

# Grapes: Diseases and Insects in Vineyards

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Additional information on pest and beneficial species identification is available online at <http://www.virginiafruit.ento.vt.edu/>. Disease updates and management information is available at <http://ext.grapepathology.org>.

In January 2018, a new invasive insect was found in Virginia. Spotted lanternfly came to Virginia from southeastern Pennsylvania, and spread through the Shenandoah Valley and parts of the Piedmont. Isolated counties to the south are also infested. SLF feeds on more than 70 different hosts, and can cause significant injury on some. Some of our important fruit crops are on the host list: grape, caneberry, blueberry, stone and pome fruits, and hops; grape is the most vulnerable commercial crop. Populations can build to create a severe nuisance in residential areas as well. An eradication effort has been implemented in 2018, and a quarantine was established by VDACS in May 2019. More information on the **quarantine program** is posted ([https://www.pubs.ext.vt.edu/content/dam/pubs\\_ext\\_vt\\_edu/ENTO/ento-319/ENTO-319.pdf](https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/ENTO/ento-319/ENTO-319.pdf)). An online training is available too allow certification as part of the quarantine effort (<https://register.ext.vt.edu/search/>

[publicCourseSearchDetails.do?method=load&courseId=210837&selectedProgramAreaId=25577&selectedProgramStreamId=](https://www.pubs.ext.vt.edu/ENTO/ENTO-323/ENTO-323.html)). Fruit growers should be aware of the pest’s appearance, and how to handle finds you may make in your operations. For information on **SLF appearance and management in vineyards**, refer to our fact sheet (<https://www.pubs.ext.vt.edu/ENTO/ENTO-323/ENTO-323.html>). For updated information, visit the spotted lanternfly page in the Virginia Cooperative Extension web site (<https://ext.vt.edu>). For updated control information, visit the SLF page in Virginia Fruit (<https://www.virginiafruit.ento.vt.edu/SLF.html>). To report suspected discoveries, please contact your county Extension Agent (<https://ext.vt.edu/offices.html>).

**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. In training systems that don’t result in extensive canopies, use 100 gal/acre throughout the season.) is usually given on the label.

Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
<b>Dormant</b>			
Anthracnose (Bird’s eye rot) Powdery Mildew Phomopsis	lime sulfur solution Sulfurix	10.0 gal, or see label	Only necessary where anthracnose, Phomopsis, or powdery mildew have been a serious problem. Lime sulfur can reduce overwintering inoculum of these diseases.
Botryosphaeria canker, Eutypa dieback, ESC	Topsin-M	1 lb per 5 gal of water	Obtain either a section 24c label for VA or the newest (2020) label for paint application information.
	Rally 40WSP	5 oz	Obtain the newest label for paint application information.
	Mettle 125 ME	5 fl oz	Obtain the newest label for paint application information.
	B-lock	n/a	B-lock is a latex paint with boron for pruning wound protection, and shown to be effective against a number of trunk diseases.
Mealybugs	Applaud 70DF	24 oz	If a problem at harvest in the previous year. If a delayed dormant spray does not provide adequate control, a summer application may be made. Baythroid targets only crawlers, present in May. Mealybug materials may be applied in May, contact materials mainly effective at that time. Movento prebloom only in table grapes. The use of Baythroid should be delayed until fourth cover in blocks where Spotted-wing drosophila must be controlled, in order to observe maximum applications per season.
	Belay Insecticide	6.0 fl oz	
	Venom 70	1.0-3.0 oz (foliar) 5.0-6.0 oz (soil)	
	Scorpion 35SL	2.0-5.0 fl oz (foliar) 9.0-13.25 fl oz (soil)	
	Assail 30SG	2.5-5.3 oz	
	Admire Pro	1.0-1.4 fl oz (foliar) 7.0-14.0 fl oz (soil)	
	Movento 2SC	6.0-8.0 fl oz	
Actara 25WDG	1.5-3.5 oz		

Table 3.1 - Disease and Insect Control (continued)			
Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
Grape scale	Dormant oil	2% solution	Apply in high volume (dilute) application. Loose bark on vines makes coverage of scale difficult.
	Knack	16 fl oz	Since Knack is an Insect Growth Regular, evidence of activity may take longer than with a contact insecticide. In dormant application, combine with a spray oil. May also be applied in foliar spray when crawlers are active.
<b>Bud Swell</b>			
Grape flea beetle	Danitol 2.4EC	8.0 fl oz	If adult beetles are present in damaging numbers. See Table 3.4 for Restricted Entry Intervals. The REI for Imidan may render it impractical for most growers. The use of Baythroid, Mustang Maxx, and Tombstone should be delayed until fourth cover in blocks where Spotted-wing drosophila must be controlled, in order to observe maximum applications per season.
	Sevin XLR Plus	1.0-2.0 qt	
	Imidan 70WP	2.0 lb	
	Baythroid XL 1EC	2.4-3.2 fl oz	
	Mustang Maxx	4.0 fl oz	
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 (Bt)</i>	Rates vary	Spray in evening if possible. Various preparations of <i>Bt</i> available. Check label for rates. <b>See Table 3.4 for Restricted Entry Intervals.</b> The use of Delegate, Baythroid, Brigade and Sniper 2 should be delayed until fourth cover in blocks where Spotted-wing drosophila must be controlled, in order to observe maximum applications per season.  Seduce spinosad bait may be applied at a rate of 20-44 lb/A (0.5-1 lb/1000 sq ft, or a 6" circular band around the base of the trunk)
	Sevin XLR Plus	1.0-2.0 qt	
	Danitol 2.4EC	15.0 fl oz.	
	Intrepid 2F	12.0-16.0 fl oz	
	Entrust 2SC	4.0-8.0 fl oz	
	Seduce bait 25WG	See label and comments	
	Delegate	3.0-5.0 oz	
	Baythroid XL 1EC	2.4-3.2 fl oz	
	Brigade 10WSB	8.0-16.0 oz	
	Altacor 35WDG	3.0-4.5 oz	
Sniper 25EC	3.2-6.4 fl oz		
Spotted lanternfly (eggs)	Malathion 5EC	3 pt	Malathion has ovicidal activity if applied in the two weeks before hatch. Apply in volume sufficient to provide soaking of egg masses.
<b>New Shoots: at weekly intervals or according to label until pre-bloom</b>			
Black rot, Phomopsis cane and leaf spot, Downy mildew	captan 50WP or equivalent	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. Captan has only fair efficacy against black rot. At high disease pressure, it should be tank-mixed with a more efficacious material. Do not make captan applications within two weeks of an oil spray.
	mancozeb 75DF	2.0-4.0 lb	
	Ziram 76DF See Table 3.2	2.0-4.0 lb	
Powdery mildew	wettable sulfur (81.25% or 92%) See Table 3.2	2.0-5.0 lb (See label)	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 (with risk increasing near 90F and above), as sulfur injury can occur even on sulfur-tolerant varieties. Do not apply sulfur to Concord, red-fruited French-American hybrids, and other sulfur sensitive varieties. See prebloom powdery mildew options for such situations.
Anthracnose	captan 50WP or equivalent See Table 3.2	2.0-4.0 lb	Apply at 4- to 10-inch shoot length. Repeat at 10- to 14-day intervals. Only necessary where anthracnose has been a problem.
	copper fungicides with lime	see label	
	Aprovia	8.6-10.5 fl oz	
	Aprovia Top	8.5-13.3 fl oz	
	Inspire Super	16.0-20.0 fl oz	
	Kenja	20.0-22.0 fl oz	
	Mettle 125ME	3.0-5.0 fl oz	
	Miravis Prime	9.2-13.4 fl oz	
Pristine	8.0-12.5 oz		

<b>Table 3.1 - Disease and Insect Control (continued)</b>			
<b>Pest</b>	<b>Chemical and Formulation</b>	<b>Rate/Acre</b>	<b>Spray Timing and Remarks</b>
Grape cane girdler	Danitol 2.4EC	10.6 fl oz	When shoots are 4- to 6-inches long, where infesting more than 10% of shoots. Mainly a problem when training young vines. See Table 3.4 for Restricted Entry Intervals.
	Imidan 70WP	2.0 lb	
	Baythroid XL 1EC	2.4-3.2 fl oz	
Redbanded leafroller	Altacor 35WDG	3.0 oz	Where pest has been a problem in past. Various preparations of <i>Bt</i> available. Check rates. See Table 3.4 for Restricted Entry Intervals.
	Entrust 2SC	4.0-8.0 fl oz	
	Delegate 25WG	5.0 oz	
	Intrepid 2F	12.0-16.0 fl oz	
	Imidan 70WP	2.0 lb	
	Sevin XLR Plus	2.0 qt	
	<i>Bacillus thuringiensis (Bt)</i>	See label	
Climbing cutworms	<i>Bacillus thuringiensis (Bt)</i>	See label	Spray in evening if possible. Various preparations of <i>Bt</i> available. Check rates. See Table 3.4 for Restricted Entry Intervals.
	Sevin XLR Plus	1.0-2.0 qt	
	Danitol 2.4EC	15.0 fl oz	The use of Delegate, Baythroid, Brigade and Sniper 2 should be delayed until fourth cover in blocks where Spotted-wing drosophila must be controlled, in order to observe maximum applications per season.
	Intrepid 2F	12.0-16.0 fl oz	
	Entrust 2SC	4.0-8.0 fl oz	
	Seduce bait		Seduce spinosad bait may be applied at a rate of 20-44 lb/A (0.5-1 lb/1000 sq ft, or a 6" circular band around the base of the trunk)
	Delegate 25WG	5.0 oz	
	Baythroid XL 1EC	2.4-3.2 fl oz	
	Brigade 10WSB	3.2-6.4 oz	
	Altacor 35WDG	3.0 oz	
	Sniper 25EC	3.2-6.4 fl oz	
Spotted lanternfly	Sevin XLR Plus	1.0-2.0 qt	Assess SLF nymphs in the first two weeks of May. A provisional action threshold is 15-20 nymphs per vine. Watch for secondary pests (e.g. mealybug) infestations following pyrethroid applications. BoteGHA is organically approved, but limited efficacy.
	Malathion 5EC	3.0 pt	
	Avaunt 30DG	5.0-6.0 oz	
	Danitol 2.4EC	16-21 fl oz	
	BoteGHA ES	3 qt	
	Aza-Direct	1.0-3.5 pf	
<b>Pre-Bloom - Just before blossoms open, critical spray for black rot, powdery, and downy mildew</b>			
Black rot	mancozeb (various)	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, Rally, Elite, Orius, Procure, Inspire Super, Mettle, Revus Top, Topguard EQ) or strobilurins (group 11, Abound, Sovran, Flint, Topguard EQ, Rhyme, Quadris Top or Pristine) continuously; rotate with other groups of fungicides.
	Ziram 76DF	2.0-4.0 lb	
	Abound	10.0-15.5 fl oz	
	Aprovia	8.6-10.5 fl oz	
	Aprovia Top	8.5-13.3 fl oz	
	Cevya	4.0 fl oz	
	Flint Extra	3.5-3.8 fl oz	
	Inspire Super	16.0-20.0 fl oz	
	Luna Experience	8.0-8.6 fl oz	
	Luna Sensation	7.0 fl oz	
	Mettle 125ME	3.0-5.0 fl oz	
	Miravis Prime	9.2-13.4 fl oz	
	Pristine	8.0-12.5 oz	
	Quadris Top	12.0-14.0 fl oz	
	Rally 40WSP	3.0-5.0 oz	
	Revus Top	7.0 fl oz	
	Rhyme	4.0-5.0 fl oz	
	Sovran	3.2-4.8 oz	
	tebuconazole 45% (Orius 20AQ, formerly Elite, various fomulations available)	8.6 oz	
	Topguard EQ.	5.0-6.0 fl oz	
	Viathon	2.0-4.0 pt	

