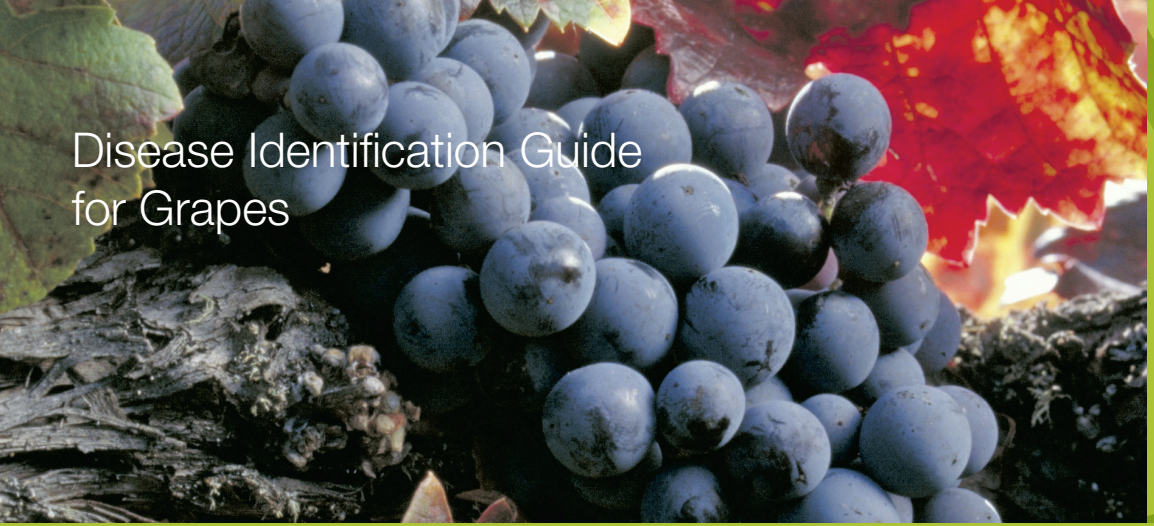
Disease Identification Guide for Grapes



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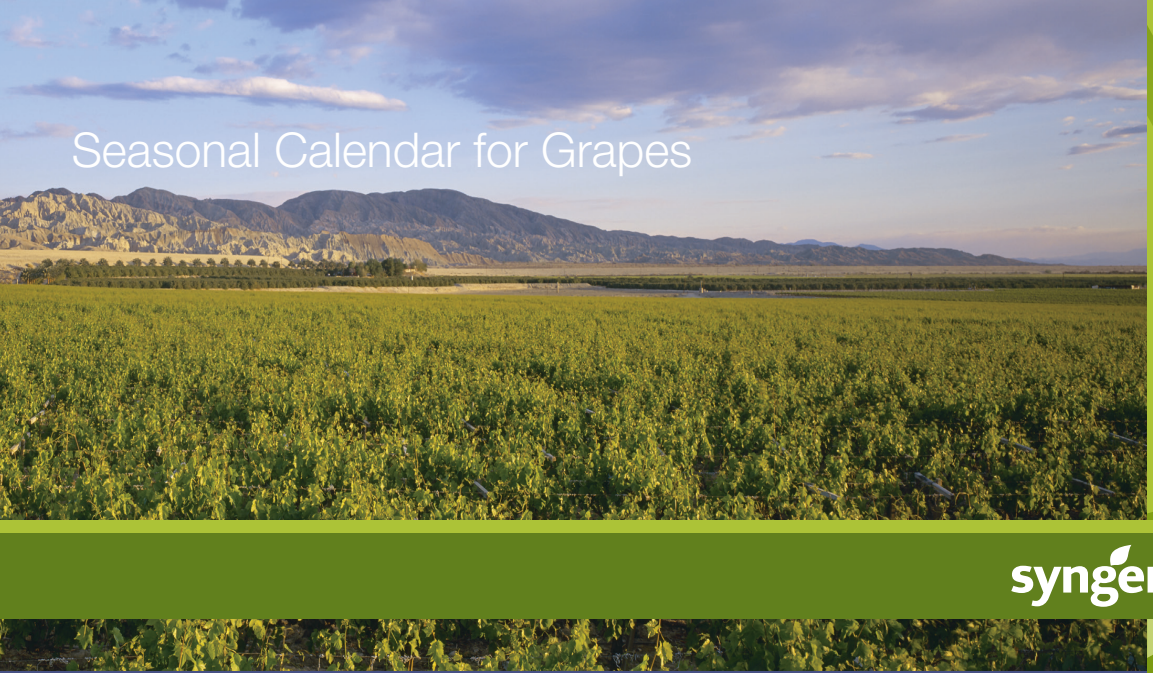
Syngenta Crop Protection helps grape growers achieve optimal yield by providing outstanding disease-control solutions.

