2010 Southeast Regional Bunch Grape Integrated Management Guide

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Bunch Grape Integrated Management Guide (Insect and Disease Control)

Establishment

Site selection – Site selection may be the most important decision of the thousands of decisions that will be made over the life of a vineyard. Virtually every aspect of production and marketing will, in some aspect, be affected by site. Time spent in selecting, preparing and maintaining a site can result in greater cropping consistency, higher fruit quality, reduced pest pressures, increased efficiency in maintaining the vineyard and, potentially, longer vineyard life. **Elevation** in regards to immediate surroundings provides some protection from frosts and diseases. Frosts and fogs settle in low areas first. Vineyards in elevated sites may escape damaging low temperatures. They may also dry off faster after a rain or dew, thus lessening the potential for development of certain diseases. **Direction of slope** may also impact vineyard performance. Vines on a south-facing slope are more prone to trunk injury from winter cold and, since they become active earlier in spring, to spring frosts. An east-facing slope dries off quicker than others thus lessening pressure from certain diseases. **Soils** should have a minimum rooting depth of 24 to 30 inches with good internal and surface drainage. Highly fertile soils are not desirable as vine growth may be excessive resulting in reduced yields, poor fruit quality and high disease potential. The spacing between vines and rows may be increased and the type of trellis modified to accommodate more fertile sites, however, many of the problems due to excessive vigor will still exist. The ideal pH of vineyard soils is in the range of 6.0 to 6.5 for American bunch and French-American hybrids and 6.5 for *Vitis vinifera*. The presence of wild grapevines near the site may increase problems with certain pests of grapes. Adjacent woodlands, brushy areas and power lines may be good nesting and roosting sites for birds, which can cause significant damage to crops.

Site development – Once a site has been selected, ample time should be devoted to preparing the site well in advance of planting. Hedgerows, overgrown fencerows or any other obstacles to good air drainage out of the vineyard site should be removed. Certain non-persistent herbicides that are not labeled for vineyards can be used in advance of planting to eliminate noxious weeds. **Soil testing** should be done to determine the nutritional status of the soil. Collect one sample in the upper 8 inches of soil (discard the top inch) and a second sample in the 8 to 16-inch depth. If needed, fertilizer and lime should be applied and incorporated into the soil well in advance of planting. Where magnesium levels are low, use dolomitic limestone. The desired amount of phosphorus should be incorporated during preplant soil preparation and should provide adequate phosphorus for the life of the vineyard. If the field is rough, it should be tilled to provide a smoother vineyard floor and reseeded to a desirable sod. If this is not necessary, 4 to 6-foot wide strips where the rows will be located should be sprayed with a suitable herbicide in advance of planting to eliminate competition for moisture, nutrients and sunlight between young vines and grasses or weeds. Tilling these strips once the herbicide has had time to act will help to incorporate lime and fertilizers. If the field to be planted is flat or very gently sloping, orienting rows north and south may result in more uniform exposure of clusters and leaves throughout the life of the vineyard, especially with certain trellis designs and training systems. However, if the site is not level, or close to level, consider orienting rows across the slope. The ideal floor management system for most southern vineyards involves maintaining a strip 3 to 4 feet wide under the trellis free of grasses and weeds through the use of appropriate herbicides. The area between rows should be maintained in sod which serves as a deceleration and diffusion strip for runoff water to lessen erosion problems. The sod strip also provides support for equipment travel. The precision in pesticide application and the ease in designing and operating an irrigation system is better when working across slopes as opposed to up and down them. Constructing and maintaining trellises on a contour can be very difficult. Operating a mechanical harvester on contoured rows is also difficult. Instead, plant straight rows more or less across the slope. Where the direction of the slope changes, stop the trellis and start anew on the different slope. This will facilitate construction and maintenance of the trellis, provide a drainage path for air out of the vineyard and give a place to turn equipment. Use a trellis design and a training system that keeps the vine up off the ground to allow for good air drainage under the trellis. The function of a trellis is to support the vine and the crop, orient the foliage and fruit for maximum sunlight exposure and to facilitate ease of working in the vineyard. The trellis should be designed and constructed to last a long time. These concepts will not only allow for better quality fruit production, but also serve to lessen pest pressure by good sunlight penetration, wind movement and spray coverage throughout the canopy.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Nematodes	1,3-dichloro-propene (Telone II)	27-35 gallons	+++++	5 days		**Suggested pre-plant interval:** 4 to 8 weeks, longer when dissipation is slow.
Fumigation with Telone products. Telone products are highly toxic. Carefully abide by all label precautions and review the label before each application. Telone II may be used when soil temperatures are from 40˚-80˚F at the prescribed injection depth (a minimum of 12 inches). Thorough soil preparation is required and soil moisture is a critical consideration. If it is too dry, the soil surface will not seal enough to prevent premature dissipation. If the soil is too wet, the product is less effective because it will not move as well in the soil, which will decrease product effectiveness. Excessive soil moisture can also prolong desired dissipation from the soil, which forces delay of planting to avoid phytotoxicity. Soil temperatures of 40˚-80˚F are required for use of Telone. However, the product is more active at the upper end of this temperature range. In the Southeast, applications should generally be made in the fall prior to mid-November. October soil temperatures often provide the best opportunity for efficacy, due to adequate soil temperatures. Plants can be easily killed by Telone if planting takes place too soon after application. At a minimum, the 27 GPA rate would require 4 weeks from application to planting, and the 35 GPA rate would require 5 weeks. If soils are wet or they have a clay component, dissipation will be much slower. Plan for at least 6-8 weeks between fumigation and planting. Even more time may be necessary. Before planting, use a post-hole digger or shovel to smell of the soil at the full depth of injection; if the almond-like odor of Telone is present, dissipation is not complete, and it is too early to plant. Cultivation, at a depth not to exceed the depth of Telone application, with subsoil shanks, a middle buster or other implements, will hasten dissipation of Telone. More than one cultivation may be required to get Telone out of the ground pre-plant.						

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Nematodes (continued)	metam sodium (Vapam, Sectagon II, Busan 1020)	75 gallons	+++	48 hours		If tarps are used for the application, non-handler entry is prohibited while tarps are being removed. Soil temperature must be 40˚-90˚F for activity. Soil moisture must be adequate, and has to be thoroughly cultivated prior to application. On well-drained soils with light to medium texture planting can begin 14-21 days after treatment. If soils are heavy or high in organic matter, or if the soils remain wet and/or cold (<60˚F) following the application, a minimum interval of 21 days is necessary. Dissipation can be increased through cultivation. **Plan for at least a 4 week interval between treatment and planting. More time may be required.**

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments
Nematodes (continued)	Pic-Clor 60 EC (1,3-dichloropropene 37% + choropicrin 57%)	19.5-44.5 gallons	++++	5 days		SEE LABEL FOR ADDITIONAL INFORMATION
	Midas EC Gold (33% iodomethane + 62% chloropicrin	See labels	+++++	48 hours		Not registered in Arkansas or South Carolina. Be sure to follow all buffer zone restrictions indicated on the labels.
	Midas EC Bronze (50% iodomethane + 50% chloropicrin)					
	Midas 98:2 (98% iodomethane + 2% chloropicrin)					
	Midas 50:50 (50% iodomethane + 50% chloropicrin)					
	Midas 33:67 (33% iodomethane + 33% chloropicrin)					
	Midas 25:75 25% iodomethane + 25% chloropicrin					

Bunch Grape (continued)

Dormant

Dormant pruning – Pruning has several functions: removal of non-productive or marginally productive wood, encouraging the growth of new wood where fruiting will occur the following year, opening up the canopy to sunlight, air and spray penetration, adjusting crop load and eliminating dead, diseased or insect-infested wood. Annual pruning is essential to the consistent production of high quality fruit. Prunings should be removed from the vineyard or finely chopped using a flail mower to lessen the chances of perpetuating a disease problem that might have existed on the prunings. The time to prune depends on the amount of labor available, the size of the vineyards, fruitfulness of the variety on secondary buds and conflicting demands for time. Generally, the later in the dormant season that pruning can be done, the better it is. In fact, pruning after growth has started can be used as a way to delay bud break in the area where the crop is wanted, thus possibly escaping damage from a late frost.