Table 3.1 - Disease and Insect Control (continued)			
Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
Downy mildew	captan (various)	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, Pristine, and other Group 11 fungicides are present in many Virginia locations. Rotating or tank mixing with a different anti-downy-mildew material is recommended. Downy mildew isolates that are resistant to group 40 (Revus, Revus Top, Forum, and a part of Zampro) were found in several vineyards in Virginia.
	copper (with lime or various formulations)	see label	
	mancozeb (various)	2.0-4.0 lb	
	Gavel 75DF	2.0-2.5 lb	
	Ziram 76DF	3.0-4.0 lb	
	Forum	6.0 fl oz	
	phosphorous acid (various)	See label	
	Ranman 400SC	2.1-2.75 fl oz	
	Revus	8.0 fl oz	
	Revus Top	7.0 fl oz	
	Ridomil Gold MZ	1.5-2.0 lb	
	Ridmil Gold Copper	2.0 lb	
	Viathon	2.0-4.0 pt	
Zampro	11.0-14.0 fl oz		
Powdery mildew	wettable sulfur (81.25% or 92%), or other sulfur products (e.g., Microthiol Disperr)	2.0-4.0 lb	Do not use sterol inhibitors (Group 3, 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) are very 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. Quintec resistance has been observed in Virginia, but appears as yet uncommon and its impact limited. 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. Be aware of label restrictions of Merivon (no mixing) that may make it impractical in many vineyards. There are many generic tebuconazole materials with various concentrations (e.g., Sonoma). Please refer to your label for specific application rate.
	Aprovia	10.5 fl oz	
	Aprovia Top	8.6-13.3 fl oz	
	Cevya	4.0 fl oz	
	Endura	4.5 oz	
	Gatten	6.4 fl oz	
	Inspire Super	16.0-20.0 fl oz	
	Kenja	20.0-22.0 fl oz	
	Luna Experience	6.0-8.6 fl oz	
	Luna Sensation	7.0 fl oz	
	Merivon	4.0-5.5 fl oz	
	Mettle 125ME	3.0-5.0 fl oz	
	Miravis Prime	9.2-13.4 fl oz	
	Pristine	8.0-12.5 oz	
	Procure 480SC	4.0-8.0 oz	
	Quadris Top	12.0-14.0 fl oz	
	Quintec	4.0-6.6 fl oz	
	Rally 40WSP	3.0-5.0 oz	
	Revus Top	7.0 fl oz	
	Rhyme	4.0-5.0 fl oz	
tebuconazole 45% (Orius 20AQ)	8.6 fl oz		
Topguard EQ	5.0-6.0 fl oz		
Trionic 4SC	4-8 fl oz		
Viathon	2.0-4.0 pt		
Vivando	10.3-15.4 fl oz		
Grape berry moth	Intrepid 2F	12.0-16.0 fl oz	Use higher rate of Entrust for more intensive infestations and larger larvae, where pest has been a problem in past. Mating disruption: SPLAT-GBM is registered for GBM. Spray edge rows with insecticides. For SPLAT-GBM mating disruption, apply when temperatures are between 60-80°F and no rain is expected within 1 to 2 hours. For high population densities, apply 1.0 kg/A as 1,000 point sources of 1.0 g (1/4 tsp.) throughout an acre. For low-moderate populations, apply 1.0 kg as 250 point sources of 2.5 g (1/2 tsp.). See application information on label. See Table 3.4 for Restricted Entry Intervals. The use of Delegate should be delayed until fourth cover in blocks where spotted-wing drosophila must be controlled, in order to observe maximum applications per season.
	Entrust 2SC	4.0-8.0 fl oz	
	Delegate 25WG	3.0-5.0 oz	
	Altacor 35WDG	2.0-4.5 oz	
	Imidan 70WP	2.0 lb	
	Belay 50WDG	6.0 fl oz	
	SPLAT-GBM	1.0 kg	
	Avaunt 30DG	5.0-6.0 oz	
	Sevin XLR	1.0-2.0 qt	
	<i>Bacillus thuringiensis</i> (BT)	Rates vary	

Table 3.1 - Disease and Insect Control (continued)			
Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
Grape leafhopper	Assail 30SG	2.5-5.3 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. See Table 3.4 for Restricted Entry Intervals. The use of malathion should be delayed until fourth cover in blocks where Spotted-wing drosophila must be controlled, in order to observe maximum applications per season. When available, flowable (F) formulations pose less risk of phytotoxicity than emulsifiable (EC; oil-based) formulations. Avoid using captan and oil-based pesticides within 14 days of each other.
	Actara 25WDG	1.5-3.5 oz	
	Admire Pro	1.0-1.4 fl oz	
	Imidan 70WP	2.0 lb	
	malathion 5EC	3.0 pt	
	Surround 95WP	12.5-50.0 lb	
	Sevin XLR Plus	1.0-2.0 qt	
	Nexter 75WP	4.4-10.67 oz	
	Applaud 70DG	9-12 oz	
Grape scale	Applaud 70DF	12.0 oz	Apply when crawlers are active, or at 493 and 990 degree-days above 50° F starting at April 1 (early and peak activity of first generation).
	Movento 2SC	6.0-8.0 fl oz	
	Admire Pro	1.0-1.4 fl oz	
	Assail 30SG	2.5-5.3 oz	
	Knack	16 fl oz	
Mealybugs	Applaud 70DF	24 oz	If a problem at harvest in the previous year. If a delayed dormant spray does not provide adequate control, a summer application may be made. Baythroid targets only crawlers. Movento prebloom only in table grapes. The use of Baythroid should be delayed until fourth cover in blocks where Spotted-wing drosophila must be controlled, in order to observe maximum applications per season.
	Belay Insecticide	6.0 fl oz	
	Venom 70	1.0-3.0 oz (foliar) 5.0-6.0 oz (soil)	
	Scorpion 35SL	2.0-5.0 fl oz (foliar) 9.0-13.25 fl oz (soil)	
	Assail 30SG	2.5-5.3 oz	
	Admire Pro	1.0-1.4 fl oz (foliar) 7.0-14.0 fl oz (soil)	
	Baythroid XL 1EC	2.4-3.2 fl oz	
	Movento 2SC	6.0-8.0 fl oz	
	Actara 25WDG	1.5-3.5 oz	
Grape tumid gallmaker	Movento 2SC	6.0-8.0 fl oz	Apply when galls first appear in blocks with a history of high populations of grape tumid gallmaker. Traminette and Niagara are notably sensitive to grape tumid gall.
Periodical cicada	Sevin XLR	1-2 qt	The next appearances of periodical cicada in Virginia will be 2024 (Brood XIX, a 13-year brood limited to Southside Virginia and south) and in 2025 (Brood XIV, a 17-year brood). Egg-laying results in injured shoots and trunks. Bird netting with a mesh no larger than 1 cm will provide effective control of injury. Pyrethroid sprays may induce outbreaks of mealybugs or mites.
	Danitol 2.4ECin	5.33-10.66 fl oz	
	Baythroid XL	1.6-3.2 fl oz	
	Surround WP	25-50 lb	

Table 3.1 - Disease and Insect Control (continued)			
Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
<b>Bloom</b>			
Botrytis	Elevate 50 WDG	1.0 lb	Materials may be applied at early mid-bloom and again before bunch closing, if needed. Botrytis strains with resistance to strobilurins, Endura, Pristine, and Topsin M, and with reduced sensitivity to Rovral/Meteor are widespread in Virginia. Isolates with reduced sensitivity to Vanguard and Scala as well as Elevate, Kenja, Luna, Miravis, and Merivon have also been observed in some locations. Use 10 oz/A of Vanguard or 18 fl oz/A of Scala when it is applied by itself. You can use lower rates when you tank-mix it with another Botrytis fungicide.
	Inspire Super	16-20 fl oz	
	Kenja	20-22 fl oz	
	Luna Experience	6.0-8.6 fl oz	
	Luna Sensation	5.0-7.6 fl oz	
	Miravis Prime	10.3-13.4 fl oz	
	Rovral 4F or Meteor	0.67-1.33 lb or 1.5-2.0 pt	
	Scala	9.0-18.0 fl oz	
	Switch	11.0-14.0 oz	
Vanguard	5.0-10.0 oz		
<b>Post-Bloom: Immediately after bloom</b>			
Black rot	Same fungicides and rates as pre-bloom spray		This is a very important spray. Do not delay more than 12-14 days after last pre-bloom spray. Note: Rally, Elite, Inspire Super, or Revus Top at the higher rates using 200 gal/A dilute sprays in combination with black rot predictor models provide excellent curative control. There are many generic tebuconazole materials with various concentrations. Please refer to your label for specific application rate.  Note 5-day REI for cane work for Luna Experience and Topguard EQ
Downy mildew	Same fungicides and rates as pre-bloom spray		Do not apply mancozeb or Gavel within 66 days of harvest. Copper fungicides may be mixed with hydrated lime to reduce risk of phytotoxicity, especially in cool, wet conditions, when copper fungicides may cause injury on certain varieties.
Powdery mildew	Same fungicides and rates as pre-bloom spray		Very important spray. Use at 12-14 day intervals as needed. Use higher rates and/or shorter intervals (see label) under severe disease pressure. See notes for prebloom.
Grape berry moth	Intrepid 2F	12.0-16.0 fl oz	See Table 3.4 for Restricted Entry Intervals. The REI for Imidan may render it impractical for most growers.
	Entrust 2SC	4.0-8.0 fl oz	
	Delegate 25WG	3.0-5.0 oz	
	Altacor 35WDG	2.0-4.5 oz	
	<i>Bacillus thuringiensis (Bt)</i>	Rates vary	
	Imidan 70WP	2.0 lb	
	Sevin XLR	1.0-2.0 qt	
	Avaunt 30DG	5.0-6.0 oz	
	Knack	16 fl oz	
Grape rootworm	Sevin XLR PLUS	1.0-2.0 qt	Apply when beetles appear, usually in mid June or early July. Second application may be necessary 10 days later. beetleGone is OMRI-approved.
	beetleGone	1-17.5 lb	
	<i>Heterorhabditis bacteriophora</i> , NemaSeek	See comments	<i>Heterorhabditis bacteriophora</i> is an entomopathogenic nematode. Recommended use rate ranges from 5 million for 1600 sq ft to 50 million per treated acre ( <a href="https://www.arbico-organics.com/category/beneficial-nematodes-faqs">https://www.arbico-organics.com/category/beneficial-nematodes-faqs</a> ).

