

Stage	Diseases Controlled	Fungicides	Comments
Late Dormant	Phomopsis, anthracnose, powdery mildew	Lime sulfur	
Bud break (½ - 1 inch expansion; early)	Phomopsis, initial powdery mildew infection, early downy mildew*	Mancozeb + Sulfur	
New shoot through prebloom (next application 7-10 days after bud break application and continue every 7-10 days through prebloom)	Phomopsis, initial powdery mildew, early downy mildew*, reducing rots indirectly	<p>Mancozeb + Sulfur**</p> <p>Numerous powdery mildew controlling fungicides can be utilized, but select ones with strong activity; see the efficacy chart below for active fungicides. Use sulfur as much as possible (does not develop resistance) – as long as it can be used without phytotoxicity. When rainfall is prevalent, incorporate or substitute systemic materials (e.g. Rally, other DMIs, etc.), as sulfur is washed off relatively easily.</p> <p>If conditions are wet (rainfall and/or heavy dews) and/or downy mildew has been observed, add Prophyt or Revus or Revus Top or Zampro or the high rate of Ranman + phosphonates (e.g. Prophyt) for additional downy mildew control.***</p>	<p>Continue to use Mancozeb + Sulfur till it is too hot; then switch to Rally or other powdery mildew materials on sensitive varieties.</p> <p>At the first sign (observation or confirmation) of downy mildew, I highly recommend an application of Ridomil Gold MZ.***</p>
Prebloom (Critical period)	Phomopsis, powdery mildew, downy mildew*, reducing rots indirectly	<p>Mancozeb + Luna Experience</p> <p>Other powdery mildew controlling fungicides can be utilized, but select ones with strong activity; see the efficacy chart below for other materials.</p> <p>If conditions are wet (rainfall and/or heavy dews) and/or downy mildew has been observed, add Prophyt or Revus or Revus Top or Zampro or the high rate of Ranman + phosphonates (e.g. Prophyt) for additional downy mildew control.</p>	<p>Consider using a really active powdery mildew material at this stage, something like Luna Experience [also controls Botrytis].</p> <p>Powdery mildew is known to develop resistance to DMI fungicides such as Rally. Tank-mixing low rates of sulfur and DMIs will help to avoid resistance.</p> <p>The strobilurin materials (e.g. Pristine, Abound, Flint, Sovran) can also be utilized, but they are not likely to give control of powdery mildew, downy mildew or</p>

			Botrytis on long-established vineyards due to resistance.
Bloom (Critical period)	Controlling Botrytis, Phomopsis, powdery mildew, downy mildew* and reducing rots	<p>Mancozeb + Luna Experience</p> <p>Other powdery mildew controlling fungicides can be utilized, but select ones with strong activity; see the efficacy chart below for other materials.</p> <p>For Botrytis, apply an active material (Aprovia or Kenja or Rovral or Elevate or Switch or Inspire Super or Scala or Endura or Pristine or Luna Experience or Luna Tranquility or Vanguard).</p> <p>If conditions are wet (rainfall and/or heavy dews) and/or downy mildew has been observed, add Prophyt or Revus or Revus Top or Zampro or the high rate of Ranman + phosphonates (e.g. Prophyt) for additional downy mildew control.</p>	<p>Consider using a really active powdery mildew material at this stage, something like Luna Experience [also controls Botrytis].</p> <p>Resistance to Botrytis develops rapidly in fungicides, so test Botrytis isolates each year for resistance through the Profile system (Clemson University and UGA).</p> <p>Powdery mildew is known to develop resistance to DMI fungicides such as Rally. Tank-mixing low rates of sulfur and DMIs will help to avoid resistance.</p> <p>Overconcentration of phosphonates such as Prophyt can cause plant damage (phytotoxicity).</p> <p>Vanguard does not work well at higher temperatures, so this might be the best time to use it for Botrytis, if utilized at all.</p> <p>Use a different Botryticide chemical class (FRAC code) at bloom, bunch closure, veraison, and preharvest to prevent resistance development.</p> <p>The strobilurin materials (e.g. Pristine, Abound, Flint, Sovran) can also be utilized, but they are not likely to give control of powdery mildew, downy mildew or Botrytis on long-established vineyards due to resistance.</p>
1st and 2nd cover sprays (Critical period)	Controlling downy mildew*, powdery	Mancozeb + Sulfur	Keep in mind that Mancozeb has a 66 day preharvest interval, so you might have to