Soil testing – Soil tests should be conducted every 2 to 3 years after planting. Samples should be collected from 1 to 8 inches in depth. Results from soil tests may be useful in understanding results from petiole testing.

Insect scouting – Scout for mealybugs by looking under the bark. Examine twigs under a hand lens for European red mite eggs (round reddish-orange eggs). Scout twigs for scale insects. If any of these arthropods are found, a dormant oil application may be justified at bud swell.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Black rot Bitter rot Phomopsis Ripe rot	Prune out mummies, cankers, dead wood		*****			Removal of mummies, rachises, and cankered and dead wood is very important to reduce the inoculum of rot fungi.
Downy mildew	Shred, remove or bury leaves		*****			By shredding leaves with a flail mower, burying them by cultivation, or removing them, the inoculum of the downy mildew fungus will be reduced.
Anthracnose and Phomopsis	lime sulfur	10.0 gal	+++	48 hrs	0 days	A dormant spray of lime sulfur is needed only if anthracnose is a problem. Sufficient water should be used to thoroughly wet the vines. This spray may help reduce the overwintering inoculum of the powdery mildew fungus.

Bunch Grape (continued)

Bud swell (bud is visibly swollen but no green or pink tissue is observed)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC Code)
Climbing Cutworms	carbaryl (Sevin 80S)	2.5 lb	+++	12 hrs	7 days	**(1A)**
	fenpropathrin (Danitol 2.4 EC)	10.66-21.33 fl oz	+++	24 hrs	21 days	**(3)**
	flubendiamide (Belt SC)	3-4 fl oz	+++	12 hrs	7 days	Minimum application volume of 50 gpa. Do not apply more than 4 fl oz every 5 days or 12 fl oz per crop season**. (28)**
	methoxyfenozide (Intrepid 2F)	12-16 fl oz	+++	4 hrs	30 days	
	spinetoram (Delegate 25 WG)	3-5 oz	+++	4 hrs	7 days	
	spinosad (SpinTor 2SC)	4-8 fl oz	+++	4 hrs	7 days	**(5)**
	spinosad (Entrust)	1.25-2.5 oz	+++	4 hrs	7 days	OMRI approved. **(5)**
	Bacillus thuringiensis [Bt] (Dipel DF and others)	0.5-1 lb	++	4 hrs	0 days	OMRI approved. **(11)**
	rynaxypyr (Altacor)	3.0-4.5 oz	+++	4 hrs	14 days	Use between 100-200 gallons per acre total spray volume. **(28)**
Grape flea beetle	carbaryl (Sevin 80S)	1.25-2.5 lb	+++	12 hrs	7 days	**(1A)**
	fenpropathrin (Danitol 2.4 EC)	5.33-10.67 fl oz	+++	24 hrs	21 days	**(3)**
	cyfluthrin (Baythroid 2 EC)	2.4-3.2 fl oz	+++	12 hrs	3 days	**(3)**
	phosmet (Imidan 70-W)	1.33-2.125 1b	+++	14 days	14 days	**(1B)**

Bunch Grape (continued)

Bud swell (bud is visibly swollen but no green or pink tissue is observed)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC Code)
Mealybugs	superior spray oil	2 gallons per 100 gallons, apply 200-300 gallons of water per acre	+++	4 hrs	NA	Also helps control European red mites and scale. (NA)
	JMS Stylet Oil and Organic JMS Stylet Oil	1-2 gallons per 100 gallons of water**, apply 200-300 gallons per acre**	+++	4 hrs	NA	The Organic JMS Stylet Oil is OMRI approved. **(NA)**
	buprofezin (Applaud 70DF)	**9-12 oz**	**+++**	**12 hrs**	**30 days**	**(16)**
	dinotefuran (Venom 20SG)	**0.44-0.66 lb (foliar) 1.13-1.32 lb (soil)**	**+++**	**12 hrs**	**1 day** **28 days**	**Do not use both a foliar and a soil application in the same season. (4A)**
	acetamiprid (Assail 30SG)	**2.5 oz**	**+++**	**12 hrs**	**7 days**	**(4A)**
	imidicloprid (Provado Solupak)	**0.8-1.0 oz**	**+++**	**12 hrs**	**0 days**	**(4A)**
	cyfluthrin (Baythroid 2EC)	**2.4-3.2 fl oz**	**+++**	**12 hrs**	**3 days**	**(3)**
	spirotetramat (Movento 2SC)	**6-8 fl oz**	**+++**	**24 hrs**	**7 days**	**(23)**

Bunch Grape (continued)

Budbreak and new shoot sprays (7-10 day interval from 1-inch shoot growth until prebloom)

Fertilizing the vineyard – Annual, modest fertilization applications to the vineyard are best for maintaining consistent yields of high quality grapes. Nitrogen is the element most apt to be limiting in vineyards. About 0.1 pound of actual nitrogen per vine, is preferred for consistently good yields of high quality fruit. This amount may need to be adjusted depending on vine growth and fruiting. The best time to apply nitrogen to the soil in vineyards is between budbreak and bloom. It is important in growing grapes for wine to realize that fertilization not only affects vine growth and productivity, but also impacts the wine. The ideal nutrient management plan for vineyards takes into account the following factors: (1) **Soil testing** – soil tests should be conducted every 2 to 3 years after planting. Samples should be collected from 1 to 8 inches in depth. Results from soil tests may be useful in understanding results from petiole testing. (2) **Tissue analysis** – Analysis of petioles collected at full bloom gives the best indicator of nitrogen status whereas petioles collected at veraison give more accurate results for other nutrients. Collect petioles from leaves opposite the first or second bloom cluster from the bottom of a shoot. Do not collect over 2 petioles per vine. Randomly sample vines of the same variety and age in a vineyard accumulating a minimum of 50 petioles for analysis. Routine petiole analysis from the same vineyard over a period of years can help detect trends in nutrient levels thus helping avoid nutritional problems that may adversely affect yields and quality. Vines having different growth characteristics should be sampled separately from normal vines. Contact your county extension office for more details on collecting and sending samples for analysis. (3) **Observations on growth and fruiting** – note any abnormalities in leaf or shoot growth, leaf color and crop development. (4) **Records on vineyard performance over previous years** – notes on yields and fruit quality plus any unusual weather conditions that may have impacted vine performance may be of value in refining the fertility program.

Shoot positioning – With increasing shoot growth, light penetration, air movement and spray coverage throughout the canopy will be reduced resulting in reduced fruit quality and increased pest pressure. Leaves in heavily shaded portions of the canopy do not contribute much, if anything, beneficial to the development of the crop and sustenance of the vine. The potential for next year's crop can also be adversely affected if the leaves at the nodes to be retained for that crop are shaded. Shoot positioning involves moving shoots on the top of the canopy and those that overlap other shoots on the sides to a vertical position on each side of the canopy to allow better sunlight interception by all the leaves and to promote better air circulation throughout the canopy. Shoot positioning may need to be done several times during the growing season beginning before bloom.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Phomopsis Black rot Powdery mildew Downy mildew	mancozeb (various formulations) + sulfur (various formulations)	see label see label	++++	24 hrs	66 days	A powdery mildew fungicide is generally not needed in the first spray (1-inch shoot growth) unless the disease has been a problem in previous years. Include a fungicide for powdery mildew control in subsequent sprays (sulfur, Nova, Elite, Procure or Rubigan). Avoid sulfur on sulfur-sensitive varieties. The activity of sulfur is reduced at temperatures less than 65° F. some sulfur injury may occur if temperatures are greater than 85° F.