<b>Table 3.1 - Disease and Insect Control (continued)</b>			
<b>Pest</b>	<b>Chemical and Formulation</b>	<b>Rate/Acre</b>	<b>Spray Timing and Remarks</b>
Grape leafhopper	Admire Pro	1.0-1.4 fl oz	Apply if more than 5 leafhopper nymphs/leaf before August 1, and 10/leaf thereafter. Portal on nonbearing vines only. See Table 3.4 for Restricted Entry Intervals. The use of malathion should be delayed until fourth cover in blocks where Spotted-wing drosophila must be controlled, in order to observe maximum applications per season. When available, flowable (F) formulations pose less risk of phytotoxicity than emulsifiable (EC; oil-based) formulations. Avoid using captan and oil-based pesticides within 14 days of each other.
	Nexter 75WP	4.4-5.2 oz	
	Assail 30SG	2.5-5.3 oz	
	Actara 25WDG	1.5-3.5 oz	
	Belay Insecticide	2.0-4.0 fl oz	
	Imidan 70WP	2.0 lb	
	Malathion 8F	1.88 pt	
	Malathion 5EC	3.0 pt	
	Sevin XLR PLUS	1.0-2.0 qt	
	Applaud 70DF	12.0 oz	
	Portal 5EC	1.0-2.0 pt	
Phylloxera	Assail 30SG	2.5-5.3 oz	Spray when yellow crawlers first detected with hand lens or when galls first appear. Repeat 10-12 days after first spray if foliar form was a problem the previous year. Movento for prebloom use only on table grapes. Movento provides control of root infestations.
	Movento 2SC	6.0-8.0 fl oz	
European red mite	Vendex 50WP	1.0-2.5 lb	Only if mites exceed 10/leaf (20/leaf on labrusca 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 8.0 oz of Agri-Mek for low populations, 16.0 oz for severe; Agri-Mek should include a non-ionic surfactant. Stylet Oil should be applied at 1.0-2.0 gal/A, every 10 to 14 days against mite eggs. Nealta should be applied at first sign of infestation; do not make more than one application of Nealta before using an acaricide of differing mode of action.
	Nexter 75WP	4.4-10.67 oz	
	Acramite 50WS	0.75-1.0 lb	
	Agri-Mek 0.15EC	8.0-16.0 fl oz	
	JMS Stylet Oil	1.0-2.0 gal	
	Envidor 2SC	16.0-34.0 fl oz	
	Zeal WP	2.0-3.0 oz	
	Onager 11.8EC	12.0-24.0 fl oz	
	Portal 5EC	2.0 pt	
	Tri-Tek	1.0-2.0% solution	
Nealta 1.67WSP	13.7 fl oz		
<b>First Cover: 7 to 10 days after post-bloom spray</b>			
Black rot, downy mildew, powdery mildew	Same fungicides and rates as pre-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 and pre-harvest intervals.
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.
<b>Second Cover: 7-10 days after first cover spray (when berries are about pea size, but before they touch in cluster)</b>			
Japanese beetle, June beetle, wasps	Sevin XLR PLUS	1.0-2.0 qt	Apply when beetles are common. Sevin may not be applied within 7 days of harvest. See Table 3.4 for Restricted Entry Intervals. beetleGone ( <i>Bacillus thuringiensis galleriae</i> ) is OMRI approved; it should be applied in up to 30 gallons of water per acre. Neemix and Trilogy are to be combined.
	Surround 95WP	12.5-50.0 lb	
	Imidan 70WP	2.0 lb	
	Belay Insecticide	2.0-4.0 fl oz	
	Actara 25WDG	1.5-3.5 oz	
	Assail 30SG	2.5-5.3 oz	
	Avaunt 30DG	3.5-6.0 oz	
	Neemix 4.5 + Trilogy	7.0-16.0 fl oz, 2% solution	
beetleGone	2.5-17.5 lb		
<b>Third Cover: before bunch closing</b>			
Botrytis	Same fungicides and rates as pre-bloom spray		Polyoxin D materials such as Ph-D and Oso (group 19) are also labeled for Botrytis management. It tends to be less effective than others, thus, it would be a nice tank-mix or alternation partner.
Downy mildew	Same pesticides and rates as pre-bloom spray		When night time temperature drops, dark, warm, and high relative humidity conditions promote downy mildew to produce spores.

Table 3.1 - Disease and Insect Control (continued)			
Pest	Chemical and Formulation	Rate/Acre	Spray Timing and Remarks
<b>Veraison: berry ripening, sugar building up</b>			
Botrytis	Same fungicides and rates as pre-bloom spray		Anti-Botrytis materials can be applied at beginning of ripening and again prior to harvest if needed. Fruit rot can be caused by a variety of organisms. Many anti-Botrytis fungicides have little effect on organisms other than Botrytis. Botrytis strains with resistance to strobilurins, Endura, Pristine, and Topsin M, and with reduced sensitivity to Rovral/ Meteor are widespread in Virginia. Isolates with reduced sensitivity to Vanguard and Scala, and to Elevate have also been observed in some locations. Rotating Vanguard or Scala (same group), Elevate, Rovral or Meteor, Switch, and/ or Luna Experience is recommended. Carefully observe per season limits on number of sprays.
Sour rot			To improve sour rot control, add a drosophila material plus Oxidate, 1:200-1:400, Use a combination of an insecticide to reduce SWD (see below) and Oxidate. Apply at ~15 Brix and one more time at 10-14 days after the first application. If possible, rotate modes of action of insecticide.
Spotted-wing drosophila	Entrust 2SC	4.0-8.0 fl oz	Spotted-wing drosophila is more important in some varieties than others; growers should incorporate block history. Berries become most vulnerable at about 15 degrees Brix. It is critical to rotate among differing modes of action in order to delay the development of resistance. PyGanic has a short residual life which limits its efficacy. Surround, Entrust and PyGanic are organic alternatives. Be watchful for flare-ups of secondary pests (mealybugs, spider mites) following application of pyrethroids. When available, flowable (F) formulations pose less risk of phytotoxicity than emulsifiable (EC; oil-based) formulations. Avoid using captan and oil-based pesticides within 14 days of each other. For more information on SWD, visit <a href="http://www.virginiafruit.ento.vt.edu/SWD.html">www.virginiafruit.ento.vt.edu/SWD.html</a> .
	Delegate 25WG	3.0-5.0 oz	
	Malathion 8F	1.88 pt	
	Malathion 5EC	3.0 pt	
	Mustang Maxx 0.8EC	4.0 fl oz	
	Tombstone 2EC	2.4-3.2 fl oz	
	PyGanic 1.4EC	64.0 fl oz	
	Surround WP	25.0-50.0 lb	
Sevin XLR Plus	1.0-2.0 qt		
Grape scale	Applaud 70DF	9.0-12.0 oz	Second generation crawlers can be targeted at first and peak activity (1100 and 2000 degree-days above 50°F after April 1) (mid-July and mid-August).
	Movento 2SC	6.0-8.0 fl oz	
	Admire Pro	1.0-1.4 fl oz	
	Assail 30SG	2.5-5.3 oz	
<b>Fourth Cover: mid-August or 10 days after third cover spray</b>			
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)	Malathion 8EC or 8F	1.88 pt	Apply if drosophila are abundant. See separate comments below on Spotted-wing drosophila
Brown marmorated stink bug	Scorpion 35SL	1.25-5.0 fl oz (foliar) 9.0-10.5 fl oz (soil)	When available, flowable (F) formulations pose less risk of phytotoxicity than emulsifiable (EC; oil-based) formulations. Avoid using captan and oil-based pesticides within 14 days of each other.
	Belay Insecticide	4.0-6.0 fl oz	
	Venom	3.0 oz	
	Malathion 5EC	3.0 pt	
	Actara 25WDG	1.5-3.5 oz	
	Azera	2.0-3.0 pt	
Spotted-wing Drosophila	Azera	1.0-2.0 p	Spotted-wing drosophila is more important in some varieties than others; growers should incorporate block history. Berries become most vulnerable at about 15 degrees Brix. It is critical to rotate among differing modes of action in order to delay the development of resistance. PyGanic has a short residual life which limits its efficacy. Surround, Entrust and PyGanic are organic alternatives. Be watchful for flare-ups of secondary pests (mealybugs, spider mites) following application of pyrethroids. When available, flowable (F) formulations pose less risk of phytotoxicity than emulsifiable (EC; oil-based) formulations. Avoid using captan and oil-based pesticides within 14 days of each other. For more information on SWD, visit <a href="http://www.virginiafruit.ento.vt.edu/SWD.html">www.virginiafruit.ento.vt.edu/SWD.html</a> .
	Entrust 2SC	4.0-8.0 fl oz	
	Baythroid XL 1EC	2.4-3.2 fl oz	
	Delegate 25WG	3.0-5.0 oz	
	Malathion 8F	1.88 pt	
	Malathion 5EC	3.0 pt	
	Mustang Maxx	4 fl oz	
	PyGanic 1.4EC	64.0 fl oz	
	Tombstone 25EC	2.4-3.2 fl oz	
	Surround WP	25.0-50.0 lb	
	Sevin XLR Plus	1.0-2.0 qt	
Yellow jackets	Sevin XLR Plus	1.0-2.0 qt	Chemical control is not very effective because short PHI materials provide limited control and only current workers are killed. Try to find the nest and spot treat, especially if located in vineyard. Yellow jacket traps placed early in spring to trap overwintered queens may be helpful.

