

# **2016 Southeast Regional Bunch Grape Integrated Management Guide**

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Recommendations are based on information from the manufacturer's label and performance data from research and extension field tests. Because environmental conditions and grower application methods vary widely, suggested use does not imply that performance of the pesticide will always conform to the safety and pest control standards indicated by experimental data.

This publication is intended for use only as a guide. Specific rates and applications methods are on the pesticide label, and these are subject to change at any time. Always refer to and read the pesticide label before making any application! The pesticide label supersedes any information contained in this guide, and it is the legal document referenced for application standards.

# PESTICIDE EMERGENCIES: 1-800-222-1222

This number automatically connects you with a local Poison Control Center from anywhere in the United States.

- **Tightening of the chest, mental confusion, blurred vision, rapid pulse, intense thirst, vomiting, convulsions, and unconsciousness are always serious symptoms! Dial 911!**
- **Pesticides with ‘DANGER’ or ‘DANGER/POISON’ on the product label can cause severe injuries or death very quickly, even with small exposures. Take immediate action!**
- *Other symptoms of pesticide poisoning:* headache, fatigue, weakness, restlessness, nervousness, profuse sweating, tearing and drooling, nausea, diarrhea, or irritation of the skin/ eyes/nose/throat. Consult the product Material Data Safety Sheet (MSDS) for symptoms associated with a particular pesticide

## Pesticide on Skin

- **WASH, WASH, WASH!** Immediately wash pesticide from skin as thoroughly as possible with any available water that does not contain pesticides.
- Quickly remove protective clothing and any contaminated clothing.
- *Rewash* contaminated skin with soap and water as soon as possible.
- If the victim experiences *any* symptom(s) of poisoning, get medical assistance immediately. *Take the pesticide label with you*, but do not contaminate vehicles or expose others if you must take the container with you.

## Pesticide in Eyes

- Rinse eye(s) gently with *clean* water for *at least* 15 minutes. Be careful of water temperature.
- **If eye remains irritated or vision is blurry after rinsing, get medical attention right away!** *Take the pesticide label with you.*

## Pesticide in Mouth or Swallowed

- Provide / drink large amounts of water or milk to drink - *Do not give liquids to a person who is unconscious or convulsing!*
- Consult the label BEFORE vomiting is induced – the label may advise against inducing vomiting. Do not induce vomiting with emulsifiable concentrate (E, EC) formulations.
- *Do not induce vomiting if a person is unconscious or is convulsing!*
- Seek medical attention. *Take the pesticide label with you.*
- If the pesticide was not swallowed, *rinse mouth thoroughly with clean water.* If mouth is burned or irritated, consult a physician.

## Pesticide Inhaled

- Move victim to fresh air immediately!
- Warn others in the area of the danger.
- Loosen tight clothing.

- Administer artificial respiration if necessary, but try to determine if the person also may have swallowed any pesticide - avoid any pesticide or vomit that may be around the victim's mouth.
- **Seek medical attention.** *Take the pesticide label with you.*

### Heat Stress

- Move the victim to a cooler area, remove protective clothing, and pour cool water over the person.
- Give cool liquids to drink – *Do not give liquids to a person who is unconscious or convulsing!*
- Pesticide poisoning may mimic heat illness! Get medical attention if the person is unconscious or if the person is not fully recovered within 15 minutes of cooling down and drinking liquids.

### Signal Words

- The pesticide signal word will appear on the pesticide label. It provides information about the acute risks of the pesticide to people.
  - **DANGER/POISON:** *Highly toxic*-less than a teaspoon can kill an adult
  - **DANGER:** *Highly toxic*-pesticide can cause severe eye and/or skin injury
  - **WARNING:** *Moderately toxic* - two tablespoons or less can kill an adult.
  - **CAUTION:** *Slightly toxic* - an ounce or more is required to kill an adult.
- Understand that the signal word does *not* provide information about long term pesticide exposure risks (*e.g.*, cancer) or allergic effects.
- Minimize your exposure to *all* pesticides.
- The signal word does *not* indicate environmental toxicity or other environmental effects.
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### PESTICIDE SPILLS OR OTHER EMERGENCIES

*Spills on public roads (Usually call the state police/state highway patrol. In many cases you can call CHEMTREK at 1-800-424-9300 or 911.)*

STATE	AGENCY	PHONE NUMBER
Georgia	Georgia State Patrol	Cell: call *GSP or 911
North Carolina	Regional Response Team (RRT) For spills not on public road ways, contact the Pesticide Section of NCDA&CS	911 or your RRT  (919) 733-3556 or (800) 662-7956 during non-business hours
South Carolina	South Carolina Highway Patrol, South Carolina DHEC Emergency Response Section	Cell: call *HP or 1-888-481-0125 (Toll Free)
Tennessee	Tennessee Emergency Management Agency (TEMA) State Emergency	1-800-262-3300

	Operations Center	
<b>Virginia</b>	Virginia Emergency Operations Center	<b>1-804-674-2400</b>

*Environmental emergencies* (contamination of waterways, fish kills, bird kills, etc.)