Bunch Grape (continued)

Budbreak and new shoot sprays (7-10 day interval from 1-inch shoot growth until prebloom)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC Code)
Phomopsis Black rot Powdery mildew Downy mildew (continued)	Mancozeb (various formulations) + Myclobutanil (Nova 40W)	See label 4-5 oz	+++++	24 hrs	66 days	To avoid resistance of the powdery mildew fungus to sterol inhibiting fungicides (SI fungicides Nova, Rubigan, Elite and Procure), limit their use to three applications a year, and use the maximum labeled rate/acre. For these applications, mancozeb is combined with the other fungicides as indicated. The REI and PHI refer to the most stringent aspect of the combined spray; mancozeb drives both the REI and the PHI for this application.
	mancozeb (various formulations) + tebuconazole (Elite 45DF)	see label 4 oz	++++	24 hrs	66 days	
	mancozeb (various formulations) + fenarimol (Rubigan 1E)	see label 3 fl oz	++++	24 hrs	66 days	
	mancozeb (various formulations) + triflumizole (Procure 50WS)	see label 4-8 oz	++++	24 hrs	66 days	
Leafhoppers (Pierce's disease suppression)	imidacloprid (Admire Pro)	14 fl oz	++++	12 hrs	30 days	Only apply 14 fl oz per season. Use either drip irrigation or drench application. **(4A)**
	dinotefuran (Venom)	5-6 oz	+++	12 hrs	28 days	Make no more than one soil application per season by drip. **(4A)**
	clothianidin (Clutch 50WDG)	6 oz	++++	12 hrs	30 days	Make no more than one soil application per season by drip or trickle irrigation. **(4A)**
Mealybugs	imidacloprid (Admire Pro)	7-14 fl oz	++++	12 hrs	30 days	Only apply 14 fl oz per season. Use either drip irrigation or drench application. **(4A)**
	dinotefuran (Venom)	5-6 oz	+++	12 hrs	28 days	Make no more than one soil application per season by drip. **(4A)**
	clothianidin (Clutch 50WDG)	6 oz	++++	12 hrs	30 days	Make no more than one soil application per season by drip or trickle irrigation. **(4A)**

Bunch Grape (continued)

Budbreak and new shoot sprays (7-10 day interval from 1-inch shoot growth until prebloom)

Cutworms	See bud swell recommendations
Grape flea beetle	See bud swell recommendations

Bunch Grape (continued)

Prebloom

Cluster thinning – Cluster thinning may be done to further refine crop load adjustment on the vine. Overproduction on a vine can result in poor cluster size and quality and reduced shoot growth, which under extreme situations, may mean that there will be too few buds formed to give a good crop the following year. Cluster thinning should be done early – before bloom up to no later than 2 weeks after bloom to achieve the best results however, some response will be received even when thinning is delayed as late as veraison. The earlier that it is done, the more pronounced the effects will be. Cluster should be removed on short shoots as there may not be sufficient leaf area to ripen the fruit. Third clusters on a shoot should be removed and, if some cases, the second cluster may be removed as well. When thinning to one cluster per shoot, yields will be reduced which may be desirable only in cases where a premium price will be received for the crop. When thinning at veraison, it is possible to remove clusters that appear to be lagging in their development.

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Phomopsis Black rot Powdery mildew Downy mildew	mancozeb (various formulations) + sulfur (various formulations)	see label see label	++++	24 hrs	66 days	This is one of the most important sprays for powdery mildew, phomopsis, and black rot. If black rot is a problem, combine mancozeb with Nova or Elite. Nova and Elite are more active on black rot than Procure or Rubigan. Abound is more active on downy mildew than Flint or Sovran. For these applications, mancozeb can be is combined with the other fungicides as indicated. The REI and PHI refer to the most stringent aspect of the combined spray; mancozeb drives both the REI and the PHI for this application.
	mancozeb (various formulations) + tebuconazole (Elite 45DF)	see label 4 oz	++++	24 hrs	66 days	
	mancozeb (various formulations) + fenarimol (Rubigan 1E)	see label 3 fl oz	++++	24 hrs	66 days	

Bunch Grapes (continued)

Prebloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC Code)
Phomopsis Black rot Powdery mildew Downy mildew (continued)	mancozeb (various formulations) + triflumizole (Procure 50WS)	see label 4-8 oz	++++	24 hrs	66 days	
	azoxystrobin (Abound 2SC)	11-15.4 fl oz	+++++	12 hrs	14 days	
	kresoxim-methyl (Sovran 50WG)	3.2-4.0 oz	++++	12 hrs	14 days	
	trifloxystrobin (Flint 50WG)	1.5-2.0 oz	++++	12 hrs	14 days	Do not use Flint on Concords.
	boscalid + paraclostrobin (Pristine 38WG)	8.0-10.5 oz	+++++	24 hrs	14 days	Do not apply Pristine to Concord, Worden, Fredonia, Niagara or related grape varieties due to possible injury.
Leafhoppers (Pierce's disease suppression) Initiation of foliar treatments should be based on trap captures.	carbaryl (Sevin 80S)	1.25-2.5 lb	++	12 hrs	7 days	**(1A)**
	malathion (Malathion 57EC or Malathion 5)	3 pt	++	12hrs	3 days	Rates are based on 200 gal per acre spray volumes. **(1B)**
	methomyl (Lannate SP)	0.5-1 lb	++	7 days	14 days	1 day PHI for fresh market grapes. **(1A)**
	methomyl (Lannate LV)	1.5-3 pt	++	7 days	14 days	1 day PHI for fresh market grapes. **(1A)**
	fenpropathrin (Danitol 2.4 EC)	5.33-10.66 fl oz	++	24 hrs	21 days	**(3)**
	cyfluthrin (Baythroid)	1.6-3.2 fl oz	++	12 hrs	3 days	
	bifenthrin (Brigade 10 WSB) (Sniper 2EC)	16 oz 6.4 fl oz	++ ++	12 hrs	30 days	

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC Code)
Leafhopper (Pierce's disease suppression) - continued Initiation of foliar treatments should be based on trap captures	imidacloprid (Provado) **(Admire 2F)** **(Admire Pro)**	3-4 fl oz **16.0-32.0 fl oz** **7.0-14.0 fl oz**	+++	12 hrs	0 days **30 days** **30 days**	A foliar application of a Group 4A insecticide should not be used following soil application of any Group 4A insecticides. **Check label for soil versus foliar use. (4A)**
	dinotefuran (Venom)	1-3 oz	+++	12 hrs	1 day	
	clothianidin (Clutch 50WDG)	1-2 oz	+++	12 hrs	0 days	
	acetamiprid (Assail 30SG)	2.5 oz	+++	12 hrs	7 days	
Grape berry moth (only treat for grape berry moth if adults are captured in pheromone traps)	methomyl (Lannate SP)	0.5-1 lb	++	7 days	14 days	1 day PHI for fresh market grapes. **(1A)**
	methomyl (Lannate LV)	1.5-3 pt	++	7 days	14 days	1 day PHI for fresh market grapes. **(1A)**
	carbaryl (Sevin 80S)	2.5 lb	++	12 hrs	7 days	**(1A)**
	fenpropathrin (Danitol 2.4 EC)	10.66 to 21.33 fl oz	++	24 hrs	21 days	**(3)**
	methoxyfenozide (Intrepid 2F)	4-8 fl oz	++++	4 hrs	30 days	Minimum application volume for airblast sprayers of 40 gallons per acre. **(18)**
	spinosad (SpinTor 2SC)	4-8 fl oz	+++	4 hrs	7 days	**(5)**
	spinosad (Entrust)	1.25-2.5 oz	+++	4 hrs	7 days	OMRI approved. **(5)**
	rynaxypyr (Altacor)	2.0-4.5 oz	+++	4 hrs	14 days	Use between 100-200 gallons per acre total spray volume. **(28)**
	phosmet (Imidan 70-W)	1.33-2.125 1b	+++	14 days	14 days	**(1B)**
	Spinetoram (Delegate)	3-5 oz	+++	4 hrs	7 days	**(5)**
	indoxacarb (Avaunt 30DG)	**5-6 oz**	**+++**	**12 hrs**	**7 days**	**(22)**
	Isomate GBM-Plus	**400 dispensers**	**+++**			**(NA)**

Bunch Grapes (continued)

Prebloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC Code)
Grape flea beetle	carbaryl (Sevin 80S)	1.25-2.5 lb	+++	12 hrs	7 days	**(1A)**
	fenpropathrin (Danitol 2.4 EC)	5.33-10.67 fl oz	+++	24 hrs	21 days	**(3)**
	phosmet (Imidan 70-W)	1.33-2.125 1b	+++	14 days	14 days	**(1B)**
Downy mildew only	mefenoxan + copper (Ridomil gold copper)	2.0 lbs	+++++	48 hrs	66 days	Ridomil products provide excellent activity against downy mildew. However, only one or two applications are recommended per year, due to potential resistance issues. Use these products conservatively. In general, other products should be utilized till downy mildew symptoms are first observed or environmental conditions are very conducive for this disease; if observed, use Ridomil immediately.
	mefenoxan + manzate (Ridomil Gold MZ)	2.5 lbs	+++++	48 hrs	66 days	
	fluopicolide (Presidio)	3.0-4.0 oz	+++++	12 hrs	21 days	Another fungicide product with a different mode of action must be tank mixed with Presidio for resistance management purposes. (43)
	mandipropamid (Revus)	**8.0 fl oz**	**+++++**	**4 hrs**	**14 days**	Make no more than 2 consecutive applications before switching to a non-Group 40 fungicide. The addition of a spreading/penetrating type adjuvant such as a nonionic based surfactant or crop oil concentrate or blend is recommended. (40)
	famoxadone + cymoxanil (Tanos)	8.0 oz	++++	12 hrs	30 days	Make no more than 1 application of Tanos before rotating to a fungicide with a different mode of action. (11, 27)

Bunch Grapes (continued)

Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Botrytis	iprodione (Rovral 50 WP)	1-2 lb	+++	12 hrs	7 days	A spray for botrytis during bloom may be beneficial in the wet seasons and in blocks with a botrytis problem. Rovral, Vangard, Endura and Elevate should be rotated through the season when needed to avoid resistance development. See product label for complete information on resistance management and use restrictions.
	iprodione (Rovral 4F)	1-2 pt	+++	12 hrs	7 days	
	cyrpodinil (Vangard 75WG)	10 oz	+++++	12 hrs	7 days	
	fenheximide (Elevate 50WDG)	1 lb	+++++	12 hrs	0 days	
	boscalid + pyraclostrobin (Pristine 38WG)	18.5-23 oz	+++++	24 hrs	14 days	Pristine also has activity on black rot, phomopsis, downy mildew, and powdery mildew. Do not apply to Concord, Worden, Fredonia, or Niagara.
	boscalid (Endura 30WG)	8 oz	+++++	12 hrs	14 days	Endura will also control powdery mildew.
Thrips	spinosad (SpinTor 2SC)	4-8 fl oz	+++	4 hrs	7 days	**(5)**
	spinosad (Entrust)	1.25-2.5 oz	+++	4 hrs	7 days	OMRI approved. **(5)**
	spinetoram (Delegate)	3-5 oz	+++	4 hrs	7 days	**(5)**
	dinotefuran (Venom)	1-3 oz	+++	12 hrs	1 day	A foliar application of a Group 4A insecticide should not be used following soil application of any Group 4A insecticides. **(4A)**
	azadirachtin (Aza-Direct)	1-2 pt	++	4 hrs	0 days	OMRI approved. **(UN)**
	pyrethrins (Pyganic 1.4EC)	16-64 fl oz	++	12 hrs	0 days	OMRI approved. **(3)**
	pyrethrins (Pyganic EC 5)	4.5-18 fl oz	++	12 hrs	0 days	OMRI approved. **(3)**

Bunch Grape (continued)

Postbloom (10-14 days after the prebloom spray)

Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments (FRAC/IRAC)**
Phomopsis Black rot Powdery mildew Downy mildew Bitter rot Ripe rot	mancozeb (various formulations) + myclobutanil (Nova 40W)	see label 3-5 oz	+++++	24 hrs	66 days	Very important spray for black rot, phomopsis, and powdery mildew control. If downy mildew is a problem, substitute Ridomil Gold MZ at 2.5 lb/acre for mancozeb. Do not apply more than 4 total sprays per season of Abound, Sovran or Flint. Do not make more than 6 applications of Pristine or Pristine and Flint, Sovran and Abound. Do not make more than 2 sequential applications of QoI fungicides (Flint, Sovran, Abound or Pristine).
	Mancozeb (various formulations) + tebuconazole (Elite 45DF)	see label 4 oz	++++	24 hrs	66 days	
	azoxystrobin (Abound 2SC)	11-15.4 fl oz	+++++	12 hrs	14 days	
	kresoxim-methyl (Sovran 50WG)	3.2-4.8 oz	++++	12 hrs	14 days	
	trifloxystrobin (Flint 50WG)	2.0 oz	++++	12 hrs	14 days	Do not use Flint on Concords.
	Boscalid + paraclostrobin (Pristine 38WG)	8.0-10.5 oz	+++++	24 hrs	14 days	Do not apply Pristine to Concord, Worden, Fredonia, Niagara or related grape varieties due to possible injury.
	Canopy management		*****			Proper canopy management initiated at this time is very important to ensure that conditions are least favorable for disease development later in the season. Pull leaves (north and east sides), position/tuck shoots, top and hedge as needed 18 to 24 inches above the top wire.

Bunch Grape (continued)						
Postbloom						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments (FRAC/IRAC)**
Downy mildew only	mefenoxam + copper (Ridomil gold copper)	2.0 lbs	+++++	48 hrs	66 days	Ridomil products provide excellent activity against downy mildew. However, only one or two applications are recommended per year, due to potential resistance issues. Use these products conservatively. In general, other products should be utilized till downy mildew symptoms are first observed or environmental conditions are very conducive for this disease; if observed, use Ridomil immediately.
	mefenoxam + manzate (Ridomil gold MZ)	2.5 lbs	+++++	48 hrs	66 days	
	fluopicolide (Presidio)	3.0-4.0 oz	+++++	12 hrs	21 days	Another fungicide product with a different mode of action must be tank mixed with Presidio for resistance management purposes. (43)
	mandipropamid (Revus)	**8.0 fl oz**	**+++++**	**4 hrs**	**14 days**	Make no more than 2 consecutive applications before switching to a non-Group 40 fungicide. The addition of a spreading/penetrating type adjuvant such as a nonionic based surfactant or crop oil concentrate or blend is recommended.
	famoxadone + cymoxanil (Tanos)	8.0 oz	++++	12 hrs	30 days	Make no more than 1 application of Tanos before rotating to a fungicide with a different mode of action. (11, 27)
Grape berry moth	See prebloom recommendations					
Leafhoppers (Pierce's disease suppression)	See prebloom recommendations					
Mealybugs	buprofezin (Applaud 70DF)	12-24 oz	++++	12 hrs	7 days	Use in 50-200 gallons per acre spray-tank volume. Do not apply more than twice. **(16)**
	dinotefuran (Venom)	1-3 oz	+++	12 hrs	1 day	A foliar application of a Group 4A insecticide should not be used following soil application of any Group 4A insecticides. **(4A)**

Bunch Grape (continued)						
Postbloom						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments (FRAC/IRAC)**
Mealybugs - continued	spirotetramat (Movento)	6-8 fl oz	+++	24 hrs	7 days	**(23)**
European red mite Twospotted spider mite	bifenazate (Acramite-50WS)	1 lb	+++++	12 hrs	14 days	The reentry interval is 5 days for cane turning, tying, and girdling of table grapes. Minimum of 50 gallons per acre spray volume. **(UN)**
	etoxazole (Zeal)	3 oz	++++	12 hrs	28 days	This is an ovicide/larvicide, so it has be used early in the life-cycle of the mites. Use this once per season. **(10B)**
	fenpyroximate (Portal 5EC)	2 pt	++++	12 hrs		Nonbearing use only. Do not apply more than 2 pints per acre per season. Use a minimum of 50 gallon spray volume per acre. **(21A)**
	abamectin (Agri-Mek 0.15EC) and others	16 fl oz	++++	12 hrs	28 days	With Agri-Mek, add a nonionic surfactant. **(6)**
	pyridaben (Nexter 75WP)	10.67 oz	+++	12 hrs	7 days	Do not make more than two applications per season. **(21A)**
	fenbutatin-oxide (Vendex 50WP)	2.5 lb	+++	48 hrs	28 days	Do not make more than two applications per season. **(12B)**
	spirodiclofen (Envidor 2SC)	18 fl oz	++++	12 hrs	14 days	The reentry interval is 6 days for cane turning, tying, and girdling of table grapes. **(23)**
	hexythiazox (Onager 11.8EC)	**12-24 fl oz**	**+++**	**12 hrs**	**28 days**	**Ovicide only. (10A)**
	Saf-T-Side or Glacial Spray Fluid	1-2 gal per 100 gal water	+++	4 hrs	0 days	OMRI approved. **DO NOT use in combination with or immediately before or after spraying with fungicides such as captan or any product containing sulfur. DO NOT use with carbaryl or dimethoate. DO NOT use with any product whose label recommends the use of no oils. Do not use in combination with NPK foliar fertilizer applications. (UN)**