<b>Table 3.1 - Disease and Insect Control (continued)</b>			
<b>Pest</b>	<b>Chemical and Formulation</b>	<b>Rate/Acre</b>	<b>Spray Timing and Remarks</b>
Spotted lanternfly	Brigade 10WSB	3.2-6.4 oz	Adults begin to appear in mid-July, and will be present through most of the fall. A provisional action threshold is 5-10 adults per vine. Assess frequently; continued re-immigration is a problem with SLF. Pay close to attention to PHI and season maximum applications or amount of material per season.
	Actara 25WDG	1.5-3.5 oz	
	Scorpion 35SL	1.25-5.0 fl oz	
	Admire Pro (G)	1.0-1.4 fl oz	
	Mustang Maxx (G)	4 fl oz	
	Sevin XLR Plus	1.0-2.0 qt	
	BoteGHA ES	3 qt	
	PFR-97 20WDG	1-2 lb	
<b>Harvest: Day before or day of harvest</b>			
Brown marmorated stink bug	Belay 50WDG	6.0 fl oz	This spray is timed to knock down of stink bugs in the clusters at harvest in case of high BMSB populations (>3/cluster). Not intended for residual control.
	PyGanic 1.4EC	64.0 fl oz	
<b>Postharvest: vines only</b>			
Mealybugs	Applaud 70DF	24.0 oz	Apply if control is not achieved by delayed dormant spray. Rotate modes of action is multiple applications are made.
	Venom 70	1.0-3.0 oz	
	Assail 30SG	2.5-5.3 oz	
	Actara 25WDG	1.5-3.5 oz	
	Admire Pro	1.0-1.4 fl oz	
	Belay Insecticide	6.0 fl oz	
	Movento 2SC	6.0-8.0 fl oz	
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.			
<b>Special Borer Treatment</b>			
Grape root borer	Isomate GRB	100 dispensers	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. Apply pheromone dispenser at 100/A, at the beginning of flight, around the first of July
<b>Special Sharpshooter Sprays</b>			
<p>In some vineyards in the eastern part of the state, sharpshooter leafhoppers, the vectors of Pierce's disease are of concern. The risk of Pierce's disease is greatest when there are fewer than 3 winter nights below 15 degrees F (9.4 degrees C). While research is needed on the vector relationships and timing in Virginia, the neonicotinoids Admire Pro (1.0 fl oz), Assail 70WSP (1.1-2.3 oz/A), Assail 30SG (2.5-5.3 oz/A), Belay Insecticide (4.0-6.0 fl oz), Scorpion 35SL (2.0-5.0 fl oz), 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, Scorpion and Venom are registered for soil application (9.0-10.5 fl oz; 5.0-6.0 oz/A respectively), as is 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.</p> <p>Besides neonicotinoids, the following pyrethroids are registered for sharpshooter control: Esteem (5 oz/A), 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.</p> <p>In blocks where Spotted-wing drosophila will need to be controlled, early use of pyrethroids will decrease the number of applications available in late season.</p> <p>Consult <a href="http://www.virginiafruit.ento.vt.edu/PDsharpshooters.html">http://www.virginiafruit.ento.vt.edu/PDsharpshooters.html</a> for updated information.</p>			

## ■ 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.

**Fungicide resistance** is a pressing issue. Prolonged use of a particular at-risk mode of action can lead to the selection of resistant fungal populations. While some resistant populations may not survive for long due to associated fitness costs, many persist. Once resistance is found in a vineyard, it tends to persist for an extended period.

The mode of action is conveniently summarized by FRAC group codes (Fungicide Resistance Action Committee, "<https://www.frac.info/>" [FRAC | Home](https://www.frac.info/)), which you can find on the fungicide label and in this guide. Codes that start with "M" indicate multi-site compounds with a low risk of resistance development. If the FRAC code lacks the "M," it likely represents a single-site mode of action and the FRAC group code will just be a number or start with the letter "U" (mode of action unknown). It's important to note that some fungicide products combine two different modes of action (two FRAC codes) and that several different chemicals may share the same mode of action and thus have the same FRAC code. Therefore, rotating the mode of action (FRAC group), rather than just the chemical, is crucial. For example, rotating Rally (myclobutanil) with Orius (tebuconazole) isn't a rotation as both belong to FRAC group 3. The same applies to rotating Flint and Pristine, both containing FRAC group 11. When using materials with single-site mode of action, it is essential to **rotate** them, **limit their use** (ideally, no more than twice per year), and also **tank-mix** them with materials with FRAC code starting with "M", such as sulfur, copper, mancozeb, ziram, captan, etc. to minimize the risk of fungicide resistance.

Instances of resistance against certain mode of action groups have been found in Virginia:

### Powdery mildew

benzimidazoles (FRAC = 1) and QoIs (FRAC = 11) are usually no longer effective.

DMIs (FRAC = 3) are still effective, but you may see a decline in its efficacy, which may depend on the product and spray history.

Quintec (FRAC = 13): resistant strains of powdery mildew have been reported in VA, but only one case so far, not known to be widespread as of 2023.

### Downy mildew

QoIs (FRAC = 11) are usually no longer effective.

Revus (FRAC = 40) resistance to downy mildew has been reported in several VA vineyards across the state.

### Botrytis gray mold

benzimidazoles (FRAC = 1) and QoIs (FRAC = 11) are usually no longer effective.

Reduced sensitivity to iprodione (FRAC = 2), Vangard (FRAC = 17), and SDHI (FRAC = 7, e.g., Endura, Luna, Kenja, Merivon, etc.) have been reported. FRAC group 7 is complicated because some common mutations cause resistance to some members of the group (e.g., boscalid=Endura), but not others.

### Ripe rot

Several QoI (FRAC = 11) resistant isolates have been reported in VA

In general, SDHI (FRAC = 7) fungicides are not effective, except Aprovia

In some cases, efficacy is product-dependent (i.e., you may see big differences in efficacy among products); however, if they belong to the same FRAC group, the risk of fungicide resistance development is often similar. Thus, please rotate and mix when it comes to fungal disease management.

**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	Black rot	Botrytis bunch rot	Downy Mildew	Phomopsis cane/leaf spot	Powdery Mildew
Abound <sup>1</sup>	azoxystrobin <sup>1</sup>	H	11	G	E	Var	Var	F-G	Var
Aprovia	benzovindiflupyr	M	7	G	G	–	–	–	G-E
Aprovia Top	benzovindiflupyr plus difenoconazole	M	3 + 7	labeled	G	–	–	labeled	G-E
Aliette	fosetyl-AI	L	P07	–	–	–	E	–	–
Armicarb, Kaligreen, Agricure	potassium bicarbonate	L	M	–	–	–	–	–	F-G
Captan, Captec, etc	captan	L	M4	G	F	F	G-E	G-E	N
Cevya	mefentrifluconazole	M	3	–	E	–	–	labeled	G-E
Coppers <sup>3</sup>	Bordeaux <sup>3</sup> , fixed coppers <sup>8</sup>	L	M1	F-G	F	P-F	G-E	F	F-G
Elevate <sup>5</sup>	fenhexamid	M	17	–	–	G-E	–	–	P-F
Endura	boscalid	M	7	G	–	Var	–	–	G-E
Ferbam	ferbam	L	M3	–	G	N	F	F	N
Flint <sup>1</sup>	trifloxystrobin <sup>1</sup>	H	11	–	E	Var	Var	F-G	Var
Fracture, ProBlad Verde	BLAD	Unknown	NC	–	–	labeled	–	–	labeled
Forum	dimethomorph	M	40	–	–	–	G-E <sup>11</sup>	–	–
Gatten	flutianil	Unknown	U13	–	–	–	–	–	labeled
Gavel	zoxamide + mancozeb	M for zoxamide	22+M3	F	F	–	G	G	–
Inspire Super	difenoconazole + cyprodinil	M	3+9	–	E	G-E	–	–	E
Intuity	mandestrobin	H	11	–	–	Var	–	–	P
Kenja	isofetamid	M	7	G	–	G-E	–	–	G-E
LifeGard	Bacillus mycooides	Unknown		–	–	–	labeled	–	
Luna Experience	fluopyram + tebuconazole	M	7+3	–	E	E	–	–	E
Luna Sensation	fluopyram + trifloxystrobin	M for flu H for tri	7+11	–	E	G	–	G	G
Manzate, various <sup>4</sup>	mancozeb <sup>4</sup>	L	M3	G	G	N	E	G-E	N
Miravis Prime	pydiflumetofen + fludioxonil	M for pyd M for flu	7+12	–	E	E	–	labeled	E
Merivon	fluxapyroxad + pyraclostrobin	M for flu H for pyr	7+11	–	–	–	–	–	labeled
Mettle	tetraconazole	M	3	–	E	–	–	–	G-E
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
Ph-D, OSO	polyoxin D	M	19	–	–	labeled	–	–	labeled
Pristine <sup>1</sup>	boscalid plus pyraclostrobin <sup>1</sup>	H+H	11+7	G	G-E	Var	Var	labeled	E
Procure, Viticure	triflumizole	M	3	–	–	–	–	–	G
Prolivo	pyriofenone	M	50	–	–	–	–	–	labeled
ProPhyt, Phostrol, Agri-Fos, Fosphite, Fungi-Phite	phosphorous acid (phosphite)	L	P07	–	–	–	G	F	–
Quadris Top	azoxystrobin + difenoconazole	M-H	3+11	G	E	Var	Var	F-G	G-E
Quintec	quinoxyfen	M	13	–	P	–	–	–	G-E (var)
Rally <sup>2</sup>	myclobutanil <sup>2</sup>	M	3	G	E	–	N	P	G <sup>10</sup>
Ranman 400SC	cyazofamid	M-H	21	–	–	–	G-E	–	–
Reason <sup>1</sup>	fenamidone	H	11	–	–	–	P-E (var)	–	–

