immediately after bloom</i>			
Black rot	captan 50WP	4.0 lb	This is a <b>very important spray</b> . Do not delay more than 12-14 days after last pre-bloom spray. <b>Note:</b> (Rally), Elite, or Bayleton at the higher rates using 200 gal/A dilute sprays in combination with black rot predictor models provide excellent curative control.
	or		
	ferbam 76WP	4.0 lb	
	or		
	mancozeb 80WP or DF	4.0 lb	
	or		
	Ziram	4.0 lb	
	or		
	Rally (Nova) 40WSP	3.0-5.0 oz	
	or		
	Elite 45DF or Orins	4.0 oz	
	or		
	Abound	10.0-15.5 fl oz	
or			
Sovran	3.2-5.6 oz		
or			
Flint	2.0 oz		
or			
Pristine	8.0-12.5 oz	Note 5- day REI for cane work.	
Downy mildew	captan 50WP	4.0 lb	Do not apply mancozeb or Gavel within 66 days of harvest. Copper fungicides should be mixed with hydrated lime. Copper fungicides may cause injury on certain varieties, esp. under cool, wet conditions.
	or		
	mancozeb 80WP or DF	4.0 lb	
	or		
	Ridomil Gold Copper	1.0-2.0 lb	
	or		
	copper fungicides	See label	
	or		
	phosphorous acid	See label	
	or		
Gavel	2.0-2.5 lb		
or			
Revus	6.0-8.0 oz		
or			
Presidio	3.0-4.0 oz		
<i>Post-Bloom: Immediately after bloom (cont.)</i>			

### 3-6 Grapes: Diseases and Insects in Vineyards

<b>Table 3.1 - Disease and Insect Control (cont.)</b>					
<b>Pest</b>	<b>Chemical and Formulation</b>	<b>Rate/Acre</b>	<b>Spray Timing and Remarks</b>		
Powdery mildew	Elite 45DF or Orius	4.0 oz	<b>Very important spray.</b> Use at 14- to 18-day intervals as needed. Use higher rates and/or shorter intervals (see label) under severe disease pressure. <b>See notes for prebloom.</b>		
	or Rally (Nova) 40WSP	3.0-5.0 oz			
	or wettable sulfur (81.25% or 92%)	4.0 lb			
	or Rubigan EC	4.0-6.0 oz			
	or Vintage	4.0-6.0 oz			
	or Procure	4.0-8.0 oz			
	or Pristine	8.0-12.5 oz			
	or Quintec	4.0 oz			
	or Endura	4.5 oz			
	Grape berry moth	Intrepid 2F		12.0-16.0 fl oz	Mating disruption is registered for GBM. Use full labeled rate and consult a grape entomologist before use for specific instructions. See prebloom spray. <b>See Table 3.4 for Restricted Entry Intervals.</b> The REI for Imidan may render it impractical for most growers.
		or SpinTor 2SC		4.0-8.0 fl oz	
or Entrust 80 WP		1.25-2.5 oz			
or Delegate 25WG		3.0-5.0 oz			
or Altacor 35 WDG		2.0-4.5 oz			
or <i>Bacillus thuringiensis</i> (Bt)		Rates vary			
or Imidan 70 WP		2.0 lb			
or Lannate SP		0.5-1.0 lb			
or Sevin 50WP		4.0 lb			
or Danitol 2.4EC		10.6 fl oz			
or Brigade 10WSB		8.0-16.0 oz			
or Baythroid 2EC		2.4-3.2 fl oz			
or Avaunt 30DG		5.0-6.0 oz			
Grape rootworm		Sevin XLR PLUS	2.0 qt	Apply when beetles appear, usually in late June or early July. Second application may be necessary 10 days later.	
<i>Post-Bloom: Immediately after bloom (cont.)</i>					