<b>STATE</b>	<b>AGENCY</b>	<b>PHONE NUMBER</b>
<b>Georgia</b>	Georgia Department of Natural Resources Response Team	<b>1-800-241-4113</b>
<b>North Carolina</b>	North Carolina Div. of Water Quality	<b>1-800-858-0368</b>
<b>South Carolina</b>	South Carolina DHEC	<b>1-888-481-0125</b> (Toll Free)
<b>Tennessee</b>	Tennessee Wildlife Resources Agency	<b>1-615-781-6643</b>
<b>Virginia</b>	Virginia Emergency Operations Center	<b>1-804-674-2400</b>

### **PESTICIDE LIABILITY and STEWARDSHIP**

Pesticide applicators, supervisors, and business owners may all face severe criminal and/or civil penalties if pesticides are misused – knowingly or accidentally.

*The pesticide label.* Federal and state laws require pesticide applicators to follow the directions on the pesticide label exactly. Do not exceed maximum label rates, apply a pesticide more frequently than stated on the label, or apply a pesticide to a site that is not indicated on the label. Labels change; review yours regularly.

*Restricted Use Pesticides (RUP).* These pesticides are clearly labeled “Restricted Use Pesticide” in a box at the top of the front label. Applicators purchasing, applying, or supervising the application of an RUP, must be certified or licensed through their state pesticide regulatory agency. Some states have mandatory licensing for certain pesticide use categories whether or not RUPs are applied.

*Personal Protective Equipment (PPE).* Anyone handling or applying pesticides must wear the PPE stated on the pesticide label. The Worker Protection Standard requires applicators to wear the label required PPE and requires agricultural employers to supply the label PPE and ensure that

the PPE is worn correctly by applicator employees. Do not wear PPE items longer than it has been designed to protect you. Clean, maintain and properly store PPE. Do not store PPE with pesticides.

**Reentry Interval (REI).** The period of time immediately following the application of a pesticide during which unprotected workers should not enter a field. **Pre-Harvest Interval (PHI).** The time between the last pesticide application and harvest of the treated crops.

**EPA Worker Protection Standard (WPS;** <http://www.epa.gov/agriculture/twor.html>) Growers who employ one or more *non*-family members must comply with the WPS. This standard requires agricultural employers to protect applicator employees and agricultural worker employees from pesticide exposure in the workplace by 1) providing specified pesticide safety training, 2) providing specific information about pesticide applications made on the agricultural operation, 3) providing and ensuring that applicators wear clean and properly maintained label required PPE, 4) providing decontamination facilities for potential pesticide and pesticide residue exposures, and 5) providing timely access to medical assistance in the event of a suspected pesticide exposure. These protections apply to both Restricted Use *and* general use pesticides used in agricultural plant production.

**Pesticide Recordkeeping.** You must keep records of all RUP applications for at least two years under the Federal (USDA) Pesticide Recordkeeping Requirement if your state does not have its own pesticide recordkeeping requirements. Some states require records be kept for longer than the federal requirement. Maintaining records of all pesticide applications, not just RUP applications, indefinitely, cannot only help troubleshoot application problems, but also allows you to reference successful applications and can help protect against future liability. Consult your [local Extension Service](#) for details.

**Be prepared for emergencies.** Store pesticides and clean empty containers securely. Develop and provide written plans and training to prepare your employees, and family members, for pesticide fires, spills, and other emergencies. Assign responsibilities to be carried out in the event of pesticide emergencies. Keep copies of the pesticide labels and MSDS away from the area where pesticides are stored. Provide copies of product MSDSs to your community first responders. Consult your local Extension office and insurance company for assistance.

**Properly dispose of clean empty pesticide containers and unwanted pesticides** as soon as possible. Containers can often be recycled in a pesticide container recycling program. Unwanted pesticides may pose a risk of human exposure and environmental harm if kept for long periods of time. Consult your local Extension office for assistance.

## PESTICIDE APPLICATION

Information on pesticide use is available from the Pesticide Environmental Stewardship website (<http://pesticidestewardship.org>) including information on sprayer calibration, personal protective equipment, recordkeeping, and resistance management.

## RESISTANCE MANAGEMENT

Insects, weeds, and disease-causing organisms are all capable of developing resistance to pesticides. To minimize the likelihood of resistance development against your material of choice:

1. Only use pesticides when necessary: When the damage caused by the pest you are controlling is greater than the cost of the pesticide and no other, effective options are available.
2. Use the appropriate material for the pest.
3. Use the recommended rate of the material. Do not use a lower rate than listed on the label.
4. If more than one treatment is needed when the same pest is present, rotate pesticide mode of action (MOA) between treatments.

The Fungicide Resistance Action Committee (**FRAC**, [www.frac.info](http://www.frac.info)), Insecticide Resistance Action Committee (**IRAC**, [www.irc-online.org](http://www.irc-online.org)), and Weed Science Society of America (**WSSA**, <http://www.wssa.net>) have grouped pesticides into MOA categories, which are listed in this guide to aid in the development of resistance management programs.