Table 3.2 - Relative Effectiveness of Selected Fungicides in Grapes (continued)									
(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	Black rot	Botrytis bunch rot	Downy Mildew	Phomopsis cane/leaf spot	Powdery Mildew
Revus <sup>11</sup>	mandipropamid	M	40	–	–	–	G-E <sup>11</sup>	–	–
Revus Top <sup>11</sup>	difenoconazole + mandipropamid	M	3+40	–	E	–	G-E <sup>11</sup>	–	E
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+M1	–	F	P	E	F	F
Rovral <sup>5</sup> , Meteor <sup>5</sup>	iprodione <sup>5</sup>	M	2	–	P	G-Var	–	N	N
Rhyme	flutriafol	M	3	–	E	–	–	–	G <sup>10</sup>
Scala	pyrimethanil	M	9	–	–	G-E	–	–	P?
Sovran <sup>1</sup>	kresoxim methyl <sup>1</sup>	H	11	G	E	Var	F-Var	F-G	Var
Sulfur, Various <sup>7</sup>	sulfur <sup>7</sup>	L	M2	–	N	N	N	–	G
Switch	cyprodinil + fludioxonil	M	9+12	–	–	E	–	–	–
Tanos	cymoxanil + famoxadone	M	11+27	–	–	–	Var	–	–
tebuconazole (Orius, Tebuzol, etc.)	tebuconazole	M	3	–	E	–	–	–	G <sup>10</sup>
TopGuard EQ	flutriafol + azoxystrobin	M for flu H for azo	3+11	–	G	E	Var	Var	F-G
Topsin M	thiophanate methyl	H	1	F-G	F	P-G <sup>9</sup>	N	F	P-G <sup>9</sup>
Torino	cyflufenamid	M	U6	–	–	–	–	–	E
Trionic 4SC	triflumizole	M	3	–	–	–	–	–	G-E
Vanguard	cyprodinil	M	9	–	–	G-E	–	–	–
Viathon	potassium phosphite plus tebuconazole	3 plus P07	–	E	–	G	P	G	–
Vivando	metrafenone	M	50	–	–	–	–	–	E
Ziram 76DF, XCEL	ziram	L	M3	G	G	–	F	G	–
Zampro	ametoctradin + dimethomorph	M	45+40	–	–	–	E <sup>11</sup>	–	–

<sup>1</sup> Do not use Abound (azoxystrobin), Sovran (kresoxim methyl), Flint (trifloxystrobin), Reason (fenamidone) or Pristine (pyraclostrobin plus boscalid) continuously. Rotate with other fungicide groups as per label. Powdery and downy mildew as well as Botrytis 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. Botrytis strains with resistance to both ingredients in Pristine are common in Virginia. 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> Rally, tebuconazole and other Group-3 materials 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 Mettle, Inspire Super, Revus Top, 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 note8 for fixed copper fungicides.

<sup>4</sup> Trade names for mancozeb include Manzate 200, Manzate 200 DF, Dithane M45, Dithane F45, Dithane DF, and Penncozeb. Gavel is mancozeb + zoxamide.

<sup>5</sup> Continuous use of Rovral or Meteor, Elevate, and Vanguard or Scala entails the risk of selecting strains of Botrytis with resistance to these fungicides. Strains of Botrytis with reduced sensitivity to all these products have been found in some Virginia vineyards. Do not routinely apply more than two sprays of either of these groups 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 note8).

<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.

<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, Orius, Mettle, and tebuconazole, and to a lesser extent Procure, have lost some of their efficacy against grape powdery mildew.

<sup>11</sup> Downy mildew with resistance to mandipropamid (Revus and Revus Top) and dimethomorph (Forum) has been identified in several areas in Virginia.



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
Actara (thiamethoxam)	Syngenta	12 hours	5
Admire Pro (imidacloprid)	Bayer CropScience	12 hours	30 (soil), 0 (foliar)
Agri-Mek (abamectin)	Syngenta	12 hours 4 days (grape girdling, cane turning and tying)	28
Aliette WDG (fosetyl AI)	Bayer CropScience	24 hours	15
Altacor (chlorantraniliprole)	DuPont	4 hours	14
Applaud (buprofezin)	Nichino America	12 hours	7 (12 oz), 30 (24 oz)
Aprovia (benzovindiflupyr)	Syngenta	12 hours	21
Aprovia Top (benzovindiflupyr plus difenoconazole)	Syngenta	12 hours	21
Assail (acetamiprid)	United Phosphorus	12 hours	7
Avaunt (indoxacarb)	DuPont	12 hours	7
Aza-Direct (azadirachtin)	Gowan	4 hours	0
Azera (azadirachtin, pyrethrins)	MGK	12 hours	0
Baythroid (cyfluthrin)	Bayer CropScience	12 hours	3
beetleGone ( <i>B.t. galleriae</i> )	Phyllom Bioproducts	4 hours	0
Belay (clothianidin)	Valent	12 hours	0
BLAD (Fracture, ProBlad Verde, etc.)	FMC, SymAgro	4 hours	1
BoteGHA ES ( <i>Beauveria bassiana</i> )	LAM Intermat	4 hours	0
Brigade (bifenthrin)	FMC	12 hours	30
Bordeaux mixture (copper sulfate + hydrated lime)	Instructions for making Bordeaux mix available at <a href="http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7481.html">www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7481.html</a>		0
Captan (Captan, Captec)	various	2-4 days (see label)	0
Cevya	BSAF	12 hours	14
copper, fixed	various	4-28 hours	0
Danitol (fenpropathrin)	Valent	24 hours	21
Delegate (spinetoram)	Corteva Agriscience	4 hours	7
Dipel ( <i>B.t. kurstaki</i> )	Abbott	4 hours	0
Elevate (fenhexamid)	UPL	12 hours	0
Elite (tebuconazole)	Bayer CropScience	12 hours	14
Endura (boscalid)	BASF	12 hours	14
Entrust (spinosad)	Corteva Agriscience	4 hours	7
Envidor (spirodiclofen)	Bayer CropScience	12 hours	14
Flint Extra (trifloxystrobin)	Bayer CropScience	12 hours	14
Forum (dimethomorph)	BASF	12 hours	14
Gatten (flutainil)	Nichino-America	12 hours	14
Gavel (zoxamide + mancozeb)	Gowan	48 hours	66
Imidan (phosmet)	Gowan	14 days	14
Inspire Super (difenoconazole +cyprodinil)	Syngenta	12 hours	14
Intrepid (methoxyfenozide)	Corteva Agriscience	4 hours	30
Intuity (mandestrobin)	Valent	12 hours	10
JMS Stylet-Oil	JMS Flower Farms	4 hours	0
Kenja (isofetamid)	Summit Agro	12 hours	14

LifeGard (Bacillus mycoides)	Certis	4 hours	0
<b>Table 3.4 - Chemical Names, Re-entry Times, and Days to Harvest<sup>1</sup> (continued)</b>			
Chemical (Other name)	Manufacturers	Restricted Entry Interval	Days to Harvest
Knack (pyriproxyfen)	Valent	12 hours	21
Leverage 360 (imidacloprid + beta-cyflutrin)	Bayer	12 hours	1
Luna Experience (fluopyram + tetraconazole)	Bayer	12 hours (5 days for cane work)	14
Luna Sensation (fluopyram + trifloxystrobin)	Bayer	12 hours	14
malathion (Malathion, Rainshield)	Gowan	24 hours (72 h for girdling and tying)	3
mancozeb (Dithane M45, Dithane DF, Rainshield, Manzate 200, Manzate Prostick, Penncozeb)	various	24 hours	66
Merivon (fluxapyroxad+pyraclostrobin)	BASF	12 hours (5 days for cane tying and leaf pulling in grapes)	14
Meteor (iprodione)	UPL	48 hours	7
Mettle (tetraconazole)	Gowan	12 hours	14
Miravis Prime (pydiflumetofen + fludioxonil)	Syngenta	12 hours	14
Movento (spirotetramat)	Bayer CropScience	24 hours	7
Mustang Max (zeta-cypermethrin)	FMC	12 hours	1
Nealta (cyflumetofen)	BASF	12 hours	14
Neemix (azadirachtin)	Certis	12 hours	0
Nexter (pyridaben)	Gowan	12 hours	7
Onager (hexythiazox)	Gowan	12 hours	7
Orius 20AQ (tebuconazole)	ADAMA	12 hours	14
Oxidate (hydrogen peroxide)	BioSafe Systems	1 hour	0
PFR-97 (Isaria fumosorosea Apopka 97)	Certis	4 hours	0
Phosphorous acid or phosphite (Fosphite, K-phite, Phostrol, Prophyt, Rampart, etc.)	Nufarm, Loveland Products, JH Biotech, Helena and others	4 hours	0
Polyoxin D (Ph-D, Oso)	UPL, Certis	4 hours	0
Portal (fenproximate)	Nichino America	12 hours	14
Potassium bicarbonate (Armcarb, Kaligreen, Milstop, etc.)	various	4 hours	0-1 (see label)
Pristine (boscalid + pyraclostrobin)	BASF	12 hours (5 days for cane work)	14
Procure, Viticure (triflumizole)	UPL	12 hours (24 h for girdling)	7
Prolivo (pyriofenone)	Summit-Agro USA	4 hours	0
Purespray Green (oil)	Petro-Canada	4 hours	0
PyGanic (pyrethrins)	MGK	12 hours	0
Quadris Top (azoxystrobin + difenoconazole)	Syngenta	12 hours	14
Quintec (quinoxifen)	Gowan	12 hours	21
Rally (myclobutanil)	Corteva Agriscience	24 hours	14
Ranman 400SC (cyazofamid)	SummitAgro USA	12 hours	30
Reason (fenamidone)	Bayer CropScience	12 hours	30
Rendition (peroxyacetic acid)	Certis	when dry	0
Revus (mandipropamid)	Syngenta	4 hours	14
Revus Top (difenoconazole + mandipropamid)	Syngenta	12 hours	14
Ridomil Gold Copper (mefenoxam & copper)	Syngenta	48 hours	42
Ridomil Gold MZ (mefenoxam + mancozeb)	Syngenta	48 hours	66