**Table 3.1 - Disease and Insect Control (cont.)**

Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
Grape leafhopper	Provado Solupak 75WP	0.75-1.0 oz	Apply if more than 5 leafhopper nymphs/leaf before August 1, and 10/leaf thereafter. <b>See Table 3.4 for Restricted Entry Intervals.</b>
	or Nexter 75WP	4.4-5.2 oz	
	or Assail WSP	1.1 oz	
	or Assail 30SG	2.5 oz	
	or Imidan 70WP	2.0 lb	
	or malathion 8EC	3.0 pt	
	or Sevin 50WP	4.0 lb	
	or Sevin XLR PLUS	2.0 qt	
	or Danitol 2.4EC	10.6 fl oz	
	or Applaud 70DF	9.0-12.0 oz	
	or Baythroid 2EC	2.4-3.2 fl oz	
	or Brigade 10WSB	8.0-16.0 oz	
	Phylloxera	Thionex 50WP	
or Danitol 2.4EC		15.0 fl oz	
or Assail WSP		1.1 oz	
or Assail 30SG		2.5 oz	
European red mite	Vendex 50WP	2.0 lb	Only if mites exceed 10/leaf (20/leaf on <i>labrusca</i> types), and more than minor bronzing occurs. Rotate acaricides. Use 8.8-10.67 oz of Nexter if twospotted spider mite is the predominant mite, or in vineyards with dense foliage. Vendex is available in water-soluble bags (1-2.5 bags/A). Acramite may only be applied once per year. Use 8 oz of Agri-Mek for low populations, 16 oz for severe. Stylet Oil should be applied at 1-2 gal/A, every 10-14 days against mite eggs.
	or Vendex 4L	1.0 qt	
	or Nexter 75WP	4.4-5.2 oz	
	or Acramite 50WS	0.75-1.0 lb	
	or Agri-Mek 0.15EC	8.0-16.0 fl oz	
	or JMS Stylet Oil	1.0-2.0 gal	
	or Envidor 2SC	16.0-18.0 fl oz	
	or Zeal WP	2.0-3.0 oz	
	or Onager 11.8EC	12.0-24.0 fl oz	
<i>First Cover: 7 to 10 days after post-bloom spray</i>			
Black rot, downy mildew, powdery mildew	Same fungicides and rates as post-bloom spray.		Do not apply ferbam more than twice after pre-bloom spray. Copper fungicides with hydrated lime may be used for control of downy mildew. Observe per-season limits on pesticide amounts.
Grape berry moth, grape leafhopper, phylloxera, European red mite, grape rootworm	Same insecticides and rates as post-bloom spray.		Do not apply Imidan within 14 days of harvest.
<i>Second Cover: 7-10 days after first cover spray (when berries are about pea size, but before they touch in cluster)</i>			

### 3-8 Grapes: Diseases and Insects in Vineyards

<b>Table 3.1 - Disease and Insect Control (cont.)</b>			
<b>Pest</b>	<b>Chemical and Formulation</b>	<b>Rate/Acre</b>	<b>Spray Timing and Remarks</b>
Black rot, downy mildew, powdery mildew, grape berry moth, grape leaf-hopper, phylloxera, European red mite	Same fungicides and rates as Post-bloom spray. Same insecticides and rates as Post-bloom spray		Observe per-season limits on pesticide amounts. (See label.)
Japanese beetle, June beetle, wasps	Sevin 50WP or Sevin XLR PLUS or Surround 95WP or Imidan 70WP or Danitol 2.4EC or Assail WSP or Avaunt 30DG or Brigade 10WSB	4.0 lb  2.0 qt  12.5-50.0 lb  2.0 lb  20.0 fl oz  1.1 oz  3.5-6.0 oz  8.0-16.0 oz	Apply when beetles are common. Sevin may not be applied within 7 days of harvest. <b>See Table 3.4 for Restricted Entry Intervals.</b>
<i>Third Cover: before bunch closing</i>			
Botrytis	Rovral 75WG or 4F or Vangard or Scala or Elevate or Endura or Pristine	1.0-1.33 lb or 1.5-2.0 pt 5.0-10.0 oz  9.0-18.0 oz  1.0 lb  8.0 oz  12.5-23.0 oz	
<i>Veraison: berry ripening, sugar building up</i>			
Botrytis	Rovral 75WG or 4F or Vangard or Scala or Elevate or Endura or Pristine	1.0-1.33 lb or 1.5-2.0 pt 5.0-10.0 fl oz  9.0-18.0 oz  1.0 lb  8.0 oz  12.5-23.0 oz	Apply Rovral at beginning of ripening and again prior to harvest if needed to a maximum of 4 sprays/season. Fruit rot can be caused by a variety of organisms. Rovral has little effect on organisms other than Botrytis. Do not routinely apply this material unless a problem exists. Resistance to this chemical can develop within several seasons if over used. Strains with reduced sensitivity to Rovral have been found in some Virginia vineyards. Alternating Vangard or Scala (same group), Elevate, Rovral, and/or Endura is recommended. Do not apply more than two Vanguard plus Scala sprays/season. Pristine, at the rate of 12.5 oz, provides some control, and at 18.0-23.0 oz, good control of Botrytis.
<i>Fourth Cover: mid-August or 10 days after third cover spray</i>			