	mildew, Phomopsis and rots	<p>Numerous powdery mildew controlling fungicides can be utilized, but select ones with strong activity; see the efficacy chart below for active fungicides. Use sulfur as much as possible (does not develop resistance) – as long as it can be used without phytotoxicity. When rainfall is prevalent, incorporate or substitute systemic materials (e.g. Rally, other DMIs, etc.), as sulfur is washed off relatively easily.</p> <p>If conditions are wet (rainfall and/or heavy dews) and/or downy mildew has been observed, add Prophyt or Revus or Revus Top or Zampro or the high rate of Ranman + phosphonates (e.g. Prophyt) for additional downy mildew control.***</p>	<p>switch to Captan, but you are likely to make it through second cover.</p> <p>Powdery mildew is known to develop resistance to DMI fungicides such as Rally. Tank-mixing low rates of sulfur and DMIs will help to avoid resistance.</p> <p>The strobilurin materials (e.g. Pristine, Abound, Flint, Sovran) can also be utilized, but they are not likely to give control of powdery mildew, downy mildew or Botrytis on long-established vineyards due to resistance.</p>
3rd cover (Critical period)****	Controlling downy mildew*, powdery mildew, Phomopsis and rots	<p>Captan + Sulfur</p> <p>Numerous powdery mildew controlling fungicides can be utilized, but select ones with strong activity; see the efficacy chart below for active fungicides. Use sulfur as much as possible (does not develop resistance) – as long as it can be used without phytotoxicity. When rainfall is prevalent, incorporate or substitute systemic materials (e.g. Rally, other DMIs, etc.), as sulfur is washed off relatively easily.</p> <p>If conditions are wet (rainfall and/or heavy dews) and/or downy mildew has been observed, add Prophyt or Revus or Revus Top or Zampro or the high rate of Ranman + phosphonates (e.g. Prophyt) for additional downy mildew control.***</p>	<p>Powdery mildew is known to develop resistance to DMI fungicides such as Rally. Tank-mixing low rates of sulfur and DMIs will help to avoid resistance.</p> <p>The strobilurin materials (e.g. Pristine, Abound, Flint, Sovran) can also be utilized, but they are not likely to give control of powdery mildew, downy mildew or Botrytis on long-established vineyards due to resistance.</p>
Bunch closure	Controlling Botrytis, powdery mildew, downy mildew, Phomopsis and reducing rots	<p>Captan + Sulfur</p> <p>For Botrytis, apply an active material (Aprovia or Kenja or Rovral or Elevate or Switch or Inspire Super or Scala or Endura or Pristine or Luna Experience or Luna Tranquility).</p>	<p>This is the last opportunity to deliver a fungicide into the cluster.</p> <p>Resistance to Botrytis develops rapidly in fungicides, so test Botrytis isolates each year for resistance through the Profile system (Clemson University and UGA).</p>