Table 3.4 - Chemical Names, Re-entry Times, and Days to Harvest <sup>1</sup> (continued)			
Chemical (Other name)	Manufacturers	Restricted Entry Interval	Days to Harvest
Rhyme (flutriafol)	FMC	12 hours (5 days for cane work)	14
Rovral (iprodione)	FMC	48 hours	7
Scala (pyrimethanil)	Bayer CropScience	12 hours	7
Scorpion (dinotefuran)	Gowan	12 hours	1 (foliar) 28 (soil)
Seduce (spinosad bait)	Certis	4 hours	7
Sevin (carbaryl)	Aventis	12 hours	7
Sniper (bifenthrin)	Loveland Products	12 hours	30
Sovran (kresoxim methyl)	BASF	12 hours	14
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	02
Switch (cyprodinil + fludioxonil)	Syngenta	12 hours	7
Tanos (cymoxanil + famoxadone)	Corteva	12 hours	30
tebuconazole (various)	various	12 hours	14 (see label)
Tombstone (cyfluthrin)	Loveland	12 hours	3
TopGuard EQ (flutriafol+azoxystrobin)	FMC	12 hours (5 days for girdling or tying)	14
Topsin M (thiophanate methyl)	UPL	2-7 days (see label)	7-14 (see label)
Torino (cyflufenamid)	Gowan	4 hours	3
Trilogy (clarified hydrophobic extract of neem oil)	Certis	4 hours	0
Trionic 4SC (triflumizole)	UPL	12 hours (24h for girdling)	7
Tri-Tek	Brandt	4 hours	0
Vanguard (cyprodinil)	Syngenta	12 hours	7
Vendex (fenbutatin oxide)	DuPont	48 hours	28
Venom (dinotefuran)	Valent	12 hours	1 (foliar) 28 (soil)
Viathon (potassium phosphite + tebuconazole)	Helena Chemicals	12 hours	14
Vivando (metrafenone)	BASF	12 hours	14
Zapro (ametoctradin + dimethomorph)	BASF	12 hours	14
Zeal (etoxazole)	Valent	12 hours	14
Ziram 76DF	UPL	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 recent years, and more changes are expected in the future.

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

# Grapes: Weed Control in Vineyards

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<b>Table 3.5 - Herbicides Labeled for Use in Grapes</b>		
For preemergence herbicides, use lower rates on sandy soils and higher rates on clay soils. Do not disturb soil after a preemergence herbicide application. Tank mixes of certain preemergence and postemergence herbicides can be made to control existing vegetation and control weeds germinating from seed. Check compatibility of tank mixes prior to application.		
<b>Pest</b>	<b>Chemical and Formulation Rate per Acre</b>	<b>Timing and Remarks</b>
<b>Preemergence directed under vines</b>		
Many annual weeds	indaziflam 0.045-0.065 lb (Alion 3.5-5.0 fl oz)	Vines must be established at least 3 years. Do not use in soils high in sand or gravel. Do not apply within 14 days of harvest.
Most annuals, fescue, quackgrass, dandelions, dock, and other herbaceous perennials	dichlobenil 4.0-6.0 lb (Casoron 4G 100.0-150.0 lb or 2.3-3.4 lb/1000 sq ft)	Apply dry granules in late winter or early spring. Shallow incorporation may improve weed control. Do not apply within 4 weeks after transplanting. Short residual activity, regrowth usually occurs in late summer. Do not graze livestock in treated areas. Do not make an application within 1 month of harvest.
Most annuals and some perennials	diuron 1.6-2.4 lb (Karmex 80DF 2.0-3.0 lb)	Apply a single application/year in early spring to a weed free surface or include an appropriate postemergence herbicide. Use in vineyards established at least 3 years. Do not replant to any crop within 2 years after application.
Annual grasses and broadleaf weeds	flumioxazin 0.19-0.375 lb (Chateau EZ 6.0-12.0 fl oz)	Preemergence and early postemergence action. Apply as a directed spray to dormant vines or use shields if applications are made after flowering to prevent spray contact with grape foliage or fruit. Do not apply to vines established less than 2 years unless protected from spray contact using nonporous wraps, grow tubes, or waxed containers. Apply prior to weed germination or to small emerged weed seedlings. Combine with a labeled postemergence herbicide such as glufosinate for control of larger annual weeds or perennials.
Annual broadleaf weeds	isoxaben 0.5-1.0 lb (Trellis SC 16-31 fl oz)	Do not apply within 60 days of harvest. Apply after soil has settled following transplanting. Combine with a preemergence herbicide for annual grass control, such as oryzalin. Add a postemergence herbicide to control emerged weeds.
Many annual weeds	simazine 2.0-4.0 lb (Princep Caliber 90 2.2-4.4 lb or 4L 2.0-4.0 qt)	Apply a single application per year in the fall or spring to a weed free surface or include an appropriate postemergence herbicide. Vineyards must be established at least 3 years.
Annual grasses and certain annual broadleaf weeds	oryzalin 2.0-6.0 lb (Orzalin 4AS, Surfian 4AS 2.0-6.0 qt)	May be used in non-bearing and bearing vineyards. Areas to be treated should be free of weeds or include an appropriate postemergence herbicide. Remove or thoroughly mix trash into the soil before application. Use lower rate for short-term control (4 months) and higher rate for long-term control (6-8 months). Apply as a directed spray and avoid contact with leaves, branches, or trunks of vines. Do not apply to newly transplanted vineyards until soil has settled and there are no cracks present. Make only one application/growing season. May be tank-mixed with diuron or simazine to control many broadleaf weeds. Observe precautions and time limitations for diuron or simazine. Oryzalin is currently unavailable so consider other options.
Annual broadleaf weeds and certain annual grasses	oxyfluorfen 0.5-2.0 lb (Goal 2XL 2.0-8.0 pt, GoalTender 1.0-4.0 pt)	Dormant application only. Will control certain small seedling weeds plus provide soil residual control of annual broadleaf weeds and certain annual grasses. Combine with an annual grass herbicide for broader-spectrum control.
Annual broadleaf weeds and certain annual grasses	rimsulfuron 0.063 lb (Matrix FNV 4 oz/A)	Preemergence and postemergence control of certain annual weeds. Combine with other preemergence herbicides such as oryzalin or pendimethalin and with other postemergence herbicides (including glyphosate and glufosinate) for broader spectrum control. Grapevines need to be in the ground at least one year.
Annual and perennial grasses and certain broadleaf weeds	pronamide 1.0-4.0 lb (Kerb 50W 2.0-8.0 lb, Kerb SC 2.5-9.5 pt)	Apply in the fall after fruit harvest but prior to leaf drop and soil freeze-up. Do not apply to vines less than one year old. <b>RESTRICTED USE PESTICIDE.</b>

<b>Table 3.5 - Herbicides Labeled for Use in Grapes (continued)</b>		
For preemergence herbicides, use lower rates on sandy soils and higher rates on clay soils. Do not disturb soil after a preemergence herbicide application. Tank mixes of certain preemergence and postemergence herbicides can be made to control existing vegetation and control weeds germinating from seed. Check compatibility of tank mixes prior to application.		
<b>Pest</b>	<b>Chemical and Formulation Rate per Acre</b>	<b>Timing and Remarks</b>
<b>Preemergence directed under vines</b>		
Annual grasses and certain annual broadleaf weeds	pendimethalin 2.0-4.0 lb (Prowl 3.3EC 2.4-4.8 qt, Prowl H2O 3.2-6.3 qt)	Prowl EC - use on nonbearing plantings only. Prowl H2O - do not apply within 21 days of harvest. Allow soil to settle around vines before application. Apply only to dormant plants. Do not apply after buds have started to swell. Do not apply overtop vines.
Annual grasses, certain annual broadleaf weeds and suppression of yellow nutsedge	norflurazon 1.0-4.0 lb (Solicam 1.25-5.0 lb)	Apply prior to budbreak. Vines must be established at least 2 years. Combine with simazine or diuron for improved broadleaf weed control in vineyards over 3 years old. Apply to weed-free areas or combine with an appropriate postemergence herbicide.
Annual grasses and certain annual broadleaf weeds	napropamide 4.0 lb (Devrinol 50DF 8.0 lb)	Apply to the soil surface in the fall through early spring prior to weed emergence. Do not apply to frozen ground. Does not control existing weeds, but may be used with an appropriate postemergence herbicide to kill existing vegetation or with simazine to broaden the spectrum of weeds controlled. Use as a directed spray and avoid contact with fruit or foliage. Do not apply when fruit is on the ground during the harvest period. Do not graze areas. Make only one application/season. Must be incorporated within 24 hours by rainfall, irrigation, or mechanical means for optimum results.
Certain annual broadleaf and grass weeds and yellow nutsedge	sulfentrazone 0.25-0.375 lb (Zeus XC 8-12 fl oz)	Vines must be established at least 3 years. Do not apply more than 12 fl oz Zeus XC per acre per year. Do not allow spray to contact grape vines. Use a shielded spray if applying after budbreak. Add a herbicide such as oryzalin for improved annual grass control and add a postemergence herbicide if weeds are present. Provides postemergence control of yellow nutsedge. Preharvest interval PHI is 3 days.
	sulfentrazone + carfentrazone (Zeus Prime XC 7.7-15.2 fl oz)	Vines must be established at least 2 years. Avoid contact with green bark by wrapping trunk with a grow tube or wax container. Apply using a hooded sprayer. Provides postemergence control of yellow nutsedge and small broadleaf seedlings. Can be applied with other preemergence or postemergence herbicides for broader spectrum control.
<b>Postemergence directed under vines</b>		
Yellow nutsedge and certain broadleaf weeds	bentazon 0.75-1.0 lb (Basagran 1.2-2 pt/A + 1 qt/A crop oil concentrate)	Nonbearing only - allow at least one year between application and harvest. Apply when yellow nutsedge and annual broadleaf weeds are small and actively growing.
Annual and perennial grasses	fluazifop-butyl 0.25-0.375 lb ai (Fusilade DX 16.0-24.0 fl oz + 2.0 pt crop oil concentrate or 1/2 pt nonionic surfactant/25 gal)	Do not apply within 50 days of harvest. Apply as directed spray to actively growing grasses. Treat annual grasses before tillering for optimum results. Perennial grasses may need repeat treatment for total control. For spot treatment use 0.75 fl oz Fusilade DX plus 1.5 oz crop oil concentrate or 0.5 fl oz nonionic substance/gal. Ensure thorough coverage of weed foliage.
	clethodim 0.09-0.12 lb ai (Select 2EC 6.0-8.0 fl oz or Select Max 9.0-16.0 fl oz + nonionic surfactant at 0.25% by volume)	Use on nonbearing plantings only (at least 1 yr before harvest). Postemergence control of actively-growing grasses. For spot treatment, apply 0.33-0.65 fl oz/gal Select 2EC solution or 0.44-0.88 fl oz Select Max with 0.33 fl oz nonionic surfactant.
	sethoxydim 0.28-0.47 lb ai (Poast 1.5E 1.5-2.5 pt + 1.0 qt crop oil concentrate)	Do not apply within 50 days of harvest. Apply in a minimum of 10 GPA of water. Apply the lower rate to annual grasses up to 6 inches tall and apply higher rate to annual grasses up to 12 inches tall and to perennial grasses. For spot treatment use 1.25-1.9 fl oz Poast plus 1.25 fl oz crop oil concentrate/gal. Provides postemergence grass control only.
Annual weeds and certain perennials	glufosinate 0.88-1.5 lb (Rely 280 48.0-82.0 fl oz)	Apply as a directed spray to emerged weeds. Do not allow spray to contact desired foliage or green bark. Do not apply within 14 days of harvest. For spot treatment, mix 1.7 fl oz Rely 280/gal of water. Glufosinate has also been sold under the trade names Cheetah, Forfeit 280, Glufosinate 280, and Reckon 280SL, among others, for use in grapes. Check the label to determine the current registration status.