Syngenta offers a broad product portfolio for control of grape diseases, insects and weeds. This portfolio comes from a commitment to research and development — Syngenta helps growers more efficiently produce high quality crops by bringing new products to the marketplace and by developing new uses for existing chemistries. Syngenta annually spends more than 10 percent of its sales revenue on research and development, and nearly 4,000 of its employees are involved in Research and Development. In addition, Syngenta has more than 400 agreements with universities and other research organizations.

Syngenta has developed specific solutions for preventive and curative disease management. Moreover, Syngenta works diligently to improve resistance management strategies to help ensure the continuation of outstanding crop protection solutions.

The information in this grape disease guide will help growers produce top-quality grapes through effective disease management. These fungicides have no effect on taste or taint of wine or the fermentation process. By recognizing a pathogen and knowing when to treat it and what to treat it with, growers commit themselves to the highest quality in crop production.

Seasonal Calendar for Grapes



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Example Programs For Disease Control on Grapes in West and East

Seasonal Calendar

DISEASES	Leaf Unfolded	Leaf Development	Early Flowering	Fruit Set/Swell	Fruit Development	Veraison	Preharvest
WESTERN GRAPES							
Powdery mildew			Quadris Top*	Inspire Super*	Miravis Prime		
Botrytis			Vangard	Miravis Prime		Inspire Super* Switch	
Summer bunch rot						Switch	
Phomopsis		Abound		Miravis Prime			

Inspire Super and Quadris Top are not currently registered for sale or use on grapes in all states. Revus Top is not currently registered for sale or use in all states. Please check with your state or local extension service before buying or using this product.

* Do not use on Concord, Concord Seedless or Thomcord. On *V. labrusca*, *V. labrusca* hybrids and other non-viniferea hybrids where sensitivity is not known - the use of Revus Top, Inspire Super or Quadris Top by itself or in tank mixtures with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects.

Note: Suggested timing for Syngenta brands. Incorporate alternate products according to their label for a complete disease program.

DISEASES	Leaf Unfolded	Leaf Development	Early Flowering	Fruit Set/Swell	Fruit Development	Veraison	Preharvest
EASTERN GRAPES							
Powdery mildew		Quadris Top*		RevusTop* / Miravis Prime		InspireSuper*	
Downy mildew			RidomilGold MZ	Revus / RevusTop*		Revus / RevusTop*	
Black rot			Quadris Top*	RevusTop*		InspireSuper*	

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Note: Suggested timing for Syngenta brands. Incorporate alternate products according to their label for a complete disease program.

Seasonal Calendar

DISEASES	Leaf Unfolded	Leaf Development	Early Flowering	Fruit Set/Swell	Fruit Development	Veraison	Preharvest
EASTERN GRAPES *continued*							
Phomopsis	Abound®						
Botrytis			Vangard®	Miravis® Prime		InspireSuper®* Switch®	

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* Do not use on Concord, Concord Seedless or Thomcord. On *V. labrusca*, *V. labrusca* hybrids and other non-viniferea hybrids where sensitivity is not known - the use of Revus Top, Inspire Super or Quadris Top by itself or in tank mixtures with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects.

Note: Suggested timing for Syngenta brands. Incorporate alternate products according to their label for a complete disease program.

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Protect Your Grapes from Phomopsis with Abound

Abound fungicide is the only truly systemic fungicide in the strobilurin class of products. Additionally, Abound is one of the strongest defenses against grape diseases. Abound has excellent activity against Phomopsis cane and leaf spot, and also provides control of powdery mildew, downy mildew and black rot. Its mode of action and powerful combination of preventive and systemic activity make Abound a one-of-a-kind disease management tool.

Abound®

Abound Recommendations for Grapes*

Target Diseases	Use Rate	Remarks
Black rot (*Guignarda bidwellii*) Downy mildew (*Plasmopara viticola*) Phomopsis cane and leaf spot (*Phomopsis viticola*) Powdery Mildew (*Uncinula necator)* Suppression Only: Botrytis bunch rot (*Botrytis cinerea*)	10-15.5 fl oz of product/A (0.16-0.25 lbs a.i./A)	Abound should be integrated into an overall disease management strategy that includes canopy management through pruning and thinning, proper selection of varieties with disease tolerance, proper timing and placement of irrigation and removal of plant debris in which inoculum overwinters. Do not apply more than two sequential foliar applications of Abound or other QoI fungicides before alternating with a fungicide that has a different mode of action. Begin Abound applications prior to disease development and continue throughout the season every 10 to 14 days following resistance management guidelines. Applications may be made by ground, air or chemigation. An adjuvant may be added at specified rates. Do not apply within 14 days of harvest (14-day preharvest interval [PHI]). Do not apply more than 1.5 lbs a.i./A/season of azoxystrobin-containing products. ** Please consult the Abound product label for complete use instructions.*

Effective Powdery Mildew Control and Botrytis Control

Inspire Super offers robust control of damaging grape diseases. The active ingredients provide complementary activity to control pathogens while offering rapid uptake into the plant due to the translaminar movement of difenoconazole and the xylem-mobile movement of cyprodinil. Inspire Super provides protection against quick-spreading diseases that cause severe crop yield and quality issues, including Botrytis and powdery mildew. Inspire Super applications provide consistent, reliable disease protection.

