

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://www.grapepathology.blogspot.com>. 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.

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) | lime sulfur solution Sulforix | 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. |
| Powdery Mildew | | | |
| Phomopsis | | | |
| Botryosphaeria canker, Eutypa dieback, ESCA | Topsin-M | 0.75-1.5 lb | For Topsin-M, you need to obtain a section 24c label for VA. Please read the label for specific application information. Rally requires a supplemental label (can be obtained through manufacturer's website). B-lock is a latex paint with boron for pruning wound protection, and shown to be effective against a number of trunk diseases. |
| | Rally 40WSP | 5 oz | |
| | B-lock | n/a | |
| 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 6.0-8.0 fl oz | |
| | Movento 2SC Actara 25WDG | 1.5-3.5 oz | |
| Grape scale | Dormant oil | 2% solution | Apply in high volume (dilute) application. Loose bark on vines makes coverage of scale difficult. |
| <i>Bud Swell</i> | | | |
| 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 | |

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>Bud Swell (cont.)</i> | | | |
| 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) | Rates vary | Spray in evening if possible. Various preparations of Bt available. Check label for rates. See Table 3.4 for Restricted Entry Intervals. 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. |
| | 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 | | |
| <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 | 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 | 2.0-4.0 lb | |
| | See Table 3.2 | | |
| 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 | copper fungicides with lime | 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. |
| | captan 50WP or equivalent | 2.0-4.0 lb | |
| | See Table 3.2 | | |
| 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 Bt 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</i> (Bt) | See label | |

Table 3.1 - Disease and Insect Control (cont.)

| Pest | Chemical and Formulation | Rate/Acre | Spray Timing and Remarks |
|--|---|-----------------|--|
| Climbing cutworms | <i>Bacillus thuringiensis</i> (Bt) | See label | Spray in evening if possible. Various preparations of Bt available. Check rates. See Table 3.4 for Restricted Entry Intervals. 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 | | |
| | 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 | | |
| <i>Pre-Bloom - Just before blossoms open, critical spray for black rot, powdery, and downy mildew</i> | | | |
| Black rot | Ziram | 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. |
| | mancozeb 75DF | 2.0-4.0 lb | |
| | Rally 40WSP | 3.0-5.0 oz | |
| | tebuconazole 45% (Orius 45DF, formerly Elite) | 4.0 oz | |
| | Abound | 10.0-15.5 fl oz | |
| | Sovran | 3.2-5.6 oz | |
| | Flint | 2.0 oz | |
| | Pristine | 8.0-12.5 oz | |
| | Inspire Super | 16.0-20.0 fl oz | |
| | Revus Top | 7.0 fl oz | |
| | Topguard EQ. | 5.0-6.0 fl oz | |
| | Luna Experience | 6.0-8.6 fl oz | |
| | Rhyme | 4.0-5.0 fl oz | |
| Quadris Top | 12.0-14.0 fl 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, 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. Presidio should be tank-mixed with another fungicide active against downy mildew. |
| | mancozeb 75DF | 2.0-4.0 lb | |
| | Ridomil Gold MZ | 1.5-2.0 lb | |
| | phosphorous acid | See label | |
| | Gavel | 2.0-2.5 lb | |
| | Revus | 8.0 fl oz | |
| | Revus Top | 7.0 fl oz | |
| | Forum | 6.0 fl oz | |
| | Ranman | 2.1-2.75 fl oz | |
| | Presidio | 3.0-4.0 fl oz | |
| | Zampro | 11-14 fl 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> | | | |
| Powdery mildew | tebuconazole 45% (Orius 20AQ) | 8.6 fl oz 10.5 fl oz | 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. |
| | Aprovia | 2.0-4.0 lb | |
| | wettable sulfur (81.25% or 92%) | 3.0-5.0 oz 4.0-8.0 oz | |
| | Rally 40WSP | 8.0-12.5 oz | |
| | Procure | 4.5 oz | |
| | Pristine | 4.0 fl oz | |
| | Endura | 20-22 fl oz | |
| | Quintec | 4.0-5.0 fl oz | |
| | Kenja | 16.0-20.0 fl oz | |
| | Rhyme | 7.0 fl oz | |
| | Inspire Super | 10.3-15.4 fl oz | |
| | Revus Top | 4.0-5.5 fl oz | |
| | Vivando | 5.0-6.0 fl oz | |
| | Merivon | 6.0-8.6 fl oz | |
| | Topguard EQ | 12.0-14.0 fl oz | |
| Luna Experience | | | |
| Quadris Top | | | |
| 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 | |
| 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 | |