Table 3.5 - Herbicides Labeled for Use in Grapes (continued)		
For preemergence herbicides, use lower rates on sandy soils and higher rates on clay soils. Do not disturb soil after a preemergence herbicide application. Tank mixes of certain preemergence and postemergence herbicides can be made to control existing vegetation and control weeds germinating from seed. Check compatibility of tank mixes prior to application.		
Pest	Chemical and Formulation Rate per Acre	Timing and Remarks
<b>Postemergence directed under vines</b>		
Annual and perennial grasses and broadleaf weeds	glyphosate (various formulations, see label for application rates)	Use as a directed spray in established vineyards or for site preparation prior to transplanting new vines. Do not apply when green shoots or canes or foliage are in the spray zone. Do not allow spray drift or mist to contact foliage, green bark, suckers, or vines. Spray contact, other than with mature bark on the main trunk, can result in serious localized or systemic injury. Do not treat within 14 days of harvest. Apply prior to the end of the bloom stage or apply with shielded equipment to avoid crop damage.
All weeds, general contact	paraquat 0.63-1.0 lb (Gramoxone SL 2.0 2.5-4.0 pt/A or Gramoxone SL 3.0 1.7-2.7 pt/A plus a nonionic surfactant at 2.0 pt/100 gallons)	Apply as a directed spray in at least 30 gal of water/A. Most effective on small, actively growing weeds. Repeat applications will be needed to control perennial weeds. Do not allow spray to contact foliage, fruit, or stems. Corrosive to aluminum. Do not mix or store in aluminum tanks or in systems with aluminum fittings. Paraquat is toxic and a restricted use pesticide - handle with caution. RESTRICTED USE PESTICIDE.
	diquat (Diquat 2L 1.5-2 pt/A plus a nonionic surfactant at at 0.25-0.5% V/V)	Apply as a directed spray, keeping the spray off the grape vines. Use only on nonbearing grapes. Do not harvest within 12 months of application. Contract control of annual weeds and suppression of perennials.
Annual broadleaf weeds	carfentrazone-ethyl 0.016-0.031 lb (Aim 2EC, 1.9EW 1.0-2.0 fl oz/A)	Apply post-directed using a hooded sprayer for control of small annual broadleaf weeds less than 4 inches tall. Add a crop-oil concentrate or nonionic surfactant. Can be tank mixed with other herbicides for broader-spectrum weed control. Can also be used for control of suckers—see label for rates and directions for this use.
	pyraflufen-ethyl 0.0027-0.0053 lb (Venue 2-4 fl oz/A + Crop oil concentrate at 1% v/v)	Nonselective contact control of small annual broadleaf weeds. Can be tank-mixed with other herbicides for broader-spectrum weed control. Can also be used for sucker management. Avoid contact with green bark or foliage of grapes. Use nonporous wraps, grow tubes or wax containers to keep Venue off vines less than 1 year in the ground.

Table 3.6 - Relative Effectiveness of Selected Preemergence Herbicides and Ratings in Grapes														
Weeds	Indaziflam	Dichlobenil	Diuron	Flumioxazin	Isoxaben	Napropamide	Oryzalin	Oxyfluorfen	Pronamide1	Rimsulfuron	Simazine	Sulfentrazone	Pendimethalin	Norflurazon
<b>Annual Grasses</b>														
Barnyardgrass	-	G	G	-	-	G	G	F	F	G	F-G	F	G	E
Cheat	-	G	G	-	-	G	G	-	G	-	G	F	-	G
Crabgrasses	E	G	G	F-G	P	E	E	F	G	F	F-G	F	E	E
Fall panicum	-	F	F	-	-	G	G	-	F	F	F-G	F	G	E
Foxtails	G	G	G	F-G	-	E	E	F	G	G	G	F	G	F
Goosegrass	G	F	G	F-G	-	E	E	F	G	P	E	F	G	G
Johnsongrass (seedling)	-	F	G	P-F	-	P	F-G	-	-	-	N	F	G	G
<b>Annual Broadleaf Weeds</b>														
Annual fleabane	-	E	G	-	-	G	G	G	F	-	G	-	-	F
Annual morningglory	P	G	G	G	p	N	P-F	F	F	F	E	G	P	F
Black nightshade	-	G	G	G	-	N	P-F	G	F	P	E	G	P	F

Table 3.6 - Relative Effectiveness of Selected Preemergence Herbicides and Ratings in Grapes (continued)

Weeds	Indaziflam	Dichlobenil	Diuron	Flumioxazin	Isoxaben	Napropamide	Oryzalin	xyfluorfen	Pronamide1	Rimsulfuron	Simazine	Sulfentrazone	Pendimethalin	Norflurazon
<b>Annual Broadleaf Weeds</b>														
Carpetweed	E	G	E	-	-	G	G	G	G	-	E	G	G	G
Common chickweed	G	G	E	F-G	E	-	G	G	G	-	E	-	G	G
Common lambsquarters	F-G	G	E	E	F	F-G	G	G	F	F	E	G	F	G
Common ragweed	F-G	G	E	E	G	P	F	F	E	P	N	P	F	-
Hairy galinsoga	-	G	E	G	G	G	G	G	-	-	E	-	N	-
Henbit	E	G	E	-	G	F	P	G	G	-	E	F	G	-
Horseweed	-	G	G	G	F	P	F	F	P	G	E	-	P	G
Knotweed	-	G	G	-	-	G	G	G	E	G	E	-	-	F
Mustards	-	G	G	-	-	P	P-F	G	G	-	G	-	-	F
Pennsylvania smartweed	-	G	G	-	G	P	P-F	G	-	P	E	-	-	-
Pigweeds	-	G	E	E	G	G	G	G	N	G	E	G	F	F
Prickly lettuce	-	G	G	G	-	G	F	G	-	-	E	G	-	-
Prickly sida	-	F-G	G	E	-	N	P-F	G	N	-	G	-	-	P
Purslane	-	G	E	-	G	G	G	G	-	F	E	-	F	G
Shepherds' purse	-	G	G	-	-	F	G	G	G	-	E	G	N	G
Speedwells	-	-	-	-	-	-	-	-	P	-	-	-	-	-
Velvetleaf	-	-	F	G	F	N	P-F	G	P	F	G	-	G	-
Virginia pepperweed	-	G	G	-	-	F	G	-	P	-	E	-	-	G
Yellow rocket	-	G	P	-	-	N	N	-	P-F	-	P	-	N	F
<b>Perennial Grasses And Sedges</b>														
Fescues	-	G	F	-	N	N	N	N	G	-	P	N	N	F
Johnsongrass (rhizome)	-	-	P	N	N	N	N	N	P	-	N	-	N	P
Nimblewill	-	-	P	-	N	N	N	N	P	-	P	-	N	F
Orchardgrass	-	G	P-F	-	N	N	N	N	G	-	P	-	N	F
Quackgrass	-	G	G	-	N	N	N	N	G	-	P-F	-	N	P
Yellow nutsedge	N	P-F	P	N	N	N	N	N	N	F	N	F	N	P
Purpletop, redtop	-	-	P	-	N	N	N	N	-	-	N	-	N	F
Dallisgrass	-	-	F	-	N	N	N	N	-	-	N	N	N	P
Bermudagrass	N	N	N	N	N	N	N	N	P	N	N	N	N	P
<b>Perennial Broadleaf Weeds</b>														
Broadleaf plantain	-	G	P-F	-	N	N	N	N	F	-	G	-	N	P
Buckhorn plantain	-	G	P-F	-	N	N	N	N	F	-	G	-	N	P
Canada thistle	-	P-F	N	-	N	N	N	N	-	-	N	-	N	N
Chicory	-	G	G	-	N	N	N	N	-	-	P-F	-	N	N
Common dandelion	-	E	P-F	-	N	N	N	N	P	-	P-F	-	N	N
Common mallow	-	G	F	-	N	N	N	N	-	-	N	-	N	N
Common milkweed	-	-	N	-	N	N	N	N	-	-	N	-	N	N
Common yarrow	-	-	N	-	N	N	N	N	-	-	-	-	N	N
Docks (broadleaf, curly)	-	G	F	-	N	N	N	N	F	-	N	-	N	N
Goldenrod	-	F-G	-	-	N	N	N	N	-	-	N	-	N	N
Ground ivy	-	E	N	-	N	N	N	N	-	-	N	-	N	N