Bunch Grape (continued)

Fruit set

Leaf removal – Leaf removal facilitates better sunlight penetration into the canopy thus lessening disease pressure following rain or dew and increasing fruit quality. Leaves should be removed shortly after fruit set to allow berries to acclimate to higher sunlight levels prior to berry softening. Waiting until after the berries begin to soften increases the risk of sunscald. Leaves in the vicinity of the cluster should be removed. For some varieties, especially white-fruited varieties, sunscald can be a problem. Removing leaves on the east side of a north – south oriented row, but not on the west side, may give some of the advantages of leaf removal while reducing the incidence of sunscald. If the fruit is located at the top of the trellis, the potential for sunscald is high and the amount of leaf removal, if done at all, should be conservative.

First cover (10-14 days after the postbloom spray)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Phomopsis Black rot Powdery mildew Downy mildew Bitter rot Ripe rot	captan (various formulations) + myclobutanil (Nova 40W)	see label 4-5 oz	+++++	96 hrs	14 days	
	captan (various formulations) + tebuconazole (Elite 45DF)	see label 4 oz	+++++	96 hrs	14 days	
	mancozeb (various formulations) + myclobutanil (Nova 40W)	see label 3-5 oz	+++++	24 hrs	66 days	
	mancozeb (various formulations) + tebuconazole (Elite 45DF)	see label 4 oz	+++++	24 hrs	66 days	

Bunch Grape (continued)

First cover (10-14 days after the postbloom spray; continued)

Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments**
Downy mildew	phosphorous acid (ProPhyt)	2.4 pt	+++++	4 hrs	0 days	These phosphorous acid-based products are not very good protectants, but they are good eradicants and have pre- and post-symptom activity.
	phosphorous acid (Phostrol)	2.5-5 pt	+++++	4 hrs	0 days	
Japanese beetle Green June beetle	carbaryl (Sevin 80S)	2.5 lb	++++	12 hrs	7 days	**(1A)**
	phosmet (Imidan 70-W)	1.33-2.125 1b	+++	14 days	14 days	**(1B)**
	azadirachtin (Aza-Direct)	1-2 pt	+	4 hrs	0 days	OMRI approved. **(UN)**
	malathion (Malathion 57EC or Malathion 5)	3 pt	++	12hrs	3 days	Rates are based on 200 gal per acre spray volumes. **(1B)**
	fenpropathrin (Danitol 2.4 EC)	10.67-21.33 fl oz	++++	24 hrs	21 days	**(3)**
Grape berry moth	See prebloom recommendations					
Leafhoppers (Pierce's disease suppression)	See prebloom recommendations					
Mealybugs	See postbloom recommendations					
European red mite Twospotted spider mite	See postbloom recommendations					

Bunch Grape (continued)						
Berry touch and bunch closure						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments (FRAC/IRAC)**
Botrytis	Same as **Bloom**		++++			At closing, add Rovral or Vangard or Endura or Elevate to the appropriate cover spray for botrytis control. See **Bloom Spray** for information on resistance management when using Rovral, Vangard, Endura, and Elevate.
Botrytis Ripe rot Bitter rot	Leaf pulling		*****			Complete leaf pulling if not completed earlier. Removing leaves at will help expose the fruit clusters which will reduce drying time and increase pesticide deposition on and within the clusters.
Grape berry moth	See prebloom recommendations					
Leafhoppers (Pierce's disease suppression)	See prebloom recommendations					
Mealybugs	See postbloom recommendations					
European red mite Twospotted spider mite	See postbloom recommendations					
Japanese beetle Green June beetle	See first cover recommendations					

Bunch Grapes (continued)

Second and subsequent cover sprays (10-14 day intervals until the preharvest spray)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Ripe rot Bitter rot	captan (Captan 50W)	2-4 lb	+++++	96 hrs	0 days	
	Captan (Captan 4L)	1-2 qt	+++++	96 hrs	0 days	
Downy mildew	phosphorous acid (ProPhyt)	2.4 pt	+++++	4 hrs	0 days	These phosphorous acid-based products are not very good protectants, but they are good eradicants and have pre- and post-symptom activity.
	phosphorous acid (Phostrol)	2.5-5 pt	+++++	4 hrs	0 days	Additional sprays for downy mildew may be necessary if conditions are favorable for development.
	fluopicolide (Presidio)	3.0-4.0 oz	+++++	12 hrs	21 days	Another fungicide product with a different mode of action must be tank mixed with Presidio for resistance management purposes. (43)
	mandipropamid (Revus)	8.0 fl oz	+++++	4 hrs	14 days	Make no more than 2 consecutive applications before switching to a non-Group 40 fungicide. The addition of a spreading/penetrating type adjuvant such as a nonionic based surfactant or crop oil concentrate or blend is recommended. (40)
	famoxadone + cymoxanil (Tanos)	8.0 oz	++++	12 hrs	30 days	Make no more than 1 application of Tanos before rotating to a fungicide with a different mode of action. (11, 27)
Powdery mildew	sulfur (various formulations)	see label	++++	24 hrs	0 days	If additional sprays are needed for powdery mildew control, use sulfur. On sulfur –intolerant varieties, and when temperature exceeds 85^{o}F, use Quintec or a SI fungicide (Nova, Elite, Procure, or Rubigan). Rotate Quintec and SI fungicides to avoid resistance development. Do not make more than 5 applications of Quintec per year. If combined with captan, the REI for each combination is 96 hours.
	myclobutanil (Nova 40W)	4-5 oz	+++++	24 hrs	14 days	
	tebuconazole (Elite 45DF)	4 oz	++++	12 hrs	14 days	
	fenarimol (Rubigan 1E)	3 fl oz	++++	24 hrs	30 days	
	triflumizole (Procure 50WS)	4-8 oz	++++	24 hrs	7 days	
	quinoxyfen (Quintec 2SC)	3-4 oz	+++++	12 hrs	14 days	

Bunch Grapes (continued)						
Second and subsequent cover sprays (10-14 day intervals until the preharvest spray)						
Bitter rot Ripe rot Downy mildew	canopy management		*****			Shoot training, removal, and pruning/hedging through the summer will enhance drying and improve disease control and pesticide penetration within the canopy.
Grape berry moth	See prebloom recommendations					
Leafhoppers (Pierce's disease suppression)	See prebloom recommendations					
Mealybugs	See postbloom recommendations					
European red mite Twospotted spider mite	See postbloom recommendations					
Japanese beetle Green June beetle	See first cover recommendations					

Borer control						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments (FRAC/IRAC)**
Grape root borer	chloropyrifos (Lorsban Advanced)	4.5 pt	++	24 hrs	35 days	Apply 2 qt dilute mixture to soil at base of vine. Make a single application 35 days before harvest. Spray should not contact fruit or foliage. Application can be made with flood nozzles and low pressure (40 to 60 psi). (1B)
	Cultivation or mounding soil		**			Use clean cultivation, mound soil (July 1 or at first moth emergence when using pheromone traps) or using tightly-sealed plastic mulch 3 ft from the base of vines. This practice will inhibit adult emergence from the soil when well timed. Mounded soil needs to be removed by September 1st.