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 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 | |
| | Esteem | 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. |
| <i>Bloom</i> | | | |
| Botrytis | Rovral 4F or Meteor | 0.67-1.33 lb or 1.5-2.0 pt | 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 have also been observed in some locations. |
| | Vanguard | 5.0-10.0 oz | |
| | Scala | 9.0-18.0 fl oz | |
| | Elevate | 1.0 lb | |
| | Switch | 11.0-14.0 oz | |
| | Luna Experience | 6.0-8.6 fl oz | |
| | Kenja | 20-22 fl oz | |
| <i>Post-Bloom: Immediately after bloom</i> | | | |
| Black rot | mancozeb 75DF | 4.0 lb | 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 |
| | Ziram | 4.0 lb | |
| | Rally 40WSP | 3.0-5.0 oz | |
| | Tebuconazole 45% | 4.0 oz | |
| | Orius 20AQ | 8.6 fl oz | |
| | Abound | 10.0-15.5 fl oz | |
| | Sovran | 3.2-5.6 oz | |
| | Flint | 2.0 oz | |
| | Pristine | 8.0-12.5 oz | |
| | Inspire Super | 16.0-20.0 fl oz | |
| | Revus Top | 7.0 fl oz | |
| | Topguard EQ. | 5.0-6.0 fl oz | |
| | Luna Experience | 6.0-8.6 fl oz | |
| Rhyme | 4.0-5.0 fl oz | | |
| Quadris Top | 12.0-14.0 fl oz | | |
| Downy mildew | captan 50WP | 4.0 lb | 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. |
| | mancozeb 75DF | 4.0 lb | |
| | Ridomil Gold Copper | 1.0-2.0 lb | |
| | copper fungicides | See label | |
| | phosphorous acid | See label | |
| | Gavel | 2.0-2.5 lb | |
| | Revus | 8.0 fl oz | |
| | Presidio | 3.0-4.0 fl oz | |
| | Forum | 6.0 fl oz | |
| | Revus Top | 7.0 fl oz | |
| | Ranman | 2.1-2.75 fl oz | |
| Zampro | 11.0-14.0 fl oz | | |

3-6 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>Post-Bloom: Immediately after bloom (cont.)</i> | | | |
| Powdery mildew | Elite 45DF | 4.0 oz | 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. |
| | Aprovia | 8.6-10.5 fl. oz | |
| | Orius 20AQ | 8.6 fl oz | |
| | Rally (Nova) 40WSP | 3.0-5.0 oz | |
| | wettable sulfur (81.25% or 92%) | 4.0 lb 4.0-8.0 oz | |
| | Procure | 8.0-12.5 oz | |
| | Pristine | 20-22 fl oz | |
| | Kenja | 4.0-5.0 fl oz | |
| | Rhyme | 4.0 fl oz | |
| | Quintec | 4.5 oz | |
| | Endura | 16.0-20.0 fl oz | |
| | Inspire Super | 7.0 fl oz | |
| | Revus Top | 12.0-14.0 fl oz | |
| | Quadris Top | 3.0-5.0 fl oz | |
| | Mettle | 4.0-5.5 fl oz | |
| | Merivon | 5.0-6.0 fl oz | |
| Topguard EQ | 10.3-15.4 fl oz | | |
| Vivando | 6.0-8.6 oz | | |
| Luna Experience | | | |
| 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. 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</i> (Bt) | Rates vary | |
| | Imidan 70WP | 2.0 lb | |
| | Sevin XLR | 1.0-2.0 qt | |
| | Avaunt 30DG | 5.0-6.0 oz | |
| Esteem | 5 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. |
| 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 pre-bloom use only on table grapes. Movento provides control of root infestations. |
| | Movento 2SC | 6.0-8.0 fl oz | |

Table 3.1 - Disease and Insect Control (cont.)

| Pest | Chemical and Formulation | Rate/Acre | Spray Timing and Remarks |
|--|--|---------------------------|---|
| <i>Post-Bloom: Immediately after bloom (cont.)</i> | | | |
| European red mite | Vendex 50WP | 1.0-2.5 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 8.0 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 | | |
| <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> | | | |
| Black rot, downy mildew, powdery mildew, grape berry moth, grape leafhopper, 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 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. 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 | 7.0-16.0 fl oz | |
| + | + | | |
| Trilogy | 2% solution | | |
| <i>Third Cover: before bunch closing</i> | | | |
| Botrytis | Rovral 4F or Meteor | 1.0-1.33 lb or 1.5-2.0 pt | 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. |
| | Vanguard | 5.0-10.0 oz | |
| | Kenja | 20-22 fl oz | |
| | Scala | 9.0-18.0 fl oz | |
| | Elevate | 1.0 lb | |
| | Switch | 11.0-14.0 oz | |
| | Luna Experience | 6.0-8.6 fl oz | |