**Table 3.6 - Relative Effectiveness of Selected Preemergence Herbicides and Ratings in Grapes (continued)**

Weeds	Indaziflam	Dichlobenil	Diuron	Flumioxazin	Isoxaben	Napropamide	Oryzalin	Oxyfluorfen	Pronamide <sup>1</sup>	Rimsulfuron	Simazine	Sulfentrazone	Pendimethalin	Norflurazon
<b>Perennial Broadleaf Weeds</b>														
Hemp dogbane	-	N	N	-	N	N	N	N	-	-	N	-	N	N
Horsenettle	-	N	P-F	-	N	N	N	N	-	-	P	-	N	N
Mugwort	-	G-E	P	-	N	N	N	N	-	-	N	-	N	N
Red sorrel	-	G	N	-	N	N	-	N	F-G	-	N	-	N	N
Thistles (bull, musk, curl)	-	F	N	-	N	N	N	-	P	-	N	-	N	N
White flowered aster	-	G	N	-	N	N	N	N	-	-	N	-	N	N
Wild carrot	-	G	P	-	N	N	N	-	-	-	N	-	N	F
Wild strawberry	-	G	G	-	N	N	N	-	-	-	N	-	N	P
Yellow woodsorrel (from seed)	-	G	F	-	G	N	N	G	-	-	F	-	N	F
<b>Special Perennial Weed Problems</b>														
Bigroot morning-glory	-	N	N	-	N	N	N	N	N	-	N	-	N	N
Brambles (Rubus spp.)	-	N	N	-	N	N	N	N	N	-	N	-	N	N
Common greenbriar	-	N	N	-	N	N	N	N	N	-	N	-	N	N
Japanese honeysuckle	-	N	N	-	N	N	N	N	N	-	N	-	N	N
Poison ivy	-	N	N	-	N	N	N	N	N	-	N	-	N	N
Virginia creeper	-	N	N	-	N	N	N	N	N	-	N	-	N	N
Wild garlic	-	F	N	-	N	N	N	N	N	-	N	-	N	N

(E=excellent; G=good; F=fair; P=poor; N=none; - = not registered or information lacking)  
<sup>1</sup>Designates restricted use pesticide - must be trained and certified as a private applicator to purchase or use these more toxic chemicals in your vineyard. Refer to Publication 456-001 and the pesticide label for safety information. Ask your local Extension agent how to become a certified applicator.

**Table 3.7 - Relative Effectiveness of Selected Postemergence Herbicides and Ratings in Grapes**

Weeds	Bentazon (Basagran)	Carfentrazone (Aim)	Pyraflufen (Venus)	Clethodim (Select)	Fluazifopbutyl (Fusilade)	Glufosinate (Rely)	Glyphosate (Various)	Paraquat <sup>1</sup> (Gramoxone)	Sethoxydim (Poast)
<b>Annual Grasses</b>									
Barnyardgrass	N	N	N	E	E	G	E	E	E
Cheat	N	-	N	-	G	G	E	E	G
Crabgrasses	N	N	N	E	E	G	E	E	E
Fall panicum	N	N	N	E	E	G	E	E	E
Foxtails	N	N	N	E	E	G	E	E	E
Goosegrass	N	N	N	E	E	G	E	E	E
Johnsongrass (seedling)	N	N	N	E	E	G	E	E	E
<b>Annual Broadleaf Weeds</b>									
Annual fleabane	-	-	-	N	N	-	E	E	N
Annual morningglory	P	F	-	N	N	G	E	G	N
Black nightshade	N	G	-	N	N	G	E	G	N
Carpetweed	-	G	-	N	N	-	E	E	N
Common chickweed	-	F	-	N	N	G	E	E	N
Common lambsquarters	G	G	-	N	N	G	E	E	N
Common ragweed	G	P	-	N	N	G	E	E	N
Hairy galinsoga	-	-	-	N	N	-	E	E	N
Henbit	-	G	-	N	N	G	E	E	N

Table 3.7 - Relative Effectiveness of Selected Postemergence Herbicides and Ratings in Grapes (continued)

Weeds	Bentazon (Basagran)	Carfentrazone (Aim)	Pyraflufen (Venue)	Clethodim (Select)	Fluazifopbutyl (Fusilade)	Glufosinate (Rely)	Glyphosate (Various)	Paraquat1 (Gramoxone)	Sethoxydim (Poast)
<b>Annual Broadleaf Weeds</b>									
Horseweed	N	-	-	N	N	G	E	F	N
Knotweed	-	-	-	N	N	-	E	F-G	N
Mustards	-	-	-	N	N	G	E	G	N
Pennsylvania smartweed	G	-	-	N	N	G	E	G	N
Pigweeds	-	G	G	N	N	G	E	G	N
Prickly lettuce	-	-	-	N	N	G	E	G	N
Prickly sida	-	-	-	N	N	G	E	E	N
Purslane	-	-	-	N	N	G	E	G	N
Shepherds' purse	-	-	-	N	N	G	E	F-G	N
Speedwells	-	G	-	N	N	-	E	P	N
Velvetleaf	G	E	-	N	N	G	E	E	N
Virginia pepperweed	-	-	-	N	N	-	E	G	N
<b>Perennial Grasses And Sedges</b>									
Fescues	N	N	N	-	P	F	E	F	P-F
Johnsongrass (rhizome)	N	N	N	G	G	P	E	P	G
Nimblewill	N	N	N	-	F-G	-	G-E	P	F-G
Orchardgrass	N	N	N	-	F	P	E	F	F
Quackgrass	N	N	N	-	G	P	G	P	G
Yellow nutsedge	F-G	N	N	N	N	F-G	G	P	N
Purpletop, redtop	N	N	N	-	G	-	E	P	G
Dallisgrass	N	N	N	-	G	-	E	P	G
Bermudagrass	N	N	N	G	G	F	G	P	G
<b>Perennial Broadleaf Weeds</b>									
Broadleaf plantain	-	-	-	N	N	F	E	P	N
Buckhorn plantain	-	P	-	N	N	F	E	P	N
Canada thistle	-	-	-	N	N	-	F-G	P	N
Chicory	-	-	-	N	N	-	E	P	N
Common dandelion	-	P	-	N	N	G	E	P	N
Common mallow	-	-	-	N	N	-	E	P	N
Common milkweed	-	-	-	N	N	-	G	P	N
Common yarrow	-	-	-	N	N	-	G	P	N
Docks (broadleaf, curly)	-	P	-	N	N	-	G	P	N
Goldenrod	-	-	-	N	N	-	E	P-F	N
Ground Ivy	-	-	-	N	N	G	G	P-F	N
Hemp dogbane	-	-	-	N	N	P	F	P	N
Horsenettle	-	-	-	N	N	F-G	F-G	P	N
Mugwort	-	-	-	N	N	-	F	P	N
Red sorrel	-	-	-	N	N	G	G	P	N
Thistles (bull, musk, curl)	-	-	-	N	N	-	G	P	N
White flowered aster	-	-	-	N	N	-	E	P-F	N
Wild carrot	-	-	-	N	N	-	E	P	N
Wild strawberry	-	-	-	N	N	-	E	P-F	N
Yellow rocket	-	-	-	N	N	-	E	F	N
Yellow woodsorrel	-	-	-	N	N	G	E	P	N
<b>Special Perennial Weed Problems</b>									
Bigroot morningglory	-	-	-	N	N	-	F-G	P	N
Brambles	-	-	-	N	N	F-G	G	P	N

**Table 3.7 - Relative Effectiveness of Selected Postemergence Herbicides and Ratings in Grapes (continued)**

Weeds	Bentazon (Basagran)	Carfentrazone (Aim)	Pyraflufen (Venue)	Clethodim (Select)	Fluazifopbutyl (Fusilade)	Glufosinate (Rely)	Glyphosate (Various)	Paraquat <sup>1</sup> (Gramoxone)	Sethoxydim (Poast)
<b>Special Perennial Weed Problems</b>									
Common greenbriar	-	-	-	N	N	-	P	P	N
Japanese honeysuckle	-	-	-	N	N	-	F-G	P	N
Poison ivy	-	-	-	N	N	-	G	P	N
Virginia creeper	-	-	-	N	N	-	F-G	P	N
Wild garlic	-	-	-	N	N	G	F	P	N

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

<sup>1</sup>Designates restricted use pesticide - must be trained and certified as a private applicator to purchase or use these more toxic chemicals in your vineyard. Refer to Publication 456-001 and the pesticide label for safety information. Ask your local Extension agent how to become a certified applicator.

**Table 3.8 - Chemical Names, Re-entry Times, and Days to Harvest<sup>1</sup>**

Chemical (Other name)	Manufacturers	Re-entry time	Days to Harvest
Alion (indaziflam)	Bayer	12 hours	14
Aim (carfentrazone)	FMC	12 hours	3
Basagram (bentazon)	UPL	48 hours	365
Casoron (dichlobenil)	UPL	12 hours	30
Chateau (flumioxazin)	Valent	12 hours	60
Devrinol (napropamide)	United Phosphorus	12 hours	35
Diquat (diquat)	Nufarm	24 hours	365
Fusilade (fluazifop-butyl)	Syngenta	12 hours	50
Trellis (isoxaben)	Corteva	12 hours	60
Goal (oxyfluorfen)	Corteva	24 hours	NA <sup>2</sup>
Gramoxone (paraquat)	Syngenta	12 hours	NA <sup>5</sup>
Karmex (diuron)	ADAMA	12 hours	NA <sup>3</sup>
Kerb (pronamide)	Corteva	24 hours	NA <sup>4</sup>
Matrix (rimsulfuron)	Corteva	4 hours	14
Poast (sethoxydim)	BASF	12 hours	50
Princep (simazine)	Syngenta	12 hours	NA <sup>6</sup>
Prowl H2O (pendimethalin)	BASF	24 hours	21
Rely (glufosinate)	BASF	12 hours	14
Roundup (glyphosate)	Bayer	4 hours	14
Select (clethodim)	Valent	24 hours	365
Solicam (norflurazon)	Tessenderlo Kerley	12 hours	60
Surflan (oryzalin)	United Phosphorus	24 hours	NA <sup>6</sup>
Venue (pyraflufen-ethyl)	Nichino	12 hours	0
Zeus C (sulfentrazone)	FMC	12 hours	3
Zeus Prime XC	FMC	12 hours	3

<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 pre-harvest intervals in recent years, and more changes are expected in the future.

<sup>2</sup>Apply when crop is dormant.

<sup>3</sup>Apply between March and May.

<sup>4</sup>Apply in the fall after harvest.

<sup>5</sup>Do not allow paraquat to contact fruit.

<sup>6</sup>Apply between harvest and spring.