# Bunch Grape Integrated Management Guide (Insect and Disease Management)

<b>Bunch Grape</b>
<b>Establishment</b>
<b>General comments</b>
<p><b>Site selection</b> – 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.</p> <p><b>Elevation</b> 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. <b>Direction of slope</b> 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. <b>Soils</b> 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 <i>Vitis vinifera</i>. 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.</p> <p><b>Site development</b> – 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. <b>Soil testing</b> 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</p>

## Bunch Grape

### Establishment

#### General comments

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.

#### Plant selection

Please make sure to 1) obtain clean materials (certified vines) from reputable nurseries. Obtain materials that were certified for the protocol 2010, if possible. The risk of viral infection can be greatly reduced by planting clean vines. Only remedy for virus disease is rouging of the infected vines. 2) Consider varieties (and rootstocks) that are fit to our environment. Rootstocks should have Phylloxera resistance (American grape heritage), as well as nematode tolerance. Hybrid varieties such as Chambourcin and Chardonnal are resistant to certain diseases that are common in the South. Proper variety selection will help you reduce the number of fungicide application. Communicate with the extension agents and nurseries about varieties. It is often recommended to start communicating with a nursery a season or two prior to your planting so that they can grow vines for you.

**Fumigant risk mitigation.** There are now numerous risk mitigation regulations for all fumigants. See <http://www.EPA.gov/oppsrd1/reregistration/x-soil-fum-HOLD/> for specific regulations associated with risk mitigation. Follow all mitigation measurements carefully.

**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.

Replant disorder. This is a poorly defined condition caused by replanting in the same vineyard without allowing sufficient time between old plant removal and new plant establishment. This can occur broadly when whole vineyards are replanted or it can occur with individual vines. Broad-spectrum fumigation may help with this disorder, but good information as to the benefit of these practices is lacking in the Southeast.

<b>Bunch Grape</b>						
<b>Establishment</b>						
<b>Insect pests</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments</b>
Nematodes	1,3-dichloro-propene (Telone II)	27-35 gallons	+++++	5 days		<b>Suggested pre-plant interval:</b> 4 to 8 weeks, longer when dissipation is slow.
	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. <b>Plan for at least a 4-week interval between treatment and planting. More time may be required.</b>
	Pic-Clor 60 EC (1,3-dichloropropene 37% + choropicrin 57%)	19.5-44.5 gallons	++++	5 days		SEE LABEL FOR ADDITIONAL INFORMATION
	Paladin and others from strawberry guide to be added here					

## Bunch Grape (continued)

### Dormant

#### General comments

**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. Pruned wood materials 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 pruned woods. 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. Double pruning (a rough pruning in the fall or in winter, then a final pruning in the spring) can reduce the risk of some of woody/vascular diseases, such as *Botryosphaeria* canker, Eutypa dieback, etc.

**Soil testing** – Soil tests should be conducted every 2 to 3 years after planting. Samples should be collected from 1 to 8 and 8 to 16 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. High spray volume (100 gallons per acre) is needed to coat eggs hidden in rough bark.

**Dormant application of fungicides** – A high rate of lime sulfur (10 gal per acre using 100 gal of water) is known to be effective against anthracnose, in addition, it should suppress Phomopsis and powdery mildew; however, the dormant season application will not be a substitute for in-season protective fungicide application. Thus, use the dormant season application in conjunction with in-season applications for target pathogen(s).

**Dormant application of insecticides** – Sprays at this time are complicated by difficulties in achieving adequate coverage because of the fibrous nature of bark. European red mite eggs would be a target for oil sprays at this time if thorough coverage could be achieved. Mealybugs may be targeted in dormant or delayed dormant period if there was a problem the previous year. If control cannot be achieved at this time, summer timing is also available.

<b>Bunch Grape (continued)</b>						
<b>Dormant</b>						
<b>Diseases</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Black rot Bitter rot Phomopsis Ripe rot	Prune out mummies, cankers, dead wood		*****			Removal of mummies, rachises, and cankered and dead wood (including pruning woods) 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 helps reduce the overwintering inoculum of the Phomopsis and it may reduce powdery mildew fungus inoculum.
Botryosphaeria canker Eutypa dieback ESCA	Topsin-M	0.75-1.5 lb	+++	7 days		<u>A section 24c label <b>for your state</b> is required.</u>
	Rally 40WSP	5 oz	+++			<b>Require a supplemental label</b> (can be obtained from the manufacture's website). Often recommended to use with Topsin-M.
	Latex paint with boron (B-lock)		+++			Protective paint for wound protection
	Double pruning					Please see the comment section above