**Inspire Super is not currently registered for sale or use on grapes in all states. Please check with your state or local extension service before buying or using this product.*

InspireSuper®

Inspire Super Recommendations for Grapes*

PRECAUTION: Do not use on Concord, Concord Seedless or Thomcord. On *V. labrusca*, *V. labrusca* hybrids and other non-viniferea hybrids where sensitivity is not known - the use of Inspire Super by itself or in tank mixtures with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects.

Target Diseases	Use Rate	Remarks
Anthracnose (*Elsinoe ampelina*) Black rot (*Guignarda bidwellii*) Botrytis bunch rot and blight (*B. cinerea*) Leaf Blight (*Pseudocercospora vitis*) Powdery Mildew (*Uncinula necator)* Rotbrenner (*Pseudopezicula tracheiphila*)	16-20 fl oz of product/A	For powdery mildew, begin at bud break and apply on a 10-14 day interval, making no more than two sequential applications before alternating to a fungicide with a different mode of action. For Phomopsis diseases, apply at bud break, before shoots are 0.5 inches at length, and then again when shoots are 5-6 inches in length. For Black rot – begin when shoot length is 1-3 inches and continue on a 10 day interval. For all other disease, begin applications prior to disease onset when conditions are conducive for disease. Apply Inspire Super on a 10-21 day schedule** making no more than two sequential applications before alternating to another fungicide with a different mode of action. If disease pressure is high, use the shortest interval and highest rate.

Application: For best results, sufficient water volume must be used to provide thorough coverage. A minimum of 15 gal/A for ground applications is recommended. For aerial applications a minimum of 10 gal/A of water is recommended.

Specific Use Restrictions:

- Do not apply more than 80 fl oz/A of Inspire Super per season.
- Do not apply more than 0.46 lb a.i./A of difenoconazole containing product.
- Do not apply more than 1.4 lb a.i./A of cyprodinil containing product.
- Do not apply within 14 days of harvest (14-day PHI).

** Please consult the Inspire Super product label for complete use instructions.*

*** California, Washington and Oregon have received 2(ee) registration allowing a 10- to 21-day interval.*

** Inspire Super is not currently registered for sale or use on grapes in all states. Please check with your state or local extension service before buying or using this product.*

Top-notch *Botrytis* control with Miravis Prime

Miravis Prime offers a truly new approach to fighting the most damaging diseases in grapes, with a uniquely powerful combination of two active ingredients including Adepidyn® fungicide – the most complete SDHI mode of action fungicide ever developed. Miravis Prime leaves old technology behind through a combination of power, spectrum and stamina for better disease control and longer residual. When yield and quality are on the line, Miravis Prime delivers performance without compromises.

Miravis® Prime

Miravis Prime Recommendations for Grapes*

Target Diseases	Use Rate	Remarks
Alternaria rot, angular leaf spot, anthracnose, black rot, leaf blight, phomopsis cane and leaf spot, powdery mildew, rotbrenner, septoria leaf spot, gray mold	9.2 – 13.4 fl oz/A	Apply by ground, or air, or chemigation. An adjuvant may be added at recommended rates. Apply in sufficient volume to ensure good coverage of the bunches. If disease pressure is high, use the highest rate.

*Please consult the Miravis Prime product label for complete use instructions

Enhanced Strobilurin for Powdery and Other Diseases

Quadris Top is a broad-spectrum product and will provide utility as a resistance management tool. Offering growers reliability for sustainable and robust disease control, it has preventive, systemic and curative properties and is recommended for the control of many important grape diseases. This mixture represents an evolution of the Quadris® fungicide brand currently registered as a foliar fungicide. Quadris Top also demonstrates rapid uptake with translaminar movement of difenoconazole and xylem-systemic movement of azoxystrobin.

**Quadris Top is not currently registered for sale or use on grapes in all states. Please check with your state or local extension service before buying or using this product.*

Quadris Top®

Quadris Top Recommendations for Grapes*

PRECAUTION: Do not use on Concord, Concord Seedless or Thomcord. On *V. labrusca*, *V. labrusca* hybrids and other non-viniferea hybrids where sensitivity is not known - the use of Quadris Top by itself or in tank mixtures with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects.