3-8 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>Veraison: berry ripening, sugar building up</i> | | | |
| Botrytis | Rovral 4F or Meteor | 1.0-1.33 lb or 1.5-2.0 pt | 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. |
| | Vanguard | 5.0-10.0 oz | |
| | Scala | 9.0-18.0 fl oz | |
| | Elevate | 1.0 lb | |
| | Switch | 11.0-14.0 oz | |
| | Luna Experience | 6.0-8.6 fl oz | |
| 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 www.virginiafruit.ento.vt.edu/SWD.html . |
| | 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 | |
| <i>Fourth Cover: mid-August or 10 days after third cover spray</i> | | | |
| 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 if berries are to be used for wine. |
| 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) | 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. |
| | | 9.0-10.5 fl oz (soil) | |
| | 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 | |

Table 3.1 - Disease and Insect Control (cont.)

| Pest | Chemical and Formulation | Rate/Acre | Spray Timing and Remarks |
|--|--------------------------|----------------|--|
| 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. Addition of table sugar at the rate of 30 oz per 100 gal will aid in efficacy of chemical control of SWD. For more information on SWD, visit www.virginiafruit.ento.vt.edu/SWD.html . |
| | 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. |
| <i>Harvest: Day before or day of harvest</i> | | | |
| 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 | |
| <i>Postharvest: vines only</i> | | | |
| Mealybugs | Applaud 70DF | 24.0 oz | Apply if control is not achieved by delayed dormant spray. |
| | 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. | | | |
| <i>Special Borer Treatment</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 in mid-late July, close to peak egg-laying and hatch, 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. Apply pheromone dispenser at 100/A, at the beginning of flight, around the first of July. |
| | Isomate GRB | 100 dispensers | |

3-10 Grapes: Diseases and Insects in Vineyards

Table 3.1 - Disease and Insect Control (cont.)

| Pest | Chemical and Formulation | Rate/Acre | Spray Timing and Remarks |
|------|--------------------------|-----------|--------------------------|
|------|--------------------------|-----------|--------------------------|

Special Sharpshooter Sprays

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 Admire Pro (1.0-1.4 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.

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.

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.

Consult <http://www.virginiafruit.ento.vt.edu/PDsharpshooters.html> for updated information.

A new invasive insect

In January 2018, a new invasive insect was found in Virginia. Spotted lanternfly was found in Pennsylvania in 2014 and has been expanding its range since. 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. Populations can build to create a severe nuisance in residential areas as well. An eradication effort has been implemented in 2018; it is too soon to gauge the success of this program. While eradication has been unsuccessful to date in Pennsylvania, we have an advantage in Virginia, in that we were expecting the invasion, and began control efforts earlier. So far, SLF has not caused economic loss in our agricultural crops. Nevertheless, fruit growers should be aware of the pest's appearance, and how to handle finds you may make in your operations. For information on appearance and biology of SLF, refer to our fact sheet (<http://pubs.ext.vt.edu/ENTO/ENTO-180/ENTO-180.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 visit the SLF reporting page (<https://ask.extension.org/groups/1981/ask>).