## Bunch Grape (continued)

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

### Insect pests

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	(IRAC=1A)
	zeta cypermethrin (Mustang 1.5 EC)	2.15-4.3 oz	+++	12 hrs	1 day	(IRAC=3A)
	bifenthrin (Brigade 10WSB)	3.2-6.4 oz	+++	12 hrs	30 days	(IRAC=3A)
	cyfluthrin (Baythroid 2EC)	2.4-3.2 fl oz	+++	12 hrs	3 days	(IRAC=3A)
	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. (IRAC=28)
	methoxyfenozide (Intrepid 2F)	12-16 fl oz	+++	4 hrs	30 days	(IRAC=18)
	spinetoram (Delegate 25 WG)	3-5 oz	+++	4 hrs	7 days	(IRAC=5)
	flubendiamide + buprofezin (Tourismo 12.5)	10-14 fl oz	++	12 hrs	7 days	(IRAC=16 + 28)
	spinosad (Entrust 80W)	1.25-2.5 oz	+++	4 hrs	7 days	OMRI approved. (IRAC=5)
	<i>Bacillus thuringiensis</i> [Bt] (Dipel DF and others)	0.5-1 lb	++	4 hrs	0 days	OMRI approved. (IRAC=11)
	rynaxypyr (Altacor)	3.0-4.5 oz	+++	4 hrs	14 days	Use between 100-200 gallons per acre total spray volume. (IRAC=28)

## Bunch Grape (continued)

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

### Insect pests

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	(IRAC=1A)
	Zeta cypermethrin (Mustang 1.5 EC)	2.15-4.3 oz	+++	12 hrs	1 day	(IRAC=3A)
	cyfluthrin (Baythroid 2 EC)	2.4-3.2 fl oz	+++	12 hrs	3 days	(IRAC=3A)
	phosmet (Imidan 70-W)	1.33-2.125 lb	+++	14 days	14 days	(1B) The 14-day REI may make this product impractical to use for most growers.
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. (IRAC=NA)
	clothianidin (Belay)	6 fl oz (foliar)	+++	12 hrs	0 days	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. (IRAC=4A)
		6-12 fl oz (soil)	++++	12 hrs	30 days	
	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. (IRAC=NA)
	buprofezin (Applaud 70DF)	9-12 oz	+++	12 hrs	30 days	(IRAC=16)
dinotefuran (Venom 20SG)	0.44-0.66 lb (foliar)	+++	12 hrs	1 day	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. (IRAC=4A)	
	1.13-1.32 lb (soil)	++++		28 days		

## Bunch Grape (continued)

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

### Insect pests

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC Code)
Mealybug (cont.)	dinotefuran (Scorpion 35 SL)	2-5 fl oz (foliar)	+++	12 hrs	1 day	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. <b>(IRAC=4A)</b>
		9-10.5 fl oz (soil)	++++		28 days	
	imidacloprid (Admire Pro)	7-14 fl oz (soil)	++++	12 hrs	30 days (soil)	
	cyfluthrin (Baythroid 2EC)	2.4-3.2 fl oz	+++	12 hrs	3 days	<b>(IRAC=3)</b>

**Leafroll and red blotch diseases** – Both are viral diseases that have similar symptoms. Once infected, vines can show red discolorations on inter-veinal area of leaf (on red-fruited varieties), and cupping or rolling of leaves (on both red- and white-fruited varieties) is often associated with leafroll disease. Damages from these virus infections include reduced yields, delayed ripening, reduced sugar levels, and reduced color (~anthocyanin) in skin tissues, and it can also cause reduction of overall vine vigor. Both viruses can enter a vineyard through transplanting of infected nursery stock, thus, it is highly recommended to obtain certified (virus-tested) vines. Several types of leafroll viruses are known, and vines can be tested for these viruses. Contact your local extension agent, if you have suspicious vines. If leafroll or red blotch virus has been confirmed, infected vines should be immediately removed and destroyed to reduce risks of spreading. Several species of mealybugs are primary vectors of leafroll viruses. When both leafroll virus(es) and mealybug presence is confirmed, insecticide application should be initiated to minimize spread of mealybug infestations and leafroll.

## **Bunch Grape (continued)**

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

#### **General comments**

**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. Petiole analysis should be utilized each year to determine whether nitrogen fertilization is needed. The best time to apply nitrogen to the soil in vineyards is shortly after 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 year. Samples should be collected from 1 to 8 and 8 to 16 inches in depth. Results from soil tests will be useful in understanding results from petiole testing. (2)

**Tissue analysis** – Collect petioles at full bloom 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 while pathogen like powdery mildew thrive under the shade. 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.

#### **Diseases**

During early part of the season, your primary target disease is Phomopsis cane and leaf spot because it can be active in relatively low temperature ranges (they can cause infection in mid-40's). Also, when there are unseasonably warm rain events, both downy and black rot can appear; however, it is not very common. Moreover, if you apply mancozeb for Phomopsis, it will be effective against downy mildew and black rot. 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. However, sulfur can be a relative cheap and effective material that can be tank-mixed as insurance.