**Table 3.1 - Disease and Insect Control (cont.)**

Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
Same diseases and insects as above plus:	Same fungicides and insecticides as Post-bloom spray, except ferbam, plus the following:		DO NOT APPLY copper within 30 days of harvest or sulfur within 10- to 14-days of harvest to minimize enological problems <b>if berries are to be used for wine.</b>
Drosophila flies (vinegar flies)	diiazinon 50WP or malathion 8EC or 8F	6.0 oz  2.0-2.5 pt	Apply if drosophila are abundant. DO NOT APPLY diazinon within 28 days of harvest or malathion within 3 days of harvest.
<i>Postharvest: vines only</i>			
Mealybugs	Applaud 70DF Venom 20SG Assail WSP Assail 30SG Provado Solupak Baythroid 2EC	9.0-12.0 oz 0.44-0.66 lb 1.1 oz 2.5 oz 0.8-1.0 oz 2.4-3.2 fl oz	Apply if control is not achieved by delayed dormant spray. Baythroid targets only crawlers.
Leaves of vines should be protected up until frost to maintain healthy plants. This is especially important for control of powdery and downy mildew. Maintain green functioning leaves as long as possible. Follow sprays for powdery and downy mildew under post-bloom.			
<i>Special Borer Sprays</i>			
Grape root borer	Lorsban 4E	—	Good weed control usually prevents GRB populations from reaching high levels. In problem infestations, consider soil mounding, 8-12 inches high, around July 1. Pull down mound before following season. Also consider soil treatment with Lorsban. If GRB is a problem, apply just before adult emergence, but not within 35 days before harvest. Apply 2.0 qt of diluted spray mixture (4.5 pt/ 100gal) to soil surface on a 15 ft sq area around base of each vine. No more than once/ season. Do not allow to contact fruit or foliage.
<i>Special Sharpshooter Sprays</i>			
In some vineyards in the eastern part of the state, sharpshooter leafhoppers, the vectors of Pierce's disease are of concern. While research is needed on the vector relationships and timing in Virginia, the neonicotinoids Provado Solupak 75WP (0.8-1.0 oz/A), Provado 1.6F (3.0-4.0 fl oz/A), Assail 70WSP (1.1-oz/A), Assail 30SG (2.5oz/A), Brigade 10WSB (16.0 oz/A), Baythroid XL (1.6-3.2 fl oz/A), Venom 70SG (1.0-3.0 oz/A), and Venom 20SG (0.44-0.66 lb/A) are registered for control of sharpshooters. Use the higher rates for higher pressure. In addition, Venom is registered for soil application (5.0-6.0 oz/A), as are Admire 2F (16.0-32.0 fl oz/A) and Admire Pro (7.0-14.0 fl oz/A). Soil applications should be applied between bud-break and pea-berry stage and should be considered when there are three or fewer nights below 15°F during the preceding winter. The neonicotinoids share a common mode of action; avoid overuse to avoid resistance.			
Besides neonicotinoids, the following pyrethroids are registered for sharpshooter control: Danitol 2.4EC (10.67-21.33 fl oz/A), Brigade 2EC (6.4 fl oz/A), and Baythroid 2EC (1.6-3.2 fl oz/A). Danitol is limited to two applications, Baythroid to four applications, and Brigade to two applications at the low rate, one at the high.			
Consult <a href="http://www.virginiafruit.ento.vt.edu/PDsharpshooters.html">http://www.virginiafruit.ento.vt.edu/PDsharpshooters.html</a> for updated information.			