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 | Anthraxnose | Black rot | Botrytis bunch rot | Downy Mildew | Phomopsis cane/leaf spot | Powdery Mildew |
|--|--|------------------------|----------------------|-------------|-----------|--------------------|-------------------|--------------------------|-----------------|
| Abound ¹ | azoxystrobin ¹ | H | 11 | G | E | Var | Var | F-G | Var |
| Aprovia | benzovindiflupyr | M | 7 | G | G | – | – | – | G-E |
| Aliette | fosetyl-AI | L | P07 | – | – | – | E | – | – |
| Armcarb, Kaligreen, Agricure | potassium bicarbonate | L | M | – | – | – | – | – | F-G |
| Captan, Captec, etc | captan | L | M4 | G | F | F | G-E | G-E | N |
| Coppers ³ | Bordeaux ³ , fixed coppers ⁸ | L | M1 | F-G | F | P-F | G-E | F | F-G |
| Elevate ⁵ | fenhexamid | M | 17 | – | – | G-E | – | – | P-F |
| Elite, Orius, Tebuzol | tebuconazole | M | 3 | – | E | – | – | – | G ¹⁰ |
| Endura | boscalid | M | 7 | G | – | Var | – | – | G-E |
| Ferbam | ferbam | L | M3 | – | G | N | F | F | N |
| Flint ¹ | trifloxystrobin ¹ | H | 11 | – | E | Var | Var | F-G | Var |
| Fracture | BLAD | Unknown | NC | – | – | labeled | – | – | labeled |
| Forum | dimethomorph | M | 40 | – | – | – | G-E ¹¹ | – | – |
| Gavel | zoxamide + mancozeb | M for zoxamide | 22+M3 | F | F | – | G | G | – |
| Inspire Super | difenoconazole + cyprodinil | M | 3+9 | – | E | G-E | – | – | E |
| Kenja | isofetamid | M | 7 | G | – | G-E | – | – | G-E |
| LifeGard | Bacillus mycoides | Unknown | | – | – | – | labeled | – | |
| Luna Experience | Fluopyram + tebuconazole | M | 7+3 | – | E | E | – | – | E |
| Manzate, various ⁴ | mancozeb ⁴ | L | M3 | G | G | N | E | G-E | N |
| Merivon | Fluxapyroxad+ pyraclostrobin | M for flu H for pyr | 7+11 | | labeled | labeled | labeled | labeled | 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 |
| Presidio | fluopicolide | M | 43 | – | – | – | labeled | – | – |
| Ph-D, OSO | polyoxin D | M | 19 | – | – | labeled | – | – | labeled |
| Pristine ¹ | boscalid plus pyraclostrobin ¹ | H+M | 11+7 | G | G-E | Var | Var | labeled | E |

3-12 Grapes: Diseases and Insects in Vineyards

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 | Anthracoze | Black rot | Botrytis bunch rot | Downy Mildew | Phomopsis cane/leaf spot | Powdery Mildew |
|--|-----------------------------------|------------------------|----------------------|------------|-----------|--------------------|-------------------|--------------------------|------------------|
| Procure, Viticure | triflumizole | M | 3 | – | – | – | – | – | G |
| 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 | quinoxifen | M | 13 | – | P | – | – | – | G-E (var) |
| Rally ² | myclobutanil ² | M | 3 | G | E | – | N | P | G ¹⁰ |
| Ranman | cyazofamid | M-H | 21 | – | – | – | G-E | – | – |
| Reason ¹ | fenamidone | H | 11 | – | – | – | P-E (var) | – | – |
| Revus | mandipropamid | M | 40 | – | – | – | G-E ¹¹ | – | – |
| Revus Top | difenoconazole + mandipropamid | M | 3+40 | – | E | – | G-E ¹¹ | – | E |
| Ridomil Gold MZ ⁶ | mefenoxam + mancozeb ⁶ | H for mefenoxam | 4+M3 | F | F | – | E | F | – |
| Ridomil Gold/Copper ⁶ | mefenoxam + copper ⁶ | H for mefenoxam | 4+M3 | – | F | P | E | F | F |
| Rovral ⁵ , Meteor ⁵ | iprodione ⁵ | M | 2 | – | P | G-Var | – | N | N |
| Rhyme | flutriafol | M | 3 | – | E | – | – | – | G ¹⁰ |
| Scala | pyrimethanil | M | 9 | – | – | G-E | – | – | P? |
| Sovran ¹ | kresoxim methyl ¹ | H | 11 | G | E | Var | F-Var | F-G | Var |
| Sulfur, Various ⁷ | sulfur ⁷ | L | M2 | – | N | N | N | – | G |
| Switch | cyprodinil + fludioxonil | M | 9+12 | – | – | E | – | – | – |
| Tanos | cymoxanil + famoxadone | M | 11+27 | – | – | – | Var | – | – |
| 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 ⁹ | N | F | P-G ⁹ |
| Torino | cyflufenamid | M | U6 | – | – | – | – | – | E |
| Vanguard | cyprodinil | M | 9 | – | – | G-E | – | – | – |
| Vivando | metrafenone | M | 50 | – | – | – | – | – | E |
| Ziram Granuflo, Ziram 76 | ziram | L | M3 | G | G | – | F | G | – |
| Zampro | ametoctradin + dimethomorph | M | 45+40 | – | – | – | E ¹¹ | – | – |

¹ 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.

² 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.

- ³ Bordeaux mixture is a mixture of copper sulfate and hydrated lime; it may be purchased prepacked or mixed fresh by the grower. See also note⁹ for fixed copper fungicides.
- ⁴ Trade names for mancozeb include Manzate 200, Manzate 200 DF (DuPont), Dithane M45, Dithane F45, Dithane DF (Dow), and Penncozeb (United Phosphorus). Gavel is mancozeb + zoxamide.
- ⁵ Continuous use of Royral 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.
- ⁶ Ridomil Gold MZ contains 10% metalaxyl plus 48% mancozeb; Ridomil Gold/Copper contains 10% metalaxyl plus 60% copper hydroxide (see also note⁹).
- ⁷ 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.
- ⁸ 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.
- ⁹ 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.
- ¹⁰ In some areas of the eastern U.S., including Virginia, Rally, Orius, Adament, and tebuconazole, and to a lesser extent Procure, have lost some of their efficacy against grape powdery mildew.
- ¹¹ Downy mildew with resistance to mandipropamid (Revus and Revus Top) and dimethomorph (Forum) has been identified in several areas in Virginia.