<b>Bunch Grape (continued)</b>
<b>Budbreak and new shoot sprays (7-10 day interval from 1-inch shoot growth until prebloom)</b>
<b>Diseases (cont.)</b>
<p>Since many of newer powdery mildew fungicides are prone to develop fungicide resistance, it is advisable to use sulfur as a backbone of your powdery mildew management during early part of the season because it has multiple mode of action and the risk of resistance development is low. Notes on the use of sulfur products: 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.</p> <p>The newer powdery mildew materials (Rally, tebuconazole products, Procure, Vivando, Mettle, Quintec, etc) are very effective; however, since their mode of action is narrow (Many of them target a single gene or gene function), the risk of resistant development is higher. Thus, tank-mixing, limitation, and rotation of the material are important in order to minimize the risk of fungicide resistance development. It is a good idea to tank-mix a newer material with sulfur. Limit the use to less than three applications a year, and use the maximum labeled rate/acre. Since we need to apply multiple applications throughout the season, it is important to rotate chemicals. When you plan for the rotation, keep in your mind that you need to rotate mode of action or FRAC code. (Please see “prebloom” section)</p>

<b>Bunch Grape (continued)</b>						
<b>Budbreak and new shoot sprays (7-10 day interval from 1-inch shoot growth until prebloom)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<b>Diseases</b>						
Phomopsis Black rot Powdery mildew Downy mildew	mancozeb (various formulations) + sulfur (various formulations)	see label  see label	++++	24 hrs	66 days (The REI and PHI refer to the most stringent aspect of the combined spray)	This should be the backbone of your fungicide program, especially early in the season. Mancozeb targets for Phomopsis, downy mildew, and black rot management, and sulfur targets for powdery mildew management. <b>FRAC = M3</b> for mancozeb and <b>M2</b> for sulfur  Note: sulfur may not be as effective at low temperature < 65F,

<b>Bunch Grape (continued)</b>						
<b>Budbreak and new shoot sprays (7-10 day interval from 1-inch shoot growth until prebloom)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<b>Insect pests</b>						
Sharpshooter leafhoppers (Pierce's disease suppression)	imidacloprid (Admire Pro)	1-1.4 fl oz (foliar) 7-14 fl oz (soil)	+++ ++++	12 hrs	0 days (foliar) 30 days (soil)	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. Only apply 14 fl oz per season. <b>(IRAC=4A). Imidacloprid may be applied in two half-rate applications 30 days apart to good effect.</b>
	dinotefuran (Venom 20SG) (Scorpion 35 SL)	5-6 oz (soil) 2-5 fl oz (foliar) 9-10.5 fl oz (soil)	+++ +++ ++++	12 hrs	28 days 1 day 28 days	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. <b>(IRAC=4A)</b>
	clothianidin (Belay)	6 fl oz (foliar) 6-12 fl oz (soil)	+++ ++++	12 hrs 12 hrs	0 days 30 days	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. <b>(IRAC=4A)</b>
	clothianidin (Clutch 50WDG)	6 oz	++++	12 hrs	30 days	Make no more than one soil application per season by drip or trickle irrigation. <b>(IRAC=4A)</b>
Mealybugs	clothianidin (Belay)	6 fl oz (foliar)	+++	12 hrs	0 days	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. <b>(IRAC=4A)</b>
		6-12 fl oz (soil)	++++	12 hrs	30 days	

<b>Bunch Grape (continued)</b>						
<b>Budbreak and new shoot sprays (7-10 day interval from 1-inch shoot growth until prebloom)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Mealybugs (cont.)	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. (IRAC=NA). Do not apply within 14 days of a Captan or sulfur application.
	buprofezin (Applaud 70DF)	9-12 oz	+++	12 hrs	30 days	(IRAC=16)
	dinotefuran (Venom 20SG)	0.44-0.66 lb (foliar)	+++	12 hrs	1 day	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. (IRAC=4A)
		1.13-1.32 lb (soil)	++++		28 days	
	dinotefuran (Scorpion 35 SL)	2-5 fl oz (foliar)	+++	12 hrs	1 day	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. (IRAC=4A)
		9-10.5 fl oz (soil)	++++		28 days	
imidacloprid (Admire Pro)	7-14 fl oz (soil)	++++	12 hrs	30 days (soil)	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. (IRAC=4A)	
cyfluthrin (Baythroid 2EC)	2.4-3.2 fl oz	+++	12 hrs	3 days	(IRAC=3)	
Cutworms	See bud swell recommendations					
Grape flea beetle	See bud swell recommendations					

## Bunch Grape (continued)

### Prebloom

#### General comments

**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 would be; however, many people wait until bunch closure or late to have an “insurance” for accidental loss of yield. Excess clusters should be removed from shoots, as there may not be sufficient leaf area to ripen the fruit. Third clusters on a shoot should be removed and, in 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.

**Shoot thinning and positioning** – It is important to thin excess shoots and position remaining shoots while it is still flexible, also, in terms of disease management, open canopy will provide a good airflow to reduce the risk of disease development, and allow fungicides to reach the fruiting zone.

Please refer to Wine Grape Production Guides (example: [http://cals.ncsu.edu/hort\\_sci/extension/wine\\_grape.php](http://cals.ncsu.edu/hort_sci/extension/wine_grape.php), [http://palspublishing.cals.cornell.edu/nra\\_order.taf?function=detail&pr\\_id=178&UserReference=0E03A](http://palspublishing.cals.cornell.edu/nra_order.taf?function=detail&pr_id=178&UserReference=0E03A)) for more detailed information on vine managements.