Target Diseases	Use Rate	Remarks
Anthracnose (*Elsinoe ampelina*) Black rot (*Uncinula necator*) Downy mildew (*Plasmopara viticola*) Leaf blight (*Pseudocercospora vitis*) Powdery mildew (*Uncinula necator*) Rotbrenner (*Pseudopezicula tracheiphila*) Suppression only: Botrytis bunch rot (*B. cinerea*)	10-14 fl oz/A	Begin Quadris Top applications prior to disease onset when conditions are conducive for disease. Apply on a 14-21 day schedule making no more than two sequential applications before alternating to another fungicide with a non-QoI (Group 11) mode of action. If disease pressure is high, use the shortest interval and the highest rate. **Application:** For best results, use sufficient water volume to provide thorough coverage. Quadris Top can be applied by either ground (15 gallons per acre (GPA) minimum) or aerial application (10 GPA minimum). **Specific Use Restrictions:** • Do not apply more than 56 fl oz of Quadris Top/A/season (0.52 lb a.i./A/season). • Do not apply more than 0.46 lb a.i./A/crop of difenoconazole containing products. • Do not apply more than 1.5 lb a.i./A/crop of azoxystrobin containing products. • 14-day PHI. ** Please consult the Quadris Top product label for complete use instructions.*

** Quadris Top is not currently registered for sale or use on grapes in all states. Please check with your state or local extension service before buying or using this product.*

Get More Disease Protection with Revus

Developed with the grower in mind, Revus fungicide offers excellent control of downy mildew in grapes as well as highly effective, low use rates, a short re-entry period and short preharvest intervals. Additionally, Revus is classified as a Reduced Risk Pesticide[1] by the U.S. Environmental Protection Agency. With the powerful LOK + FLO™ action of Revus, the active ingredient mandipropamid quickly adheres to the plant's waxy layer and is rainfast in a short period of time, providing excellent preventive protection and good residual control. Revus is also a resistance management rotational partner with fungicides from other chemical classes.

Revus®

[1] A reduced-risk pesticide use is defined as one that "may reasonably be expected to accomplish one or more of the following:" (1) reduces pesticide risks to human health; (2) reduces pesticide risks to non-target organisms; (3) reduces the potential for contamination of valued, environmental resources, or (4) broadens adoption of Integrated Pest Management (IPM) or makes it more effective. Revus satisfies all four of these criteria.

Revus Recommendations for Grapes*

Target Disease	Use Rate	Remarks
Downy mildew (*Plasmopara viticola*)	8 fl oz/A (0.13 lbs a.i./A)	Begin Revus applications prior to disease development and continue throughout the season on a seven-day interval. Make no more than two consecutive applications before switching to another effective non-Group 40 fungicide. Use the shorter interval and/or higher rates under high pressure or when conditions are conducive to disease. The addition of a spreading/penetrating type adjuvant such as a non-ionic based surfactant or crop oil concentrate or blend is recommended. **Application Directions:** For best results, use sufficient water volume to provide thorough coverage. Revus may be applied by either ground (15 gallons per acre (GPA) minimum) or aerial application (10 GPA minimum). **Specific Use Restrictions:** • Do not apply more than 32 fl oz of Revus/A/season (0.52 lb a.i./A/season). • 14-day PHI. **Please consult the Revus product label for complete use instructions.*

Excellent Disease Protection with Revus Top

Revus Top fungicide offers grape growers a value option for excellent downy mildew and powdery mildew control. This mixture combines the highly effective activity of mandipropamid and difenoconazole with the unique LOK + FLO technology found only in Revus brands. Revus Top is a broad-spectrum product and an excellent alternate mode of action for disease control in grapes. Revus Top delivers long-lasting preventive protection for disease control throughout the leaf surface, even when environmental conditions favor disease development.

**Revus Top is not currently registered for sale or use in all states. Please check with your state or local extension service before buying or using this product.*

RevusTop®

Revus Top Recommendations for Grapes*

PRECAUTION: Do not use on Concord, Concord Seedless or Thomcord. On *V. labrusca*, *V. labrusca* hybrids and other non-viniferea hybrids where sensitivity is not known - the use of Revus Top by itself or in tank mixtures with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects.

Target Diseases	Use Rate	Remarks
Alternaria rot (*A. alternate*) Angular leaf spot (*Mycosphearella angulata*) Anthracnose (*Elsinoe ampelina*) Black rot (*Guignarda bidwellii*) Downy mildew (*Plasmopara viticola*) Leaf blight (*Pseudocercospora vitis*) Phomopsis cane and leaf spot (*P. viticola*) Powdery mildew (*Uncinula necator*) Rotbrenner (*Pseudopezicula tracheiphila*) Septoria leaf spot (*S. ampelina*)	7 fl oz of product/A	For powdery mildew, begin at bud break and apply on a 10-21 day interval, making no more than two sequential applications before alternating to a fungicide with a different mode of action. For Phomopsis diseases, apply at bud break, before shoots are 0.5 inches at length, and then again when shoots are 5-6 inches in length. For Black rot, begin when shoot length is 1-3 inches and continue on a 10 day interval. For all other diseases, begin applications prior to disease onset when conditions are conducive for disease. Apply Revus Top on a 10-14 day schedule making no more than two sequential applications before alternating to another fungicide with a different mode of action. The addition of a spreading/penetrating type adjuvant such as a non-ionic surfactant or crop oil concentrate or blend is recommended when applying by ground or air.