## Effectiveness of Grape Pesticides

Effectiveness ratings of grape pesticides for disease, insect, mite, and weed control are based on research from Virginia and surrounding states. Although the ratings are compiled from the results of 5-10 years of research, they may not hold true for all vineyard conditions within Virginia. Results can vary from location to location depending on the weather conditions, how well the vines were sprayed the previous year, inoculum density, pest populations, canopy size, age of vines, formulation of a given pesticide, and how the pesticide was applied (low or high volume). Under certain environmental conditions and cultural practices, the effectiveness ratings could change from good to fair or vice versa. The ratings given are intended as general guides to assist the grower in pesticide selection for disease, insect, mite, and weed control.

**Table 3.2 - Relative Effectiveness of Selected Fungicides in Grapes**

(E=excellent; G=good; F=fair; P=poor; N=none; – =information lacking or not registered; Var=variable depending on presence of resistance)

Fungicides Trade Name	Fungicides Common Name	Resistance Risk	Mode of Action Group	Anthraco- nose	Black rot	Botrytis bunch rot	Downy Mildew	Phomopsis cane/leaf spot	Powdery Mildew
Abound <sup>1</sup>	azoxystrobin <sup>1</sup>	H	11	–	E	F	Var	F-G	Var
Adament	tebuconazole + trifloxystrobin	H	3+11	–	E	F	P-F	–	F-G <sup>10</sup>
Aliette	fosetyl-AI	L	33	–	–	–	E	–	–
Armcarb, Kaligreen, Agricure	potassium bicarbonate	L	M	–	–	–	–	–	F-G
Captan, Captec, etc	captan	L	M4	–	F	F	G-E	G-E	N
Coppers <sup>3</sup>	Bordeaux <sup>3</sup> , fixed coppers	L	M1	F-G	F	P-F	G-E	F	F-G
Elevate	fenhexamid	M	17	–	–	G-E	–	–	P-F
Elite, Orius	tebuconazole	M	3	–	E	–	–	–	G <sup>10</sup>
Endura	boscalid	M	7	–	–	G	–	–	G-E
Ferbam	ferbam	L	M3	–	G	N	F	F	N
Flint <sup>1</sup>	trifloxystrobin <sup>1</sup>	H	11	–	E	G	Var	F-G	Var
Gavel	zoxamide + mancozeb	M for zoxamide	22+M3	F	F	–	G	G	–
Manzate, various <sup>4</sup>	mancozeb <sup>4</sup>	L	M3	F-G	G	N	E	G-E	N
Nutrol	mono potassium phosphate	L	M	–	–	–	–	–	F
Oils: Sun Ultra-Fine Oil JMS Stylet-Oil, Pure Spray Green, Safe-T-Side, etc.		L	M	–	–	–	–	–	G
Oxidate	hydrogen peroxide	L	M	–	–	–	–	–	F
Presidio	fluopicolide	M	43	–	–	–	labeled	–	–
Pristine <sup>1</sup>	boscalid plus pyraclostrobin <sup>1</sup>	H+M	11+7	labeled	G-E	G-E	Var	labeled	E
Procure	triflumizole <sup>2</sup>	M	3	–	–	–	–	–	G <sup>10</sup>
ProPhyt, Phostrol, Agri-Fos, Fosphite, Fungi-Phite	phosphorous acid (phosphite)	L	33	–	–	–	G-E	–	–

**Table 3.2 - Relative Effectiveness of Selected Fungicides in Grapes (cont.)**

(E=excellent; G=good; F=fair; P=poor; N=none; – =information lacking or not registered; Var=variable depending on presence of resistance)

Fungicides Trade Name	Fungicides Common Name	Resistance Risk	Mode of Action Group	Anthraco-nose	Black rot	Botrytis bunch rot	Downy Mildew	Phomopsis cane/leaf spot	Powdery Mildew
Quintec	quinoxifen	M	13	–	P	–	–	–	G-E
Rally <sup>2</sup>	myclobutanil <sup>2</sup>	M	3	labeled	E	–	N	P	G <sup>10</sup>
Revus	mandipropamid	M	40	–	–	–	labeled	–	–
Ridomil Gold MZ <sup>6</sup>	mefenoxam + mancozeb <sup>6</sup>	H for mefenoxam	4+M3	F	F	–	E	F	–
Ridomil Gold/Copper <sup>6</sup>	mefenoxam + copper <sup>6</sup>	H for mefenoxam	4+M3	–	F	P	E	F	F
Rovral <sup>5</sup>	iprodione <sup>5</sup>	M	2	–	P	G-Var	–	N	N
Rubigan, Vintage <sup>2</sup>	fenarimol <sup>2</sup>	M	3	F	F	–	–	–	G-E <sup>10</sup>
Scala	pyrimethanil	M	9	–	–	G-E	–	–	P?
Sovran <sup>1</sup>	kresoxim methyl <sup>1</sup>	H	11	–	E	F-G	F-Var	F-G	Var
Sulfur, Various <sup>7</sup>	sulfur <sup>7</sup>	L	M2	–	N	N	N	–	G
Tanos	cymoxanil + famoxadone	M	11+27	–	–	–	Var	–	–
Topsin M	thiophanate methyl	H	1	F	F	P-G <sup>9</sup>	N	F	P-G <sup>9</sup>
Vangard	cyprodinil	M	9	–	–	G-E	–	–	–
Ziram Granuflo, Ziram 76	ziram	L	M3	G	G	–	F	G	–