Bunch Grape (continued)	
Veraison	
Botrytis	See bloom recommendations
Grape berry moth	See prebloom recommendations
Leafhoppers (Pierce's disease suppression)	See prebloom recommendations
Mealybugs	See postbloom recommendations
European red mite Twospotted spider mite	See postbloom recommendations
Japanese beetle Green June beetle	See first cover recommendations

Preharvest (10-14 days before harvest)						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments (FRAC/IRAC)**
Ripe rot Bitter rot Botrytis	captan (various formulations) + iprodione (Rovral 50WP)	see label 1-2 lb	+++++	96 hrs	7 days	REIs and PHIs reflect the combination; captan alone has a 96-hour REI and 0 hour PHI. REIs and PHIs for Rovral, Vangard, Elevate and Endura, applied alone, are 48 hours and 7 days, 12 hours and 7 days, 12 hours and 0 days and 12 hours and 14 days respectfully.
	captan (various formulations) + cyprodinil (Vangard 75WDG)	see label 10 oz	+++++	96 hrs	7 days	

Bunch Grape (continued)

Preharvest (10-14 days before harvest, continued)

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Ripe rot Bitter rot Botrytis (continued)	captan (various formulations) + fenhexamid (Elevate 50WDG)	see label 1 lb	+++++	96 hrs	0 days	
	boscalid + paraclostrobin (Pristine 38WG)	18.5-23 oz	+++++	24 hrs	14 days	Do not apply Pristine to Concord, Worden, Fredonia, Niagara or related grape varieties due to possible injury.
	azoxystrobin (Abound 2SC)	15.4 fl oz	+++++	12 hrs	14 days	For suppression of Botrytis. When used in the preharvest spray, good control of Botrytis has been obtained in multiple field trials.
	kresoxim-methyl (Sovran 50WG)	4.8 oz	++++	12 hrs	14 days	For suppression of Botrytis. Good control of Botrytis has been obtained in multiple field trials, but the label recommends use of effective Botryticides.
	trifloxystrobin (Flint 50WG)	3.0 oz	++++	12 hrs	14 days	Do not use Flint on Concords.
Leafhoppers (Pierce's disease suppression)	See prebloom recommendations					
European red mite Twospotted spider mite	See postbloom recommendations					
Japanese beetle Green June beetle	See first cover recommendations					

Bunch Grape (continued)						
Postharvest (14-21 day intervals from harvest until the first killing frost)						
Pest/Problem	**Management Options**	**Amount of Formulation per Acre**	**Effectiveness (+) or Importance (*)**	**REI**	**PHI**	**Comments (FRAC/IRAC)**
Downy mildew	copper compounds (various formulations)	see label	++++	24 hrs	----	Premature defoliation may predispose vines to winter injury. Use shorter spray intervals when conditions are favorable for disease development. Copper may cause injury under cool slow drying conditions. Use mancozeb on copper sensitive varieties for downy mildew control.
	mancozeb (various formulations)	see label	++++	4 hrs	----	
	phosphorous acid (ProPhyt)	2.4 pt	+++++	4 hrs	----	
	phosphorous acid (Phostrol)	2.5-5 pt	+++++	4 hrs	----	

Efficacy of selected fungicides against diseases of bunch grapes

Fungicide	Black rot	Bitter rot	Botrytis rot	Downy mildew	Phomopsis cane and leaf spot	Powdery mildew
Azoxystrobin **(Abound)**	+++++[a]	+++++	+++	+++++	+++	+++++
Boscalid **(Endura)**			+++++			
Boscalid + Paraclostrobin **(Pristine)**	+++++	+++++	+++++	+++++	+++++	+++++
Captan **(Captan, Captec)**	+++	+++++	++	++++	+++++	**NA**
Cyprodinil **(Vangard)**	**NA**	**NA**	+++++	**NA**	**NA**	++
Famoxadone + cymoxanil **(Tanos)**				++++		
Fenhexamid **(Elevate)**	**NA**	**NA**	+++++	**NA**	**NA**	**NA**
Ferbam	+++++	+++	**NA**	++	++	**NA**
Finarimol **(Rubigan)**	++	**NA**	**NA**	**NA**	**NA**	+++++
Fixed Copper and Lime (Bordeaux mixture)	+++	++	+++	++++	++	+++
Fluopicolide **(Previdio)**				+++++		
Iprodione **(Rovral)**	**NA**	**NA**	+++	**NA**	**NA**	**NA**
Kresoxim-methyl **(Sovran)**	+++++	+++++	++	+++	+++	+++++
Mancozeb, Maneb	+++++	+++++	**NA**	+++++	+++++	**NA**
Mandipropamid **(Revus)**				+++++		
Mefanoxam + Copper **(Ridomil Gold Copper)**	++	++	++	+++++	++	+++
Mefanoxam + Mancozeb **(Ridomil Gold MZ)**	+++++	+++++	**NA**	+++++	+++++	**NA**
Myclobutanil **(Nova)**	+++++	++	**NA**	**NA**	**NA**	+++++
Phosphorus acid **(ProPhyt)**				+++++		
Phosphorus acid **(Phostrol)**				+++++		
Sulfur[b]	**NA**	**NA**	**NA**	**NA**	++	+++++
Tebuconazole **(Elite)**	+++++	**NA**	**NA**	**NA**	**NA**	+++++
Thiophanate-methyl **(Topsin M)**	++	+++	+++	**NA**	+++	+++++
Trifloxystrobin **(Flint)**	+++++	+++++	++++	+++	++	+++++
Triflumazole (**Procure)**	+++	**NA**	**NA**	**NA**	**NA**	+++++
Ziram	+++++	**NA**	++	++++	+++	**NA**

[a]NA = no significant activity, ??? = unknown activity; + = very limited activity, ++ = limited activity, +++ = moderate activity, ++++ = good activity, +++++ = excellent activity.

[b]Sulfur will cause burn on sensitive varieties, especially on hot days.

Fungicide classes with high risk of resistance development (generally single sites of action)	
Anilinopyrimidines	Vangard (cyprodinil)
Benzimidazoles	Topsin M (thiophanate methyl)
Carboximide	Pristine (boscalid; one component of a two-part mixture)
Demethylation Inhibitors (DMI=s) or Sterol Inhibitors	Bayleton (triadimefon) Elite (tebuconazole) Nova (myclobutanil) Procure (triflumizole) Rubigan (fenarimol)
Dicarboximides	Rovral (iprodione)
Hydroxyanelides	Elevate (fenhexamid)
Phenylamides	Ridomil Gold (mefanoxam)
Strobilurins or QoI (Quinine outside Inhibitors)	Abound (azoxystrobin) Flint (trifloxystrobin) Pristine (pyroclostrobin; one component of a two-part mixture) Sovran (kresoxim-methyl)
Fungicide classes with low risk of resistance development (generally multiple sites of action)	
Several Classes	Captan (Captan or Captec) Coppers (numerous formulations) Carbamate (ferbam) Dithane, Manzate (mancozeb) Maneb, Manex (maneb) Thiram (thiram) Ziram (ziram)

Seasonal 'at a glance' fungicidal spray schedule options for bunch grapes							
Developmental Stage	**Dormant[a]**	**Budbreak and New Shoot Sprays[b]**	**Prebloom**	**Bloom[d]**	**Postbloom**	**First Cover**	**Closing[f]**
Disease Controlled (Fungicides)	**Anthracnose and Phomopsis (Lime Sulfur)**	**Phomopsis, Black Rot, Powdery Mildew, and Downy Mildew (mancozeb [various formulations] + sulfur[c] [various formulations], or mancozeb + Nova, or mancozeb + Rubigan or mancozeb + Elite, or mancozeb + Procure)**	**Phomopsis, Black Rot, Powdery Mildew, and Downy Mildew (mancozeb [various formulations] + sulfur[c] [various formulations], or mancozeb + Elite, or mancozeb + Rubigan, or mancozeb + Procure, or Abound, or Sovran, or Flint, or Pristine)** **Downy Mildew (only) (Ridomil Gold Copper or MZ[e] or Presidio or Revus or Tanos)**	**Botrytis (Rovral or Vangard or Scala or Elevate or Pristine or Endura)**	**Phomopsis, Black Rot, Powdery Mildew, Downy Mildew, Bitter Rot, and Ripe Rot (mancozeb [various formulations] + Nova, or mancozeb + Elite, or Abound, or Sovran, or Flint, or Pristine);** **Downy Mildew [only] (Ridomil Gold Copper or MZ[e] or Presidio orRevus or Tanos)**	**Phomopsis, Black Rot, Powdery Mildew, Downy Mildew, Bitter Rot, Ripe Rot (captan [various formulations] + Nova, or captan + Elite, or mancozeb [various formulations] + Nova, or mancozeb + Elite);** **Downy Mildew [only] (ProPhyt or Phostrol)**	**Botrytis (Rovral or Vangard or Scala or Elevate or Pristine or Endura)**