		<p>Numerous powdery mildew controlling fungicides can be utilized, but select ones with strong activity; see the efficacy chart below for active fungicides. Use sulfur as much as possible (does not develop resistance) – as long as it can be used without phytotoxicity. When rainfall is prevalent, incorporate or substitute systemic materials (e.g. Rally, other DMIs, etc.), as sulfur is washed off relatively easily.</p> <p>If conditions are wet (rainfall and/or heavy dews) and/or downy mildew has been observed, add Prophyt or Revus or Revus Top or Zampro or the high rate of Ranman + phosphonates (e.g. Prophyt) for additional downy mildew control.***</p>	<p>Use a different Botryticide chemical class (FRAC code) at bloom, bunch closure, veraison, and preharvest to prevent resistance development.</p> <p>Powdery mildew is known to develop resistance to DMI fungicides such as Rally. Tank-mixing low rates of sulfur and DMIs will help to avoid resistance.</p> <p>The strobilurin materials (e.g. Pristine, Abound, Flint, Sovran) can also be utilized, but they are not likely to give control of powdery mildew, downy mildew or Botrytis on long-established vineyards due to resistance.</p>
4th cover****	Controlling powdery mildew, downy mildew, Phomopsis and reducing rots	<p>Captan + Sulfur</p> <p>Numerous powdery mildew controlling fungicides can be utilized, but select ones with strong activity; see the efficacy chart below for active fungicides. Use sulfur as much as possible (does not develop resistance) – as long as it can be used without phytotoxicity. When rainfall is prevalent, incorporate or substitute systemic materials (e.g. Rally, other DMIs, etc.), as sulfur is washed off relatively easily.</p> <p>If conditions are wet (rainfall and/or heavy dews) and/or downy mildew has been observed, add Prophyt or Revus or Revus Top or Zampro or the high rate of Ranman + phosphonates (e.g. Prophyt) for additional downy mildew control.***</p>	<p>Powdery mildew is known to develop resistance to DMI fungicides such as Rally. Tank-mixing low rates of sulfur and DMIs will help to avoid resistance.</p> <p>The strobilurin materials (e.g. Pristine, Abound, Flint, Sovran) can also be utilized, but they are not likely to give control of powdery mildew, downy mildew or Botrytis on long-established vineyards due to resistance.</p>
Veraison****	Controlling Botrytis, powdery mildew, downy mildew, Phomopsis and reducing rots	<p>Captan + Sulfur</p> <p>For Botrytis, apply an active material (Aprovia or Kenja or Rovral or Elevate or Switch or Inspire Super or Scala</p>	<p>Resistance to Botrytis develops rapidly in fungicides, so test Botrytis isolates each year for resistance through the Profile system (Clemson University and UGA).</p>

		<p>or Endura or Pristine or Luna Experience or Luna Tranquility).</p> <p>Numerous powdery mildew controlling fungicides can be utilized, but select ones with strong activity; see the efficacy chart below for active fungicides. Use sulfur as much as possible (does not develop resistance) – as long as it can be used without phytotoxicity. When rainfall is prevalent, incorporate or substitute systemic materials (e.g. Rally, other DMIs, etc.), as sulfur is washed off relatively easily.</p> <p>If conditions are wet (rainfall and/or heavy dews) and/or downy mildew has been observed, add Prophyt or Revus or Revus Top or Zampro or the high rate of Ranman + phosphonates (e.g. Prophyt) for additional downy mildew control.***</p>	<p>Use a different Botryticide chemical class (FRAC code) at bloom, bunch closure, veraison, and preharvest to prevent resistance development.</p> <p>If conditions are wet and/or downy mildew has been observed, use Captan + Prophyt, Revus, Revus Top, Zampro, or the high rate of Ranman plus phosphonates (e.g. Prophyt) for downy mildew.***</p> <p>One month prior to harvest, cut off sulfur use.</p> <p>Powdery mildew is known to develop resistance to DMI fungicides such as Rally. Tank-mixing low rates of sulfur and DMIs will help to avoid resistance.</p> <p>The strobilurin materials (e.g. Pristine, Abound, Flint, Sovran) can also be utilized, but they are not likely to give control of powdery mildew, downy mildew or Botrytis on long-established vineyards due to resistance.</p>
<p>Preharvest****</p>	<p>Controlling Botrytis, powdery mildew, downy mildew and reducing rots</p>	<p>Captan + Rally</p> <p>For Botrytis, apply an active material (Aprovia or Kenja or Rovral or Elevate or Switch or Inspire Super or Scala or Endura or Pristine or Luna Experience or Luna Tranquility).</p> <p>Numerous powdery mildew controlling fungicides can be utilized, but select ones with strong activity; see the efficacy chart below for active fungicides.</p> <p>If conditions are wet (rainfall and/or heavy dews) and/or downy mildew has been observed, add Prophyt or Revus or Revus Top or Zampro or the high rate of</p>	<p>Resistance to Botrytis develops rapidly in fungicides, so test Botrytis isolates each year for resistance through the Profile system (Clemson University and UGA).</p> <p>Use a different Botryticide chemical class (FRAC code) at bloom, bunch closure, veraison, and preharvest to prevent resistance development.</p> <p>One month prior to harvest, cut off sulfur use.</p>