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

| Insects and mites | Insecticides/Acaricides and Ratings | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------------|-------------------------------------|--------|----------|---------|--------|--------|--------|-------|-----------|----|-------|---------|--------|----------|----------|---------|---------|--------|----------|-------------|---------|---------|-----------|---------|----------------|--------|--------|-------|---------|-------|-----------|-----------|----------|--------|-------|------|---|---|---|---|
| | Acramite | Actara | Agri-Mek | Altacor | Appaud | Assail | Avaunt | Azera | Baythroid | Bt | Belay | Brigade | Dantol | Delegate | Diazinon | Entrust | Envidor | Imidan | Intrepid | Isomate GRB | Lannate | Lorsban | Malathion | Movento | Neemix/Trilogy | Nexter | Onager | Prado | Pyganic | Sevin | SPLAT-GBM | Sytle Oil | Surround | Vendex | Venom | Zeal | | | | |
| Brown Marmorated Stink bug | - | G | - | - | - | G | G | F | - | G | G | G | G | - | - | - | - | N | - | F | G | G | - | - | - | - | - | - | G | P | - | - | - | - | - | G | - | | | |
| Cutworms | - | - | - | - | - | - | - | G | G | G | G | G | G | G | - | - | - | - | - | - | - | - | - | - | - | - | - | - | G | - | - | - | - | - | - | - | - | - | | |
| Drosophila flies | - | - | - | - | - | - | - | G | - | - | - | - | E | - | - | E | - | - | - | - | - | E | - | - | - | - | - | G | - | - | - | - | - | - | - | - | - | - | | |
| Grape berry moth | - | - | - | E | - | G | E | F | G | E | G | G | G | G | E | - | - | - | - | - | G | - | - | - | - | - | - | G | G | - | - | - | - | - | - | - | - | - | | |
| Grape cane girdler | - | - | - | - | - | - | - | E | - | - | E | - | E | - | - | - | - | - | G | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Grape flea beetle | - | - | - | - | - | - | - | E | - | - | E | - | E | - | - | - | - | - | G | - | - | - | - | - | - | - | - | E | - | - | - | - | - | - | - | - | - | - | - | |
| Grape leafhopper | - | G | - | E | E | - | E | - | E | G | E | E | G | - | G | - | - | - | G | - | G | - | G | - | - | - | G | E | - | E | - | - | G | - | - | - | - | - | - | |
| Grape rootworm | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | G | - | - | - | - | - | - | - | - | - | - | - | - |
| Grape root borer | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | E | G | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Grape scale | - | - | - | E | F | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | G | - | - | G | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Japanese beetle | - | G | - | - | G | G | - | G | - | G | E | - | - | - | - | - | - | - | - | - | - | G | - | G | - | G | - | G | - | - | - | - | - | - | - | - | - | - | - | - |
| June beetle | - | G | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | G | - | - | - | - | - | G | - | - | - | - | - | - | - | - | - | - | - | - |
| Mealybugs | - | G | - | E | G | - | G | - | G | - | G | - | - | - | - | - | - | - | - | - | - | - | - | G | - | G | - | G | - | - | - | - | - | - | - | - | - | - | - | - |
| Phylloxera (Leaf form) | - | - | - | - | - | - | - | - | - | - | - | E | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Redbanded leafroller | - | - | E | - | - | - | G | - | G | - | E | - | E | E | G | E | - | - | - | - | - | - | - | - | - | - | - | E | - | - | - | - | - | - | - | - | - | - | - | - |
| Rose chafer | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Sharpshooter | - | - | - | - | G | - | - | - | G | G | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | G | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Spider mites | G | G | - | - | - | - | - | - | - | - | - | - | F | E | - | - | - | - | - | - | - | F | - | - | - | - | E | E | - | - | - | - | - | - | - | - | - | - | - | - |
| Spotted wing drosophila | - | - | - | - | - | - | - | F | E | - | - | E | E | G | E | - | - | - | - | - | - | G | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Wasp | - | F | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