#### Diseases

**This is one of the most important sprays for downy mildew, powdery mildew, Phomopsis, and black rot.**

From this stage, grape berries become susceptible to infection by black rot, downy mildew, and powdery mildew, and all of these pathogens become active due to warmer temperature. Once again, mancozeb and sulfur combination is the backbone of the spray program at this stage. Mancozeb materials are effective against, Phomopsis, black rot, downy mildew, and sulfur materials are effective against powdery mildew. If you decide to use captan instead of a mancozeb product, make sure to tank mix it with a material with efficacy against black rot.

Since this is the start of the critical time to protect your berries from downy mildew, powdery mildew, and black rot infection, this should be where newer materials are used. If black rot is a problem, combine mancozeb with Rally or Elite. Rally and Elite are more active on black rot than Procure or Rubigan. (Note: Rubigan/Vintage has been removed from the market. It is OK to use the ones you have, but make sure to keep your label.) If there is a rain event which can be black rot infection (please visit VA grape disease update <http://grapepathology.blogspot.com/> for more information about infection conditions for major grape diseases), and your vines are not protected by previous application, Rally should provide a good curative or kick-back activities as long as you apply within a few days after the infection event. For downy mildew, there are phosphonate materials (Prophyt, Phostrol, etc.), and Ridomil products that have curative activities; however, please note that the protective application provides much better efficacy than the curative application of fungicide.

## **Bunch Grape (continued)**

### **Prebloom**

**Fungicide resistance** – Fungicide resistance is a very serious and real matter. There are several mechanisms that fungal pathogens can develop resistance, but in general, after a certain period of use of a particular mode of action, we select fungal population(s) that is resistance to the mode of action. In some cases, there is a cost associated with having resistance and the population may not survive for a long period; however, in many other cases, resistant population will thrive. Thus, once resistance population is found at your vineyard, chances are, it will stay with you for a long time.

The mode of action is conveniently summarized for you as FRAC code (Fungicide Resistance Action Committee), and you can find it on the fungicide label and throughout this IPM guide. In many cases, different chemicals (i.e., products) have the same mode of action and some of newer materials have two different modes of action together (yet one of them is often an existing mode of action). It is important to understand that the key is rotating the mode of action (= FRAC code), and some of products under different product or chemical name may have the same mode of action. For example, if you rotate Rally (myclobutanil) with Elite (tebuconazole), it is not really a rotation since both are FRAC code 3. The same is true with the case with a rotation of Flint and Pristine because both contain FRAC code 11. (Specific information on each FRAC group is discussed in Comments area of this IPM guide.) Newer materials tend to have a single mode of action (or combination of two single mode of action), therefore, when you are using newer materials, please rotate, limit the use (twice per year), and also tank-mix with older material (sulfur, copper, mancozeb, ziram, captan, etc) in order to lower the risk of fungicide resistance development.

#### **Cases of resistance against particular mode of action groups found in the Southeastern region**

- Resistance against benzimidazoles, FRAC = 1 and QoIs (**Q**uinone **o**utside **I**nhibitor, or also known as strobilurin), FRAC = 11, by powdery mildew and Botrytis (widespread)
- Abound is more active on downy mildew than Flint or Sovran; however, in some areas of southeast, both powdery mildew and downy mildew pathogens have already developed resistance against Abound and other QoI fungicides (FRAC=11).
- Quintec (FRAC = 13) resistant strains of powdery mildew have been observed in VA (Note: Only one case reported, not widespread as of 2014)
- Pristine (QoI and SDHI FRAC = 7) resistance has been documented on Botrytis in multiple crops including wine grapes, several cases reported in VA.

<b>Bunch Grape (continued)</b>						
<b>Prebloom</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<b>Diseases</b>						
Phomopsis Black rot Powdery mildew Downy mildew	mancozeb (various formulations) + sulfur (various formulations)	see label  see label	++++	24 hrs	66 days (The REI and PHI refer to the most stringent aspect of the combined spray)	This should be the backbone of your fungicide program, especially early in the season. Mancozeb targets for Phomopsis, downy mildew, and black rot management, and sulfur targets for powdery mildew management. Both mancozeb and sulfur are low risk for fungicide resistance development <b>FRAC = M3</b> for mancozeb and <b>M2</b> for sulfur
	mancozeb + sulfur  <i>plus one of following:</i> myclobutanil (Rally 40WSP) or tebuconazole (Elite 45DF) (Tebuzole 45DF) (Orius 45DF) or triflumizole (Procure 480WS) or tetraconazole (Mettle 1ME) or fenarimol (Rubigan 1E) (Vintage SC)	see label  3-5 oz  4 oz 4 oz 8.6 oz  4-8 oz  3-5 fl oz  4-6 fl oz	++++	24 hrs	66 days	These materials for powdery mildew belong to a group called the DMI fungicide.  DMI stands for <b>DeMethylation Inhibitors</b> or sometimes some of chemicals in this group are called Sterol Inhibitors (SI) because they inhibit biosynthesis of sterol in fungi. ( <b>FRAC = 3</b> )  Fenarimol can cause phytotoxicity to some cultivars