(CONTINUED ON NEXT PAGE)

Seasonal 'at a glance' fungicidal spray schedule options for bunch grapes (continued)				
Developmental Stage	**Second and Subsequent Cover Sprays**	**Veraison [g]**	**Preharvest**	**Postharvest**
Disease Controlled (Fungicides)	**Ripe Rot and Bitter Rot (captan [various formulations])** **Downy Mildew (ProPhyt or Phostrol or Presidio or Revus or Tanos)** **Powdery Mildew (sulfur [various formulations], or Nova, or Elite, or Rubigan, or Procure, or Quintec)**	**Botrytis (Rovral or Vangard or Elevate or Pristine or Endura)**	**Ripe Rot, Bitter Rot, and Botrytis (captan [various formulations] + Rovral, or captan + Vangard, or captan + Elevate, or Pristine, or Abound, or Sovran, or Flint)**	**Downy Mildew (copper compounds [various formulations], or mancozeb [various formulations], or ProPhyt, or Phostrol)** **Powdery Mildew (sulfur [various formulations] or JMS Stylet Oil)**

[a]Lime sulfur is very effective for control of Phomopsis. Do not apply this once the leaf buds start to push; late applications will result in damage to leaves. Think about when bud break normally occurs, and back the application off by a 2-3 week period. This application may also reduce powdery mildew inoculum.

[b]In order to avoid Phomopsis in the Southeast, applications should be made very early (even less than one inch shoot growth).

[c]Sulfur has good activity for control of powdery mildew, but it can be damaging on certain grape varieties, such as Concord, Norton and Chambourcin. It should not be applied when temperatures are above 85° F.

[d]Unless using Pristine, if the bloom interval exceeds 10-14 days from the prebloom spray, consider using either Mancozeb or Captan as well as the more efficacious Botrytis-control materials listed for the bloom spray. These will provide disease control for diseases other than Botrytis.

[e]Ridomil Gold Copper or MZ provide excellent activity against downy mildew. However, only one or two applications are recommended per year, due to potential resistance issues. In general, other products should be utilized till downy mildew symptoms are first observed or environmental conditions are very conducive; if observed, use Ridomil immediately.

[f]Unless using Pristine, add appropriate cover spray materials for control of diseases other than Botrytis if more than 10-14 days from the last cover spray application.

[g]Unless using Pristine, add appropriate cover spray materials for control of diseases other than Botrytis if more than 10-14 days from the last cover spray application.

Weed Management
Grape Vineyards

Herbicide Resistance Management
The development of herbicide resistant weed species has increased significantly across the Southeast during the past few years. Lately weed resistance to glyphosate has been the most common resistance development which is largely related to the widespread planting of glyphosate resistant crops. The utilization of herbicides have differing modes of action (MOA) during the growing season or tank mixing herbicides with differing MOA are strategies that can be utilized to prevent the development of herbicide resistant weeds. As a means to assist growers with identifying herbicides having like MOA a number system identifying herbicides by MOA has been developed and is being utilized. In the table below there is a MOA number for each herbicide active ingredient to aide growers in making management decisions that will prevent the development of herbicide resistance or address options for managing a known resistant weed population that may be in or near the vineyard.

Additionally growers are encouraged to find at least two herbicide programs containing different herbicides to rotate on an annual basis. By rotating herbicide programs growers not only minimize the risk of herbicide resistance developing but they also minimize the likelihood of selecting for weeds that one herbicide program may not be particularly effective at controlling.

Vineyard Herbicide Options

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
PREPLANT/ SITE PREPARATION	**Glyphosate, MOA 9** Various brands and formulations	See label	Apply 30 days prior to planting for control of emerged weeds.	12	Use to kill strips through vineyard prior to planting. Generic formulations may require the addition of a surfactant. See label for details on controlling specific perennial weeds.
PREEMERGENCE Annual grasses and small seeded broadleaf weeds	**Oryzalin, MOA 3** Surflan 4 AS or Oryzalin	2 to 4 qt	Newly Planted (once soil has settled after transplanting) and Established Vineyards.	12	Surflan or FarmSaver Oryzalin may be tank mixed with paraquat, glyphosate, or Rely for postemergence weed control. In established vineyards tank mix with simazine for expanded residual control of annual weeds.
	Pendimethalin MOA 3 Prowl H2O	2 to 6 qt	Newly Planted (once soil has settled after transplanting) and established vineyards.	12	In newly planted vineyards Prowl may only be applied once soil has settled after transplanting but prior to bud swell. In established vineyards Prowl may be used any time after harvest, through winter, and in the spring. Use rate cannot exceed 6 qt per acre per year. Prowl has a 90 day PHI. Prowl should be tank mixed with paraquat, glyphosate, or Rely for postemergence weed control.

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
PREEMERGENCE Annual grasses and small seeded broadleaf weeds (Continued)	**Pronamide, MOA 3** Kerb 50 WP	2 to 8 lb	Fall or winter transplanted grapes established at least 1 year or spring transplanted grapes established at least 6 months.	12	Apply in fall after harvest for cool season perennial grass and small seeded broadleaf weed control. Apply when temperatures do not exceed 55^{o} F.
	Norflurazon, MOA 12 Solicam 80 DF	1.25 to 5 lb	Grapes established 2 years.	12	Apply in fall or winter to vineyards having sandy loam or coarser textured soils. Tank mix with glyphosate, paraquat or Rely for control of emerged weeds. Residual control is expanded when Solicam is tank mixed with simazine or Karmex.

PREEMERGENCE Annual weeds and some perennial weeds	**Dichlobenil, MOA 20** Casoron 4G Or Casoron 1.4 CS	100 to 150 lb 1.4 to 2.8 gal	Newly planted (4 wks after transplanting) and established vineyards.	12	Apply in January or February for best results. Warm temperatures increase volatilization therefore overhead irrigation may be use for activation when applied in early spring. In new production areas application should not be made until vines have been established at least one year.
PREEMERGENCE Broadleaf weeds	**Oxyfluorfen, MOA 14** Goal or Galigan or OxiFlo 2 EC	2 to 8 pt	Newly planted (once soil has settled after transplanting) and established vineyards.	24	**DO NOT apply after bud swell.** Use in newly planted vineyards that are trellised and once soil has settled after transplanting.
	Rimsulfuron, MOA 2 Matrix FNV 25 WG	4 oz	Vines established at least 1 year.	4	Tank mix with oryzalin, diuron, or simazine to broadenspectrum of residual control. **DO NOT** apply within 14 days of harvest. Matrix FNV will provide POST weed control of certain species like horseweed, wild radish, pigweed, chickweed, and henbit. Tank mix with glufosinate, glyphosate, or paraquat for non-selective POST weed control. Tank mixes with glyphosate will provide partial control of yellow nutsedge (2 to 3" tall).
PREEMERGENCE Broadleaf weeds and some annual grasses	**Diuron, MOA 7** Karmex 80 DF Or Direx 80 DF	2 to 3 lb	Vines established at least 3 years.	12	Rainfall soon after application to soils low in clay and <2% organic matter may result in injury. Apply with glyphosate, paraquat or Rely for postemgence weed control.