Application: For best results, sufficient water volume must be used to provide thorough coverage. Revus Top can be applied by either ground or aerial application. A minimum of 15 gal/A for ground applications is recommended. For aerial applications a minimum of 10 gal/A of water is recommended.

Specific Use Restrictions:

- Do not apply more than 28 fl oz/A of Revus Top per crop.
- Do not apply more than 0.46 lb a.i./A per season of difenoconazole containing products.
- Do not apply more than 0.52 lb a.i./A per season of mandipropamid containing products.
- 14-day PHI.
- Do not apply to Concord, Concord Seedless or Thomcord grapes; see label for other precautions.

** Please consult the Revus Top product label for complete use instructions.*

** Revus Top is not currently registered for sale or use in all states. Please check with your state or local extension service before buying or using this product.*

Develop Greater Protection with Ridomil Gold Copper

Ridomil Gold Copper fungicide is a highly effective foliar fungicide that protects grapes against downy mildew caused by *Plasmopara viticola*. Ridomil Gold Copper contains 5 percent of the active ingredient in Ridomil Gold and 60 percent of the active ingredient copper hydroxide. Ridomil Gold Copper protects plant surfaces to prevent disease infection before it starts.

RidomilGold® Copper

Ridomil Gold Copper Recommendations for Grapes*

Target Disease	Use Rate	Remarks
Downy mildew (*Plasmopara viticola*)	2 lbs of product/A	**Ridomil Gold Copper Alone:** Add ¼ of the required amount of water to the spray or mixing tank. With the agitator running, drop the required number of unopened soluble bags of Ridomil Gold Copper into the tank all at once. Continue agitation while adding the remainder of the water and during application to maintain a uniform suspension. **Tank Mixtures:** Consult your dealer or Syngenta sales representative for information concerning compatibility of other tankmix partners. **Application Directions:** Make up to four foliar applications beginning before bloom, but no closer than a three-day interval. Do not make an application within 42 days of harvest (42-day PHI). For late-season downy mildew control, apply other registered fungicides. If other formulations of Ridomil Gold are applied, do not apply more than a total of 0.4 lb a.i./A of Ridomil Gold per crop, per season. Do not use on copper-sensitive varieties. **Please consult the Ridomil Gold Copper product label for complete use instructions.*

Gain Excellent Protection with Ridomil Gold MZ WG

Ridomil Gold MZ WG fungicide is an extremely effective combination of mefenoxam (4 percent) and mancozeb (64 percent). The highly systemic nature of Ridomil Gold MZ WG makes this product ideal for protecting plants during their rapid growth stage early in the season. In addition, because Ridomil Gold MZ WG has two active ingredients, the risk of resistance is significantly reduced.

RidomilGold® MZ

Ridomil Gold MZ WG Recommendations for Grapes*

Target Disease	Use Rate	Remarks
Downy mildew (*Plasmopara viticola*)	2.5 lbs of product/A	**Ridomil Gold MZ WG Alone:** Add ¼ of the required amount of water to the spray or mixing tank. With the agitator running, add Ridomil Gold MZ WG into the tank all at once. Continue agitation while adding the remainder of the water and during application to maintain a uniform suspension. **Tank Mixtures:** Before tank mixing Ridomil Gold MZ WG with other registered products for any use on its label, read the label of the tankmix partner to be certain it is labeled for use on the particular crop and that use patterns are compatible with those of Ridomil Gold MZ WG. **Application Directions:** Make applications beginning before infection on a seven- to 10-day schedule until the threat of downy mildew has passed. Do not make an application within 66 days of harvest. For late-season downy mildew control, apply other registered fungicides. If other formulations of Ridomil Gold are applied, do not apply more than a total of 0.4 lb a.i./A of Ridomil Gold per crop, per season. If other registered fungicides containing Ethylene bisdithiocarbamate (EBDC) active ingredients are used during the growing season, do not exceed a total of 19.2 lbs of EBDC active ingredient per acre on grapes grown east of the Rocky Mountains, or 6 lbs of EBDC active ingredient per acre on grapes grown west of the Rocky Mountains. If tank mixed with other products containing EBDC active ingredients, do not exceed 3.2 lbs of EBDC active ingredients east of the Rocky Mountains, or 2 lbs of EBDC active ingredient west of the Rocky Mountains per crop, per acre, per application. **Please consult the Ridomil Gold MZ WG product label for complete use instructions.*

Effective Sour Rot Control Plus Exceptional Botrytis Control

Grape growers trust Switch fungicide for superior disease control. The fungicide is a mixture of two complementary active ingredients providing excellent protection against Botrytis bunch rot and sour rot on grapes. Conveniently premixed, Switch combines cyprodinil, the systemic component, and fludioxonil, the contact component, and offers two different modes of action. Switch attacks the pathogen at four different stages in the pathogen life-cycle, providing long-lasting control while protecting both the leaves and fruit by controlling diseases on the plant surface and within the plant.