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

Table 3.4 - Chemical Names, Re-entry Times, and Days to Harvest¹

| 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 (fosetyl Al) | Bayer CropScience | 12 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 |
| Assail (acetamiprid) | United Phosphorus | 12 hours | 7 |
| Avaunt (indoxacarb) | DuPont | 12 hours | 7 |
| Azera (azadirachtin, pyrethrins) | MGK | 12 hours | 0 |
| Baythroid (cyfluthrin) | Bayer CropScience | 12 hours | 3 |
| Belay (clothianidin) | Valent | 12 hours | 0 |
| Brigade (bifenthrin) | FMC | 12 hours | 30 |
| Bordeaux mixture (copper sulfate & hydrated lime) | Instructions for making Bordeaux mix available at www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7481.html | | 0 |
| Captan (Captan, Captec) | Arysta, Drexel | 2-4 days (see label) | 0 |
| copper, fixed | Various | 4-28 hours | 0 |
| Danitol (fenpropathrin) | Valent | 24 hours | 21 |
| Delegate (spinetoram) | Dow AgroSciences | 4 hours | 7 |
| 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 (spiroadiclofen) | Bayer CropScience | 12 hours | 14 |
| Esteem (buprofezin) | Valent | 12 hours | 21 |
| Flint (trifloxystrobin) | Bayer CropScience | 12 hours | 14 |
| Fracture (BLAD) | FMC | 4 hours | 1 |
| Forum (dimethomorph) | BASF | 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) | Dow AgroSciences | 4 hours | 30 |
| JMS Stylet-Oil | JMS Flower Farms | 4 hours | 0 |
| Kenja (isofetamid) | Summit Agro | 12 hours REI | 14 days PHI |

¹This 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.

²See label cautions regarding potential effects on harvest parameters.

3-16 Grapes: Diseases and Insects in Vineyards

Table 3.4 - Chemical Names, Re-entry Times, and Days to Harvest¹ (cont.)

| Chemical (Other name) | Manufacturers | Restricted Entry Interval | Days to Harvest |
|--|--|--|---------------------|
| LifeGard (Bacillus mycoides) | Certis | 4 hours | 0 |
| Leverage 360 (imidacloprid + beta-cyflutrin) | Bayer | 12 hours | 1 day |
| Lorsban 4E (chlorpyrifos) | Dow AgroSciences | 24 hours | 35 |
| Luna Experience (fluopyram & tetraconazole) | Bayer | 12 hours (5 days for cane work) | 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) | Dow AgroSciences, DuPont, United Phosphorus, etc. | 24 hours | 66 |
| Merivon | BASF | 12 hours | 14 |
| Meteor (iprodione) | United Phosphorus | 48 hours | 7 |
| Mettle (tetraconazole) | Isagro | 12 hours | 14 |
| Movento (spirotetramat) | Bayer CropScience | 24 hours | 7 |
| Mustang Max (zeta-cypermethrin) | FMC | 12 hours | 1 day |
| Nealta (cyflumetofen) | BASF | 12 hours | 14 days |
| Neemix (azadirachtin) | Certis | 12 hours | 0 days |
| Nexter (pyridaben) | Gowan | 12 hours | 7 |
| Onager (hexythiazox) | Gowan | 12 hours | 7 |
| Orius 20AQ (tebuconazole) | Mahkteshim Agan | 12 hours | 14 |
| Polyoxin D (Ph-D, Oso) | Arysta, Certis | 4 hours | 0 |
| Portal (fenproximate) | Nichino America | 12 hours | 14 |
| Potassium bicarbonate (Armcarb, Kaligreen, Milstop, etc.) | various | 4 hours | 0-1 day (see label) |
| Presidio (fluopicolide) | Valent | 12 hours | 21 |
| Pristine (boscalid+pyraclostrobin) | BASF | 12 hours (5 days for cane work) | 14 |
| Procure, Viticure (triflumizole) | Chemtura | 12 hours | 7 |
| Phosphorous acid or phosphite (Fosphite, K-phite, Phostrol, Prophyt, Rampart, etc.) | Nufarm, Loveland Products, JH Biotech, Helena and others | 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) | Dow Agrosiences | 12 hours | 14 |
| Rally (myclobutanil) | Dow AgroSciences | 24 hours | 14 |
| Ranman (cyazofamid) | FMC | 12 hours | 30 |
| Reason (fenamidone) | Bayer | 12 hours | 30 |
| Rendition (peroxyacetic acid) | Certis | when dry | 0 |
| Revus (mandipropamid) | Syngenta | 4 hours | 14 |

¹This 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.

²See label cautions regarding potential effects on harvest parameters.