<b>Bunch Grape (continued)</b>						
<b>Prebloom</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Phomopsis Black rot Powdery mildew Downy mildew (continued)	mancozeb + sulfur	See label		24 hrs	66 days	This class of fungicides often called QoI (Quinone outside Inhibitor) is prone to resistance. (FRAC = 11)  Where possible, use of older chemistries, such as mancozeb and sulfur, provide good management during this timeframe, while allowing the class 11 materials to be utilized later.  Do not use Flint on Concords. This class of fungicides is prone to resistance.
	<i>plus one of following:</i>  azoxystrobin (Abound 2SC) or kresoxim-methyl (Sovran 50WG) or trifloxystrobin (Flint 50WG)	10-15.5 fl oz  3.2-4.0 oz (PM) 4-6.4 oz (DM)  1.5-2.0 oz	+++++  ++++  ++++			
	boscalid + paraclostrobin (Pristine 38WG)	8.0-10.5 oz	+++++	24 hrs + 5 days for cane work	14 days	Because it is a mixed material, Pristine can be applied by itself for protection against Phomopsis, black rot, powdery mildew, and downy mildew; however, this class of fungicides is prone to resistance. Where possible, use of older chemistries, such as mancozeb and sulfur, provide good management during this timeframe, while allowing the class 11 materials to be utilized later. Do not apply Pristine to Concord, Worden, Fredonia, Niagara or related grape varieties due to possible injury. (FRAC = 7 + 11)

<b>Bunch Grape (continued)</b>						
<b>Prebloom</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Black rot Powdery mildew Downy mildew	mandipropamid + difenoconazole (Revus Top)	7.0 fl oz	++++	12 hrs	14 days	Because it is a mixed material, Revus Top can be applied by itself for protection against black rot, powdery mildew, and downy mildew; however, this class of fungicides is prone to resistance. Also active against powdery mildew and black rot. Do not use on Concords and Fredonia due to phytotoxicity. <b>(FRAC = 3 + 40)</b>
<i>Section below shows materials for specific diseases. These materials should be mixed with other materials to provide protection against other major diseases.</i>						
Anthracnose (Bird's-eye rot)	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. This class of fungicides is prone to resistance. <b>(FRAC = 7 + 11)</b>
	captan (various formulations)	see label	+++++	48 hrs	0 days	Please check your label for REI since they have changed recently. <b>FRAC = M4</b> , low resistance risk
Downy mildew	mefenoxam + copper (Ridomil Gold Copper)	2.0 lbs	+++++	48 hrs	42 days	Ridomil products provide excellent curative 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. <b>(FRAC = 4)</b>
	or mefenoxam + mancozeb (Ridomil Gold MZ)	2.5 lbs	+++++	48 hrs	66 days	

<b>Bunch Grape (continued)</b>						
<b>Prebloom</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<i>Section below shows materials for specific diseases. These materials should be mixed with other materials to provide protection against other major diseases.</i>						
Downy mildew (cont.)	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. <b>(FRAC = 40)</b>
	Ametocradin + dimethomorph (Zampro SC)	14 fl oz	+++++	12 hrs	14 days	Please see the comment above. <b>(FRAC = 40 + 45)</b>
	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. <b>(FRAC = 43)</b>
	famoxadone + cymoxanil (Tanos)	8.0 oz	++	12 hrs	30 days	Tanos is <i>required</i> to be tank-mixed with a broad-spectrum fungicide such as captan or mancozeb. Make no more than 1 application of Tanos before rotating to a fungicide with a different mode of action. Once again this FRAC code 11 group is prone to fungicide resistance development <b>(FRAC = 11 + 27)</b>
Powdery mildew	Metrafenone (Vivando SC)	10.3-15.4 fl oz	++++	12 hrs	14 days	Best to be applied before symptom development. Do not make more than 2 sequential applications. <b>(FRAC = U8)</b>
	quinoxifen (Qintec SC)	3-4 fl oz	++++	12 hrs	14 days	No more than 3 applications per season. Please see the label for higher rate usages <b>(FRAC = 13)</b>
	cyflufenamid (Torino SC)	3.4 fl oz	+++	4 hrs	3 days	Do not make more than 2 applications per year. <b>FRAC = U6</b>

<b>Bunch Grape (continued)</b>						
<b>Prebloom</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<b>Insect Pests</b>						
Sharpshooter 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	(IRAC=1A)
	malathion (Malathion 8F or Malathion 5)	1.88 pt	++	12hrs	3 days	Rates are based on 200 gal per acre spray volumes. (IRAC=1B)
	fenpropathrin (Danitol 2.4 EC)	5.33-10.66 fl oz	++	24 hrs	21 days	(IRAC=3A)
	cyfluthrin (Baythroid)	1.6-3.2 fl oz	++	12 hrs	3 days	(IRAC=3A)
	bifenthrin (Brigade 10 WSB)	16 oz	++	12 hrs	30 days	(IRAC=3A)
	(Sniper 2EC)	6.4 fl oz	++			
	imidacloprid (Admire Pro)	1-1.4 fl oz (foliar) 7-14 fl oz (soil)	+++ ++++	12 hrs	0 days (foliar) 30 days (soil)	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. Only apply 14 fl oz per season. (IRAC=4A)
	dinotefuran (Scorpion 35 SL)	2-5 fl oz (foliar) 9-10.5 fl oz (soil)	+++ ++++	12 hrs	1 day 28 days	
	(Venom)	1-3 oz	+++		1 day	
	clothianidin (Clutch 50WDG)	1-2 oz	+++	12 hrs	0 days	
acetamiprid (Assail 30SG)	2.5 oz	+++	12 hrs	7 days		