		Ranman + phosphonates (e.g. Prophyt) for additional downy mildew control.***	<p>Check all preharvest intervals for any fungicides utilized in this time frame, as several are pretty long. Rally is 14 days for example.</p> <p>The strobilurin materials (e.g. Pristine, Abound, Flint, Sovran) can also be utilized, but they are not likely to give control of powdery mildew, downy mildew or Botrytis on long-established vineyards due to resistance.</p>
Postharvest	Controlling powdery and downy mildew to prevent defoliation	Mancozeb + sulfur	

*Mancozeb and then Captan are good materials for downy mildew, and these fungicides are the backbone of your downy mildew spray program. However, at the first sign of downy mildew, I highly recommend an application of Ridomil Gold MZ. It is the “hammer,” and I would only use it once per year when you actually observe downy mildew in the vineyard. It also has a 66 day PHI, so it can only be utilized in an early-season application window. Incorporate more active downy mildew materials if it is wet and/or after downy mildew is observed; once observed, incorporate more active materials for the remainder of the season.

**You will need to have a fungicide application every 7-10 days that covers all diseases in the efficacy chart below (7 days when wet conditions prevail, and stretching to 10 days when dry conditions prevail – 14 days absolute maximum between sprays under bone dry conditions. Note that for most of the season, especially mid- to late season, powdery mildew does better under dry conditions, so you still need to make sure you cover this one well even when it is dry. Heavy dews provide sufficient moisture for most fungi to infect. Follow all label directions, as not all fungicides allow for a seven-day interval; however, alternation of different fungicides will allow for seven-day intervals.

*** If conditions are wet, use Prophyt + Captan, Revus, Revus Top, Zampro, or the high rate of Ranman plus phosphonates (e.g. Prophyt) for downy mildew; in fact, you should probably rotate these in periodically anyway – just for added insurance. The strobilurin materials (Pristine, Abound) can also be utilized on a new vineyard, as you are not likely to have resistance to downy mildew; they are also very efficacious against downy mildew until resistance develops. In new vineyards that are not in close proximity to older, established vineyards, use the strobilurins sparingly (limited number of applications per year), as resistance develops rapidly in downy mildew, as well as powdery mildew and Botrytis.

For downy mildew management, you should rotate among the chemical classes (FRAC Groups) of materials, and it would be best that you not utilize each of these materials more than once per year. Again, in older vineyards where the strobilurin materials have been utilized over time, resistance has likely developed in both powdery and downy mildew against this chemical class (Abound, Pristine, Sovran, etc.). To reiterate, do not utilize these materials and expect control of powdery mildew, downy mildew, or Botrytis where they have been utilized extensively in the past; switch to other active materials and rotate among classes. Mancozeb, captan and sulfur do not develop resistance in fungal populations, and the phosphonates develop resistance slowly. Therefore, use these materials

as the backbone of your spray programs when possible; keep in mind that sulfur can cause damage, and it should not be used on Norton at all for this reason; know your hybrids and whether sulfur will cause damage if utilized.

***Keep in mind that you need fungicides applied every 7-10 days, so you might apply more or less cover sprays between each of the applications listed above, depending on how rapidly the season advances. The same is true of the period between veraison and preharvest.

Disclaimer: Read the labels relative the timing between applications of these materials, REI, PHI, etc., as the label is the law. Note that we have not mixed all these products to determine their compatibility in a spray tank or other issues. Conduct a jar test to determine the initial compatibility, as well as following the label directions relative mixing products or avoiding potential plant damage for specific materials.