Table 3.4 - Chemical Names, Re-entry Times, and Days to Harvest¹ (cont.)

| Chemical (Other name) | Manufacturers | Restricted Entry Interval | Days to Harvest |
|--|-------------------------------|---|-------------------------|
| Revus Top (difenoconazole + cyprodinil) | Syngenta | 12 hours | 14 |
| Ridomil Gold Copper (mefenoxam & copper) | Syngenta | 48 hours | 42 |
| Ridomil Gold MZ (mefenoxam + mancozeb) | Syngenta | 48 hours | 66 |
| 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 |
| SPLAT-GBM (pheromone) | ISCA Technologies | 4 hours | – |
| Sovran (kresoxim methyl) | Cheminova | 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 | 0 ² |
| Switch (cyprodinil + fludioxonil) | Syngenta | 12 hours | 7 |
| Tanos (cymoxanil + famoxadone) | DuPont | 12 hours | 30 |
| Tombstone (cyfluthrin) | Loveland | 12 hours | 3 |
| TopGuard EQ | FMC | 12 hours (5 days for girdling or tying) | 14 |
| Topsin M (thiophanate methyl) | United Phosphorus | 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 |
| 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) |
| Vivando (metrafenone) | BASF | 12 hours | 14 |
| Zampro (ametoctradin+ dimethomorph) | BASF | 12 hours | 14 |
| Zeal (etoxazole) | Valent | 12 hours | 14 |
| Ziram | United Phosphorus, Taminco | 48 hours | 21 |

¹This 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.

²See label cautions regarding potential effects on harvest parameters.

Grapes: Weed Control in Vineyards

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Table 3.5 - Herbicides Labeled for Use in Grapes

For preemergence herbicides, use lower rates on sandy soils and higher rates on clay soils. Do not disturb soil after a pre-emergence 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 |
|--|--|--|
| <i>Preemergence directed under vines</i> | | |
| 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, quack-grass, 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 6.0-12.0 oz/A) | 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 0.67-1.33 lb) | 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, Surflan 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. |
| 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. |

3-20 Grapes: Weed Control in Vineyards

Table 3.5 - Herbicides Labeled for Use in Grapes (cont.)

| Pest | Chemical and Formulation Rate per Acre | Timing and Remarks |
|---|---|---|
| <i>Preemergence directed under vines</i> | | |
| 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. RESTRICTED USE PESTICIDE. |
| Annual grasses and certain annual broadleaf weeds | pendimethalin 2.0-4.0 lb (Prowl 3.3EC 2.4-4.8 qt, Prowl H ₂ O 3.2-6.3 qt) | Prowl EC - use on nonbearing plantings only. Prowl H ₂ O - do not apply within 90 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. |
| <i>Postemergence directed under vines</i> | | |
| 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. |

Table 3.5 - Herbicides Labeled for Use in Grapes (cont.)

| Pest | Chemical and Formulation Rate per Acre | Timing and Remarks |
|--|--|--|
| Annual and perennial grasses (cont.) | 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. Rely can also be used for sucker control. See label for directions. 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. |
| Annual and perennial grasses and broadleaf weeds | glyphosate 0.75-3.75 lb ae (acid equivalent) (Roundup UltraMax 26 fl oz-4 qt, Touchdown 1.0-5.0 qt, or other labeled formu- lation) Spot treatment 1.3-2.6 fl oz Roundup UltraMax or Touchdown/gallon. For wiper application use 1 part Roundup Ultra Max or Touchdown to 2 parts water | 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. If repeat treatments are necessary, do not exceed a total of 10.6 qt/A/year. 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 2.5-4.0 pt/A plus a nonionic surfac- tant at 1.0-2.0 pt/gal) | 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 surfac- tant at 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. |

3-22 Grapes: Weed Control in Vineyards

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

| Weeds | Indaziflam | Dichlobenil | Diuron | Flumioxazin | Isoxaben | Napropamide | Oryzalin | Oxyfluorfen | Pronamide ¹ | Rimsulfuron | Simazine | Sulfentrazone | Pendimethalin | Norflurazon |
|-------------------------------------|------------|-------------|--------|-------------|----------|-------------|----------|-------------|------------------------|-------------|----------|---------------|---------------|-------------|
| <i>Annual Grasses</i> | | | | | | | | | | | | | | |
| 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 |
| <i>Annual Broadleaf Weeds</i> | | | | | | | | | | | | | | |
| 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 |
| 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 | - | F | P | F | F | P | - | E | - | P | G |
| Knotweed | - | G | G | - | - | G | G | G | E | - | 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 |
| <i>Perennial Grasses And Sedges</i> | | | | | | | | | | | | | | |
| 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 |