<sup>1</sup> Do not use Abound (azoxystrobin), Sovran (kresoxim methyl), Flint (trifloxystrobin), or Pristine (pyraclostrobin plus boscalid) continuously. Rotate with other fungicide groups as per label. Powdery as well as downy mildew strains with resistance to these strobilurins have been found in **many** locations in Virginia, and can cause control failure! It is recommended that strobilurins be tank mixed with sulfur or another anti-powdery mildew material, and also with another anti-downy-mildew material. Pristine contains a strobilurin and also boscalid (group 7), which has separate activity against powdery mildew but **not** against downy mildew. Abound can cause serious injury to some **apple** cultivars. Avoid drift to apples and do not spray apples with equipment containing Abound residues. Pristine or Flint should **not** be used on **Concord grapes**. Sovran can injure some cherry cultivars.

<sup>2</sup> Bayleton (being discontinued), (Rally), and Elite can control black rot after infection has occurred. For effective control, infection periods must be monitored and fungicide applied within 3 days after the start of an infection period. Application of these materials and Rubigan and Procure to sporulating lesions of powdery mildew is best avoided to prevent selection of resistant strains of the pathogen. Continuous heavy use of this group of fungicides may entail the risk of selecting resistant strains of disease-causing fungi.

<sup>3</sup> Bordeaux mixture is a mixture of copper sulfate and hydrated lime; it may be purchased prepacked or mixed fresh by the grower. See also note<sup>8</sup> for fixed copper fungicides.

<sup>4</sup> Trade names for mancozeb include Manzate 200, Manzate 200 DF (DuPont), Dithane M45, Dithane F45, Dithane DF (Dow), and Penncozeb (United Phosphorus).

<sup>5</sup> Continuous use of iprodione entails the risk of selecting iprodione-resistant strains of Botrytis. Iprodione-resistant strains of Botrytis and powdery mildew have been found in some Virginia vineyards. Do not routinely apply more than two iprodione sprays per season.

<sup>6</sup> Ridomil Gold MZ contains 10% metalaxyl plus 48% mancozeb, Ridomil Gold/Copper contains 10% metalaxyl plus 60% copper hydroxide (see also note<sup>8</sup>).

<sup>7</sup> Sulfur is very phytotoxic on the foliage of Concord, red-fruited French-American hybrids and several other, mainly American (Labrusca-type), varieties. Even tolerant varieties may be injured when temperatures over 85° F occur during or immediately following an application.

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<sup>8</sup> Fixed copper compounds that are registered for use on grapes include Kocide 101, BCS-Copper Fungicide, Ten-Cop 5E, copper oxychloride sulfate (C-O-C-S), and many other compounds and formulations. The main drawback of copper fungicides is the potential for severe injury to grape foliage, depending on variety and weather conditions, and for reduced vine vigor and yields even in the absence of visible foliar injury. Cool wet weather generally makes copper toxicity worse. Phytotoxicity can be lessened by adding spray lime. One should be very careful mixing other pesticides with preparations containing lime: many of these combinations are incompatible. Excessive use of copper within 30 days of harvest may interfere with wine making. On the plus side, copper fungicides are usually cheap and may provide longer-lasting activity than others such as ferbam and captan. If growers wish to use copper materials, they should try them first on a limited acreage of each variety before treating the entire planting.