Switch®

Switch Recommendations for Grapes*

Target Diseases	Use Rate	Remarks
Botrytis (grey mold) (*B. cinerea*) Sour rot (caused by a fungal complex)	11-14 oz of product/A	Begin applications of Switch at early bloom. Up to three additional applications may be made at berry touch, veraison or preharvest. Botrytis bunch rot is most effectively controlled by ground application, using sufficient water volume to provide thorough coverage. Thorough coverage of bunches is essential. Do not apply closer than a 21-day interval. For sour rot, make an application at veraison followed by one to two additional applications. Do not apply closer than a 21-day interval. Resistance management: After two applications of Switch, alternate with another fungicide with a different mode of action for two applications. **Please consult the Switch product label for complete use instructions.*

The Proven Winner Over Botrytis

Vangard WG fungicide is ideal for use on grapes due to its unique dual activity that stops the fungus in two ways. Vangard WG provides excellent control of Botrytis bunch rot (*Botrytis* spp.) and suppresses powdery mildew (*Uncinula necator*). Use of Vangard WG in a grape disease management program provides best results.

For more information about incorporating Vangard WG fungicide into a program, contact a Syngenta dealer or consultant.

Vangard®

Vangard WG Recommendations for Grapes*

Target Diseases	Use Rate	Remarks
Botrytis bunch rot (*Botrytis* spp.) Suppression Only: Powdery mildew (*Uncinula necator*)	Vangard WG alone 10 oz of product/A	Begin applications of Vangard WG at early bloom. Make an additional application at berry touch, veraison or preharvest using at least a seven-day spray interval. Botrytis bunch rot is most effectively controlled by ground application, but needs sufficient water volume to provide thorough coverage. Thorough coverage of bunches is essential. When used at 10 oz/A, Vangard WG will provide significant suppression (approximately 60 percent control) of powdery mildew.
	Vangard WG tank mixtures 5-10 oz of product/A	Apply Vangard WG in a tank mixture at a rate of 5-10 oz/A in combination with another fungicide registered for use on grapes.
		Apply Vangard WG by ground methods. Aerial application is allowed in California only. Make no more than one application by air. Use a minimum of 20 GPA spray volume by air. Make additional applications by ground up to the maximum allowable a.i./A per plot of land per year. Do not apply more than 30 oz/A of Vangard WG (1.4 lbs a.i./A of cyprodinil) per plot of land per year. Seven-day PHI. **Please consult the Vangard WG product label for complete use instructions.*

Disease Identification

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Black Measles – *causal organism unknown*

Symptoms

Affected leaves have small chlorotic areas between veins, which enlarge and dry out.

Small, round, dark spots bordered by brownish-purple rings may appear on berries any time between fruit set and ripening.

Part of the vine may die suddenly, usually during very hot periods.

Courtesy: W.D. Gubler

Disease Cycle

It is suspected that wood-rotting fungi enter the plant through large pruning wounds and release toxins that cause black measles. Leaf symptoms usually appear after bloom in July and August. Defoliation may occur under high disease severity.

Conditions for Development

The disease is most prevalent in areas with consistently high summer temperatures. Generally, black measles affects plantings 10 years or older.

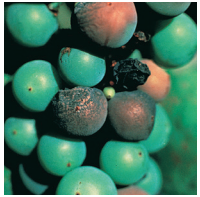
Black Rot – *Guignardia bidwellii*

Symptoms

Leaf lesions are small (2 to 10 mm in diameter), tan and circular with a dark brown border.

© American Phytopathological Society

Black rot in various stages of disease development on a cluster of Aurore grapes.

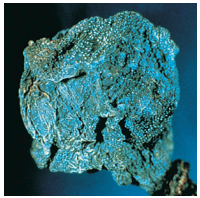


© American Phytopathological Society

Pycnidia: tiny black spore-producing bodies that often develop in lesions.

© American Phytopathological Society

Within days of infection, the berry shrivels and dries into a hard, black mummy.



© American Phytopathological Society

Disease Cycle

The black rot fungus overwinters in mummified berries on the ground or in old clusters still hanging on the vine. Spores are released in the spring shortly after bud break and may infect all new growth. Lesions develop three to five days after infection. Vast numbers of spores are released during the growing season and cause secondary infections. Peak fruit infection occurs in mid-bloom and can continue until berry coloring. Young plant tissue is more susceptible than old plant tissue. Mature leaves and ripe fruit are not susceptible.