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
PREEMERGENCE Broadleaf weeds and some annual grasses (continued)	**Simazine, MOA 5** Princep 4 L or Princep Cal 90 or various generic formulations	2 to 4 qt 2.2 to 4.4 lb	Vines established at least 3 years.	12	Tank mix with glyphosate, paraquat, or Rely for postemergence weed control. The addition of oryzalin (Surflan) or norflurazon (Solicam) with simazine will extend residual grass control several weeks.
PREEMERGENCE Annual broadleaf and grass weeds	**Flumioxazin, MOA 14** Chateau 51 WDG	6 to 12 oz	Newly planted and established vineyards	12	Apply with hooded or shielded application equipment. Grapes established less than 2 years must be shielded with grow tubes. **Chateau may only be used in table grapes after completing harvest and before bud break. Chateau may be applied in vineyards producing grapes used for wine and juice so long as hooded application equipment is used . DO NOT tank mix with glyphosate after bud break.** DO NOT apply more than 6 oz per acre to vines established less than 3 years planted on soils having a sand plus gravel content that exceeds 80% . Chateau has a 60 day PHI.
POSTEMERGENCE DIRECTED Non-selective control	**Glyphosate, MOA** Various Brands and Formulations 4 SL	See Label	Vines established 1 year or more.	12	DO NOT allow spray solution to contact green bark, foliage, or suckers. Tank mix with preemergence herbicides for residual control. **Do not apply within 14 days of harvest.** Generic formulations may require the addition of a surfactant. Refer to label for application directions for hard to control perennial species.
	Glyphosate + Carfentrazone MOA 9 & 14 Rage	20 to 48 oz	Vines established 1 year or more	12	Apply with hooded application equipment. 14 day PHI. **DO NOT** allow spray to contact green stems, leaves, fruit or any other desirable vegetation. Applin combination with non-ionic surfactant at 0.25 %v/v (1 qt per 100 gal. of spray solution). The addition of ammonium sulfate at 2 to 4 lb per acre will enhance herbicide activity. Tank mix with PRE herbicides for residual control.
	Glufosinate, MOA 10 Rely 200	55 to 96 oz	Newly planted (shielded) and established vineyards	12	Do not allow herbicide to contact desirable foliage or immature, uncallused bark. Rely may be used for grape sucker control. Refer to label for details. Apply in a minimum spray volume of 20 gal./A. **Do not apply within 14 days of harvest.**

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
POSTEMERGENCE DIRECTED Non-selective control (Continued)	**Paraquat, MOA 22** Firestorm 3 SL Gramoxone Inteon 2 SL	 1.7 to 2.7 pt 2.5 to 4 pt	Newly planted (shielded) to established vineyards	12	Do not allow herbicide to contact desirable foliage or immature, uncallused bark. Young vines must be shielded. Apply in a minimum spray volume of 20 gal./A with non-ionic surfactant at 0.25 % v/v (1qt per 100 gal. of spray solution).
POSTEMERGENCE Annual and perennial grasses	**Clethodim, MOA 1** Select, Volunteer, Intensity, and others 2EC SelectMax, Intensity One	 6 to 8 oz 12 to 16 oz	Newly planted or non-bearing vineyards	12	Sequential applications are for perennial grasses (bermudagrass or johnsongrass). The addition of a non-ionic surfactant at 0.25 % v/v (1 qt/100 gal. of spray solution) is required.
	Fluazifop, MOA 1 Fusilade DX	 12 to 24 oz	Newly planted and non-bearing vineyards	12	Sequential applications will be necessary for perennial grass (bermudagrass, etc.) control. The addition of a non-ionic surfactant (1 qt/100 gal of spray solution) or crop oil concentrate (1 gal./100 gal. of spray solution) is necessary for optimum results.
	Sethoxydim, MOA 1 Poast	 1 to 2.5 pt	Newly planted and established vineyards	12	Sequential applications will be necessary for perennial grass (bermudagrass, etc.) control. The addition of a non-ionic surfactant (1 qt/100 gal of spray solution) or crop oil concentrate (1 gal./100 gal. of spray solution) is necessary for optimum results**. Do not apply within 50 days of harvest.** Total use can not exceed 5 pt/A per year.

Suggested Herbicide Programs
Grape Vineyards

Crop Age	Fall	Winter	Spring	Summer
Newly Planted			Oryzalin (Once soil settles after transplanting)	Oryzalin + Paraquat (May or June); Fusilade, or Poast, or Select (as needed).
			Chateau (Once soil settles after transplanting)	Chateau + Paraquat (June or July); Fusilade, or Poast, or Select (as needed).
			Prowl H_2O (vines must be dormant)	Paraquat (multiple applications as needed); Fusilade, or Poast, or Select (as needed)
Vines Established 1 to 2 years or more	Glyphosate (spot treat for perennial weeds)	Glyphosate or Rage (Mid March)	Oryzalin + Matrix FNV + Paraquat, glyphosate, or Rely (Early May)	Paraquat or Rely (multiple applications as needed)
	Glyphosate (spot treat for perennial weeds)	Chateau + glyphosate, paraquat or Rely (mid to late March)	Chateau + Paraquat or Rely (early June)	Poast (as needed for POST grass control)
	Glyphosate (spot treat for perennial weeds)	Solicam (vines est. 2 yrs) + glyphosate, paraquat, or Rely		Glyphosate, Paraquat, Rely, or Poast (as needed)
	Glyphosate (spot treat for perennial weeds); Chateau + Rely (after harvest)		Chateau + Paraquat, or Rely (late May)	Rely or Paraquat or Poast (as needed)
	Glyphosate (spot treat for perennial weeds)		Chateau + Glyphosate (prior to bud break)	Rely or Paraquat or Poast (as needed)
Vines Established at least 3 years	Glyphosate (spot treat for perennial weeds)	Glyphosate or Rage (mid March)	Simazine + oryzalin + glyphosate, or Karmex + glyphosate	Paraquat, Rely, or Poast (as needed)
	Glyphosate (spot treat for perennial weeds)	Chateau + glyphosate (mid to late March)	Chateau + Glyphosate (early June)	Poast (as needed for POST grass control)
	Glyphosate (spot treat for perennial weeds); Simazine + paraquat or Rely (after harvest)		Chateau + Glyphosate (mid to late May)	Paraquat, Rely, or Poast (as needed)

Weed Response to Vineyard Herbicides

Herbicides	Annual Grasses					Annual Broadleaf Weeds																Perennial Weeds				
	Crabgrass	Foxtails	Goosegrass	Panicum, Fall	Ryegrass, Annual	Chickweed	Dock	Galinsoga	Geranium, Carolina	Groundsel, Common	Henbit	Horseweed	Lambsquarters	Morningglory, Annual	Nightshades	Pigweed	Radish, Wild	Ragweed	Sida, Prickly	Smartweed	Spotted Spurge	Bermudagrass	Dandelion	Johnsongrass	Nutsedge, Yellow	Virginia Creeper
Preemergence																										
Casoron	G	G	G	G	G	G	G	F	G	G	G	G	G	F	F	G	G	G		G	G	N	G		N	N
Chateau	E	E	E	G	G	E		G	G		E	G	E	E	E	E	G	G	E	G	E	N	G		N	N
Diuron	G	G	G	F	G	G		G	F		G	G	G	G	G	G	G	G	G	G	N	N	N		N	N
Kerb	G	G	G	G	G	G		P			G		F	F	F	P	F	F		F			P		P	N
Matrix FNV	F	F	P	P	P	G				G	G	E	G	G	F	E	G	F			G		F		F	
Oryzalin	E	E	E	G	G	G	N	N		F	F		E	F	P	E	P	P	P	P	F	N	P		N	N
Prowl H_2O	E	G	G	G	G	G			G		G		G	F	F	E	G			G	G					
Simazine	F	G	G	F	G	G		G	F	F	G	G	E	F	G	G	E	G	F	G	P	N	P		N	N
Solicam	E	E	E	E	G	E		G		F	G	G	F	F	G	P	G	G	E	G	F	P	G		P	N
Postemergence																										
Aim	N	N	N	N	N							P	G	E	G	G	F			G		N	N	N	N	N
Clethodim	E	E	E	E	E	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E	N		N	N
Fusilade	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E	N		N	N
Glyphosate	E	E	E	E	E	E	G	G	G	E	F	E	E	G	E	E	G	E	G	F	G	F	G		F	G
Paraquat	G	G	G	G	G	G		G	F	F	F	P	G	G	G	G	F	G	G	G	G	P	P		P	P
Poast	E	E	E	E	G	N	F	N	N	N	N	N	N	N	N	N	N	N	N	N	N	E	N		N	N
Rely 200	F	G	G	G	G	G	N	F	F	F	F	E	G	E	G	G	G	G	F	G	G	F	G		F	P

E = excellent, G = good, F = fair, P = poor, N = no activity

The University of Georgia and Ft. Valley State University, the U.S. Department of Agriculture and counties of the state cooperating. The Cooperative Extension Service offers educational programs, assistance and materials to all people without regard to race, color, national origin, age, sex or disability.

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