<sup>9</sup> Continuous use of Topsin M entails the risk of selecting Topsin M-resistant strains of disease-causing fungi. Topsin M-resistant Botrytis and powdery mildew have been found in many Virginia vineyards.

<sup>10</sup> In some areas of the eastern U.S., including Virginia, Rally (Nova), Orius, Adament, and Elite, and to a lesser extent Procure and Rubigan, have lost some of their efficacy against grape powdery mildew.

**Table 3.3 - Relative Effectiveness of Selected Insecticides/Acaricides in Grapes**

Insects and mites	Insecticides/Acaricides and Ratings																													
	Acramite	Agri-Mek	Altacor	Applaud	Assail	Avaunt	Baythroid	Bt	Brigade	Danitol	Delegate	Diazinon	Envidor	Imidan	Intrepid	Lannate	Lorsban	Malathion	Nexter	Onager	Provado	Sevin	Spinosad	Sytle Oil	Surround	Thionex	Vendex	Venom	Zeal	
Cutworms	-	-	-	-	-	-	G	G	G	G	G	-	-	-	G	-	-	-	-	-	-	G	G	-	-	-	-	-	-	
Drosophila flies	-	-	-	-	-	-	-	-	-	-	-	E	-	-	-	-	-	E	-	-	-	-	-	-	-	-	-	-	-	
Grape berry moth	-	-	E	-	-	G	E	F	E	E	G	G	-	G	E	G	-	-	-	-	-	G	G	-	-	-	-	-	-	
Grape cane girdler	-	-	-	-	-	-	E	-	-	E	-	-	-	G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Grape flea beetle	-	-	-	-	-	-	E	-	-	E	-	-	-	G	-	-	-	-	-	-	-	-	E	-	-	-	-	-	-	
Grape leafhopper	-	-	-	E	E	-	E	-	E	E	-	G	-	G	-	G	-	G	G	-	E	E	-	-	G	F	-	-	-	
Grape rootworm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-	
Grape root borer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-	-	-	-	-	-	
Japanese beetle	-	-	-	-	F	G	-	-	-	E	-	-	-	-	-	-	-	G	-	-	-	G	-	-	E	-	-	-	-	
June beetle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	G	-	-	-	-	-	-	-	
Mealybugs	-	-	-	E	G	-	G	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-	G	-
Phylloxera (Leaf form)	-	-	-	-	-	-	-	-	-	E	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E	-	-	-	
Redbanded leafroller	-	-	E	-	-	-	-	G	-	-	F	-	-	G	E	-	-	-	-	-	-	-	F	E	-	-	-	-	-	
Rose chafer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-	
Sharpshooter	-	-	-	-	G	-	-	-	G	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-	G	-
Spider mites	G	G	-	-	-	-	-	-	-	E	-	F	E	-	-	-	-	F	E	E	-	-	-	G	-	-	G	-	G	
Wasp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	-	-	-	-	-	-	

(E=excellent; G=good; F=fair; P=poor; N=none; - = information lacking or not registered)