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

¹Designates 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 3.6 - Relative Effectiveness of Selected Preemergence Herbicides and Ratings in Grapes (cont.)

| Weeds | Indaziflam | Dichlobenil | Diuron | Flumioxazin | Isoxaben | Napropamide | Oryzalin | Oxyfluorfen | Pronamide* | Rimsulfuron | Simazine | Sulfentrazone | Pendimethalin | Norflurazon |
|--|------------|-------------|--------|-------------|----------|-------------|----------|-------------|------------|-------------|----------|---------------|---------------|-------------|
| 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 |
| <i>Perennial Broadleaf Weeds</i> | | | | | | | | | | | | | | |
| 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 |
| 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 |
| <i>Special Perennial Weed Problems</i> | | | | | | | | | | | | | | |
| 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)

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3-24 Grapes: Weed Control in Vineyards

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

| Weeds | Bentazon (Basagran) | Carfentrazone (Aim) | Pyraflufen (Venue) | Clethodim (Select) | Fluazifopbutyl (Fusilade) | Glufosinate (Rely) | Glyphosate (Various) | Paraquat ¹ (Gramoxone) | Sethoxydim (Poast) |
|-------------------------------------|------------------------|------------------------|-----------------------|-----------------------|------------------------------|-----------------------|-------------------------|--------------------------------------|-----------------------|
| <i>Annual Grasses</i> | | | | | | | | | |
| 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 |
| <i>Annual Broadleaf Weeds</i> | | | | | | | | | |
| 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 |
| 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 |
| <i>Perennial Grasses And Sedges</i> | | | | | | | | | |
| 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 |

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

¹Designates 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 (cont.)

| Weeds | Bentazon (Basagran) | Carfentrazone (Aim) | Pyraflufen (Venue) | Clethodim (Select) | Fluazifopbutyl (Fusilade) | Glufosinate (Rely) | Glyphosate (Various) | Paraquat ¹ (Gramoxone) | Sethoxydim (Poast) |
|--|------------------------|------------------------|-----------------------|-----------------------|------------------------------|-----------------------|-------------------------|--------------------------------------|-----------------------|
| 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 |
| <i>Perennial Broadleaf Weeds</i> | | | | | | | | | |
| 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 |
| <i>Special Perennial Weed Problems</i> | | | | | | | | | |
| Bigroot morningglory | - | - | - | N | N | - | F-G | P | N |
| Brambles | - | - | - | N | N | F-G | G | P | N |
| 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)

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3-26 Grapes: *Weed Control in Vineyards*

Table 3.8 - Chemical Names, Re-entry Times, and Days to Harvest¹

| Chemical (Other name) | Manufacturers | Re-entry time | Days to Harvest |
|----------------------------|-------------------|---------------|-----------------|
| Alion (indaziflam) | Bayer | 12 hours | 14 |
| Aim (carfentrazone) | FMC | 12 hours | 3 |
| Basagram (bentazon) | Arysta | 48 hours | 365 |
| Casoron (dichlobenil) | Chemtura | 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) | Dow AgroSciences | 12 hours | 60 |
| Goal (oxyfluorfen) | Dow AgroSciences | 24 hours | NA ² |
| Gramoxone (paraquat) | Syngenta | 12 hours | NA ⁵ |
| Karmex (diuron) | ADAMA | 12 hours | NA ³ |
| Kerb (pronamide) | Dow AgroSciences | 24 hours | NA ⁴ |
| Matrix (rimsulfuron) | DuPont | 4 hours | 14 |
| Poast (sethoxydim) | BASF | 12 hours | 50 |
| Princep (simazine) | Syngenta | 12 hours | NA ⁶ |
| Prowl (pendimethalin) | BASF | 24 hours | 365 |
| Rely (glufosinate) | Bayer | 12 hours | 14 |
| Roundup (glyphosate) | Monsanto | 4 hours | 14 |
| Select (clethodim) | Valent | 24 hours | 365 |
| Solicam (norflurazon) | Syngenta | 12 hours | 60 |
| Surflan (oryzalin) | United Phosphorus | 24 hours | NA ⁶ |
| Touchdown (glyphosate) | Syngenta | 12 hours | 14 |
| Venue (puraflufen-ethyl) | Nichino | 12 hours | 0 |
| Zeus C (sulfentrazone) | FMC | 12 hours | 3 |
| Zeus Prime XC | FMC | 12 hours | 3 |

¹This 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.

²Apply when crop is dormant.

³Apply between March and May.

⁴Apply in the fall after harvest.

⁵Do not allow paraquat to contact fruit.

⁶Apply between harvest and spring.