Conditions for Development

Spore release and dissemination are dependent on splashing rain or irrigation (one to three hours is optimal). Leaf infection occurs after six hours of wetness at 81 F, but requires 24 hours at 50 F and 12 hours at 90 F. Little or no infection occurs above 90 F.

Syngenta products effective on black rot

Quadris Top, Inspire Super, Abound, Revus Top

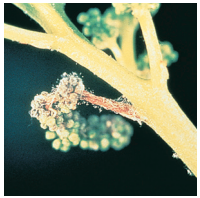
Botrytis Bunch Rot – *Botrytis cinerea*

Symptoms

Prior to bloom, large reddish-brown necrotic lesions may occur on a few leaves (usually on the leaf edge).

© American Phytopathological Society

Infected inflorescences often rot and dry out.



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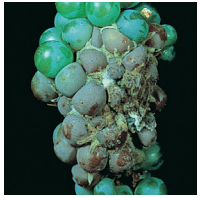
Pedicel or rachis infection forms small brown patches that turn black. Portions of the cluster wither and drop off.

© American Phytopathological Society

Fruit infection causes clusters to rot and berries to turn brown or a reddish color.



© American Phytopathological Society

A brownish-gray mold may envelop infected berries.

Courtesy: Mike Ellis, The Ohio State University

Disease Cycle

The bunch rot fungus overwinters as dormant mycelium in buds or on bark, spurs and cordons, or as sclerotia in berry mummies. In the spring, spores produced from the overwintering fungus are water-splashed and windblown to newly emerging leaves. Infections that occur during bloom often become dormant until later in the season when sugar concentration increases in the infected berry. Spores from infected fruit may infect ripe berries as harvest approaches.

Conditions for Development

Botrytis bunch rot favors cool, damp weather conditions. The optimum temperature for infection is 59 F to 68 F, but infection may occur up to 86 F. Spore germination and infection require at least 90 percent humidity or free moisture on the plant surface.

Syngenta products effective on Botrytis bunch rot

Inspire Super, Miravis Prime, Switch, Vangard

Downy Mildew – *Plasmopara viticola*

Symptoms

All green parts of the plant are susceptible, especially leaves. Leaf lesions are yellow and oily in the spring.

© American Phytopathological Society

Fungal sporulation is a dense, white, cottony growth on the undersides of leaves.

Courtesy: W. Wilcox

Late-season leaf lesions are angular and yellow to reddish-brown. Severe infection usually defoliates the plant.

© American Phytopathological Society

Young berries are highly susceptible. When infected, they are gray and covered with the downy felt of fungus sporulation.

© American Phytopathological Society

On a developed cluster, infected berries turn purple, shrivel and die.

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Disease Cycle

The downy mildew fungus may overwinter as oospores in fallen leaves, but can also survive as mycelium in buds and leaves. The oospores germinate in water in the spring when temperatures reach 52 F. Overwintering oospores or mycelium form sporangia that germinate to release zoospores. Because zoospores infect via stomates, only plant structures with stomata are susceptible. The time from infection to visible symptoms is about four days. Vast numbers of spores are produced during the growing season. These spores are wind-disseminated and cause secondary infection.

Conditions for Development

Disease development is favored by mild, wet weather. Optimum conditions for sporulation are temperatures from 64 F to 72 F and 95 percent to 100 percent humidity. Sporangia germinate in free water at 72 F to 77 F but may be inactivated by sunlight. The optimum temperature for disease development is 77 F.

Syngenta products effective on downy mildew

Abound, Aprovia Top, Quadris Top, Revus, Revus Top, Ridomil Gold Copper, Ridomil Gold MZ WG

Eutypa Dieback – *Eutypa lata*

Symptoms

Following delayed emergence in the spring, shoots on older vines are stunted and have shortened internodes. Leaves look tattered and chlorotic.

Courtesy: Edward Hellman Texas A&M University

Black stromata containing fungal fruiting bodies called perithecia may occur on the surface of dead wood.

© H. Lepp, Australian National Botanical Gardens

Dark, wedge-shaped cankers develop in vascular tissue.

Courtesy: Edward Hellman Texas A&M University

Necrosis of wood tissue as a result of Eutypa infection surrounding a pruning wound.

Courtesy: Edward Hellman Texas A&M University

Disease Cycle

The fungus survives in diseased wood and produces perithecia in old, infected host tissue. The perithecia reach maturity in early spring and disseminate ascospores after almost every rainfall throughout the growing season. Infections occur through pruning wounds. No symptoms are observed during the first one or two years after infection. Death of infected arms or trunks may not occur for several years.

Conditions for Development

High moisture is required for perithecia production. Rain is required for ascospore release. Ascospores germinate in 11 to 12 hours at the optimal temperatures of 68 F to 77 F. Fresh wounds are the most susceptible. As the wound matures, susceptibility is reduced. After four weeks, wounds are no longer susceptible to infection. The disease generally is visible only in vines more than six years old.