Efficacy of selected fungicides against diseases of bunch grapes

Chemical name (Fungicide product name)	Anthracnose	Black rot	Bitter rot	Botrytis rot	Downy mildew	Phomopsis cane and leaf spot	Powdery mildew
Azoxystrobin (Abound)		E ^a	E	G ^b	E ^b	G	E ^b
Benzovindiflupyr (Aprovia), Isofedamid (Kenja)	G ^c	VG		E ^b			VG ^c
Boscalid (Endura)				E ^b			VG ^c
Boscalid <i>plus</i> Pyraclostrobin (Pristine)	VG	E	E	E ^b	E ^b	E	E
Captan (Captan, Captec, etc.)	G	G	E	F	VG	VG	NA
Fixed coppers and Bordeaux mixture (various)		G	F	G	G	F	F
Cyazofamid (Ranman)					VG		
Cyflufenamid (Torino)		NA	NA	NA	NA	NA	VG
Cyprodinil (Vangard)		NA	NA	E ^b	NA	NA	F
Cyprodinil <i>plus</i> Fludioxonil (Switch)				VG ^b			
Cyprodinil <i>plus</i> Difenconazole (Inspire Super)		VG		VG ^b			VG
Famoxadone <i>plus</i> cymoxanil (Tanos)					G ^b		
Fenhexamid (Elevate)		NA	NA	E ^b	NA	NA	NA
Ferbam (Ferbam)		VG	G	NA	F	F	NA
Fenarimol (Rubigan)		F	NA	NA	NA	NA	E ^b
Fluopyram <i>plus</i> tebuconazole (Luna Experience)	NA	E	NA	E ^b	NA	NA	E
Iprodione (Rovral, Meteor)	NA	NA	NA	G ^b	NA	NA	NA
Kresoxim-methyl (Sovran)		E	E	F ^b	G ^b	G	E ^b
Lime Sulfur (dormant application)	G			NA	NA	G	F
Mancozeb (various: Penncozeb, Dithane, etc)		E	E	NA	E	E	NA
Mandipropamid (Revus), Dimethomorph (Forum), Dimethomorph <i>plus</i> Ametoctradin (Zampro)	NA	NA	NA	NA	E	NA	NA
Mandipropamid <i>plus</i> Difenconazole (Revus Top)							
Mefanoxam <i>plus</i> Copper (Ridomil Gold Copper)		F	F	F	E	F	F
Mefanoxam <i>plus</i> Mancozeb (Ridomil Gold MZ)		G	G	NA	E	G	NA
Metrafenone (Vivando)		NA	NA	NA	NA	NA	VG
Myclobutanil (Rally)		E	F	NA	NA	NA	E ^b
Phosphonate (ProPhyt, Phostrol, etc.)					VG		
Pyrimetamil (Scala)				E			
Sulfur ^d (various)		NA	NA	NA	NA	F	E
Tebuconazole (Elite)		E	NA	NA	NA	NA	E ^b
Tetraconazole (Mettle)							VG ^b
Thiophanate-methyl (Topsin M)		F	G	NA	NA	G	E ^b
Trifloxystrobin (Flint)		E	E	VG	G	F	E ^b
Triflumazole (Procure and Viticure)		G ^b	NA	NA	NA	NA	E
Ziram (Ziram)		VG	NA	F	VG	G	NA

^a The efficacy rating: NA = no significant activity; P = very limited activity, F = limited activity, G = moderate activity, VG = good activity, E = excellent activity

^b Resistance (or occasional failure of control) has been observed in some southeastern states, thus, if control failure occurs, it could indicate resistance has developed. The efficacy rating could be impacted by resistance development. If resistance has occurred, use of fungicides in the same class would likewise show resistance, and a substitute fungicide should be considered for pathogen management.

^c Insufficient data for the pathogen-chemical combination. The rating was given based on the general knowledge on the material.

^d Sulfur will cause burn on sensitive varieties, especially on hot days when temperature reaches above 85F when foliage are wet.