**Table 3.4 - Chemical Names, Re-entry Times, and Days to Harvest<sup>1</sup>**

Chemical (Other name)	Manufacturers	Restricted Entry Interval	Days to Harvest
Abound (azoxystrobin)	Syngenta	4 hours	14
Acramite (bifenazate)	Uniroyal	5 days (cane turning, tying, girdling) 12 hours (other activities)	14
Adament (tebuconazole + trifloxytrobin)	Bayer CropScience	24 hours	14
Admire (imidacloprid)	Bayer CropScience	12 hours	30
Agri-Mek (abamectin)	Syngenta	12 hours	28
Aliette (fosetyl Al)	Bayer CropScience	12 hours	15
Applaud (buprofezin)	Nichino America	12 hours	30
Assail (acetamiprid)	United Phosphorus	12 hours	7
Avaunt (indoxacarb)	DuPont	12 hours	7
Baythroid (cyfluthrin)	Bayer CropScience	12 hours	3
Brigade (bifenthrin)	FMC	12 hours	30
Bordeaux mixture (copper sulfate & hydrated lime)	Chemical Formulators, etc		0
Captan (Captan, Captec)	Arysta, Drexel	2-4 days (see label)	0
copper, fixed	Various	24-48 hours	0
Danitol (fenpropathrin)	Valent	24 hours	21
Delegate (spinetoram)	Dow AgroSciences	4 hours	7
Diazinon	Makhteshim-Agan	24 hours	28
Dipel ( <i>B.t.</i> )	Abbott	4 hours	0
Elevate (fenhexamid)	Arysta	12 hours	0
Elite (tebuconazole)	Bayer CropScience	12 hours	14
Endura (boscalid)	BASF	12 hours	14
Entrust (spinosad)	Dow AgroSciences	4 hours	7
Envidor (spirodiclofen)	Bayer CropScience	12 hour (6 days for high contact activities in table grapes)	14
ferbam	Taminco	24 hours	7
Flint (trifloxystrobin)	Bayer CropScience	12 hours	14
Gavel (zoxamide + mancozeb)	Dow AgroSciences	48 hours	66
Imidan (phosmet)	Gowan	14 days	14
Intrepid (methoxyfenozide)	Dow AgroSciences	4 hours	30
Lorsban 4E (chlorpyrifos)	Dow AgroSciences	24 hours	35
malathion (Malathion)	Gowan	24 hours	3
mancozeb (Dithane M45, Manzate 200, Penncozeb)	Rohm & Haas, DuPont, United Phosphorus, etc.	24 hours	66
Nexter (pyridaben)	Gowan	12 hours	7
Onager (hexythiazox)	Gowan	12 hours	28
Orius (tebuconazole)	Makhteshim Agan	12 hours	14

<sup>1</sup>This information is given as a guideline only. Always read the label because there have been many changes in re-entry times and preharvest intervals in recent years, and more changes are expected in the future.

<sup>2</sup>See label cautions regarding potential effects on harvest parameters.

<sup>3</sup>See label.

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**Table 3.4 - Chemical Names, Re-entry Times, and Days to Harvest<sup>1</sup> (cont.)**

Chemical (Other name)	Manufacturers	Restricted Entry Interval	Days to Harvest
Presidio (fluopicolide)	Valent	12 hours	21
Pristine (boscalid+pyraclostrobin)	BASF	12 hours <sup>1</sup> (5 days for cane work)	14
Procure (triflumizole)	Chemtura	24 hours	7
ProPhyt (phosphorous acid)	Helena	4 hours	0
Provado (imidacloprid)	Bayer CropScience	12 hours	0
Purespray Green (oil)	Petro-Canada	4 hours	0
Quintec (quinoxifen)	Dow Agrosciences	12 hours	14
(Rally) (myclobutanil)	Dow AgroSciences	24 hours	14
Revus (mandipropamid)	Syngenta	12 hours	14
Ridomil Gold Copper (mefenoxam & copper)	Syngenta	48 hours	42
Ridomil Gold MZ (mefenoxam + mancozeb)	Syngenta	48 hours	66
Rovral (iprodione)	Bayer CropScience	48 hours	7
Rubigan E.C. (fenarimol)	Gowan	12 hours	21
Scala (pyrimethanil)	Bayer CropScience	24 hours	7
Sevin (carbaryl)	Aventis	12 hours	7
Sovran (kresoxim methyl)	BASF	12 hours	14
Spin Tor (spinosad)	Dow AgroSciences	4 hours	7
Stylet Oil	JMS Flower Farms	4 hours	0
Sulfur (Kumulus, sulfur, Microthiol, liquid sulfur, wettable sulfur, etc.)	various	24 hours	0
Surround (Kaolin)	BASF	4 hours	0 <sup>2</sup>
Tanos (cymoxanil + famoxadone)	DuPont	12 hours	30
Thionex (endosulfan)	Makhteshim-Agan	24 hours	7
Topsin M (thiophanate methyl)	United Phosphorus	7 days	14
Vangard (cyprodinil)	Syngenta	12 hours	7
Vendex (fenbutatin oxide)	DuPont	48 hours	28
Venom (dinotefuran)	Valent	12 hours	1
Vintage (fenarimol)	Gowan	12 hours	21
Zeal (etoxazole)	Valent	12 hours	14
Ziram	United Phosphorus, Taminco	48 hours	21

<sup>1</sup>This information is given as a guideline only. Always read the label because there have been many changes in re-entry times and preharvest intervals in recent years, and more changes are expected in the future.

<sup>2</sup>See label cautions regarding potential effects on harvest parameters.

<sup>3</sup>See label.