Phomopsis Cane and Leaf Spot – *Phomopsis viticola*

Symptoms

Small light green or chlorotic leaf lesions with dark centers occur along leaf veins or margins, eventually turning brown and necrotic.

Lesions on shoots, rachises and petioles are dark brown to black streaks or blotches. During rapid shoot growth, lesions often crack and become open fissures.

Infected fruit turns brown and shrivels. Black pycnidia – the fungal spore-producing bodies – may be seen on infected berries.

Disease Cycle

The Phomopsis fungus overwinters as mycelium and pycnidia in bark and dormant buds. In the spring, pycnidia produce spores that are splashed onto very young shoots. Leaf symptoms appear 21 to 30 days after infection. Severe fruit rot at harvest often follows fruit infection during bloom. The pathogen spreads mainly via splashing rain, so localized areas of infection may be observed in the vineyard.

Conditions for Development

The optimum temperature for infection is 73 F, but infection may occur at much lower temperatures. Infection may take place in just a few hours in free water or 100 percent humidity. Epidemics can occur when rain continues for several days following bud break in early spring, especially if cool weather slows shoot growth. During summer in warm, dry climates, the fungus becomes inactive.

Syngenta products effective on phomopsis cane and leaf spot

Abound, Revus Top

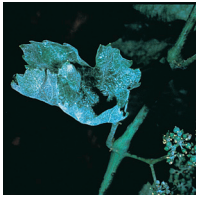
Powdery Mildew – *Uncinula necator*

Symptoms

Mycelia on the surface of any green tissue gives it a whitish-gray, dusty or powdery appearance. Both the upper and lower surfaces of leaves are susceptible.

Courtesy:
Yuan-Min Shen, Taichung District Agricultural Research and Extension Station

Young shoots growing from infected buds are the first to be covered with the powdery mycelia. Young, growing leaves become distorted and stunted.



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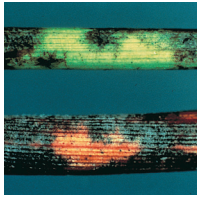
Green shoots turn dark brown to black in feathery patches. Dormant canes appear reddish-brown.



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Infected berries often split, opening the way for secondary infection, or fail to ripen properly, giving them a blotchy appearance at harvest.

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A netlike pattern of scar tissue may be seen on the surface of infected berries.

© American Phytopathological Society

Late in the season, small, round, black overwintering structures called cleistothecia may be observed on infected plant tissue.

© American Phytopathological Society

Disease Cycle

The powdery mildew fungus overwinters inside dormant buds as mycelium or on the surface of the vine as cleistothecia. Shortly after bud break, the fungus produces spores that cause primary infection. Spores are readily disseminated by the wind to cause new infections. The time from infection to sporulation can be as short as five to six days.

Conditions for Development

Powdery mildew is considered a dry weather disease. Infection can occur between 40 percent to 100 percent relative humidity; however, free water on plant surfaces slows disease development. Temperature is the most limiting factor of disease development; 68 F to 81 F is optimal. Temperatures above 104 F may kill the spores. Low, diffuse light favors disease development. As a result, disease severity may be greater inside the grape canopy.

Syngenta products effective on powdery mildew

Abound, Aprovia Top, Inspire Super, Quadris Top, Revus Top

Summer Bunch Rot (Sour Rot) –
Aspergillus niger, Alternaria tenuis, Botrytis cinerea, Cladosporium herbarum, Rhizopus arrhizus, Penicillium spp., and others

Symptoms

Sour rot showing bluish sporulation typical of Penicillium infection on grapes.

Sour rot showing black sporulation typical of Rhizopus rot.

Affected berries drip juice and smell like vinegar.

© American Phytopathological Society

Disease Cycle

As berries ripen and sugar content passes 8 percent, injured fruit becomes susceptible to invasions by many fungi. These fungi may enter at any injury point caused by insects, birds or mechanical damage, or through lesions resulting from powdery mildew or other diseases on the berry. From there, rot progresses. Many sour rot fungi produce massive numbers of spores that are disseminated by wind and splashing water.

Conditions for Development

Summer bunch rot favors high relative humidity, rain and sprinkler irrigation while berries are maturing. The longer the wet period, the greater the rot. Injury or damage to the fruit may predispose the bunch to infection.

Syngenta products effective on summer bunch rot

Switch

Syngenta Resources

Syngenta is committed to providing growers with the edge needed to grow excellent grapes.

Syngenta Crop Protection
410 Swing Rd.
Greensboro, NC 27409
For emergencies call 1-800-888-8372
(exposure concerns, spills and leaks)

Syngenta Customer Center

- For product support and compliance call 1-866-796-4368

www.SyngentaUS.com/cropprotection

- Product labels
- Material Safety Data Sheets (MSDS)
- Sales representative finder to locate your local representative
- Product-specific training modules
- Company news and product updates

Product performance assumes disease presence.

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