<b>Bunch Grape (continued)</b>						
<b>Prebloom</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Grape berry moth (only treat for grape berry moth if adults are captured in pheromone traps. For the first three flights, expect 50% emergence at 187, 869, and 1094 Degree Days above a base of 47 F after first male catch)	fenpropathrin (Danitol 2.4 EC)	10.66 to 21.33 fl oz	++	24 hrs	21 days	Use caution in the use of postbloom pyrethroids; they may flare mealybug populations with resulting issues with leafroll virus <b>(IRAC=3)</b>
	methoxyfenozide (Intrepid 2F)	12-16 fl oz	++++	4 hrs	30 days	Minimum application volume for airblast sprayers of 40 gallons per acre. See supplemental label for this use rate. <b>(IRAC=18)</b>
	clothianidin (Clutch 50WDG)	1-2 oz	+++	12 hrs	0 days	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. <b>(IRAC=4A)</b>
	spinosad (Entrust)	1.25-2.5 oz	+++	4 hrs	7 days	OMRI approved. <b>(IRAC=5)</b>
	rynaxypyr (Altacor)	2.0-4.5 oz	+++	4 hrs	14 days	Use between 100-200 gallons per acre total spray volume. <b>(IRAC=28)</b>
	phosmet (Imidan 70-W)	1.33-2.125 lb	+++	14 days	14 days	<b>(IRAC=1B)</b>
	spinetoram (Delegate)	3-5 oz	+++	4 hrs	7 days	<b>(IRAC=5)</b>
	indoxacarb (Avaunt 30DG)	5-6 oz	+++	12 hrs	7 days	<b>(IRAC=22)</b>
	clothianidin (Belay)	6.0 fl oz	++	12 hrs	0 days	<b>(IRAC=4A)</b>
	pheromone (SPLAT-GBM)	1.0 kg	+++	4 hrs	0 day	For SPLAT-GBM mating disruption, apply when temperatures are between 60-80 degrees F and no rain is expected within 1-2 hours. For high population densities, apply 1.0kg/A as 1,000 point sources of 1.0 g (1/4 tsp) throughout an acre. For low-moderate populations, apply 1.0 kg as 250 point sources of 2.5 g (1/2 tsp). See application information on label.

<b>Bunch Grape (continued)</b>						
<b>Prebloom</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Grape flea beetle	carbaryl (Sevin 80S)	1.25-2.5 lb	+++	12 hrs	7 days	(IRAC=1A)
	phosmet (Imidan 70-W)	1.33-2.125 lb	+++	14 days	14 days	(IRAC=1B)
Grape scale	buprofezin (Applaud 70DF)	9.0-12.0 oz	+++	12 hrs	30 days	Apply when crawlers are active, or at 493 and 990 degree-days (base 50 F), starting at April 1 (early and peak activity of first generation).
	spirotetramat (Movento 2SC)	6.0-8.0 fl oz	+++	24 hrs	7 days	
	imidacloprid (Admire Pro)	1.0-1.4 fl oz	+++	12 hrs	0 days (foliar)	
	acetamiprid (Assail 30 SG)	2.5 oz	+++	12 hrs	7 days	
Grape tumid gallmaker	spirotetramat (Movento 2SC)	6.0-8.0 fl oz	+++	24 hrs	7 days	Apply when galls first appear in blocks with a history of high populations of grape tumid gallmaker. Certain varieties are more susceptible (e.g. Traminette, Niagara)

## Bunch Grapes (continued)

### Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
<b>Diseases</b>						
A spray for Botrytis during bloom can be beneficial, especially in the wet seasons. It will also lower the risk of Botrytis outbreak later in the season. Materials in different classes should be rotated through the season when needed to avoid resistance development. Resistance to some of active ingredients are known in the US and also European countries. See product label for complete information on resistance management and use restrictions.						
Botrytis	iprodione (Rovral 50 WP, Meteor)	1-2 lb	+++	12 hrs	7 days	Risk of resistance is high. (FRAC = 2)
	iprodione (Rovral 4F)	1-2 pt	+++	12 hrs	7 days	Risk of resistance is high. (FRAC = 2)
	fenhexamid (Elevate 50WDG)	1 lb	+++++	12 hrs	0 days	(FRAC = 17)
	cyprodinil + fludioxonil (Switch 62.5 WG)	11-14 oz	++++	12 hrs	7 days	Do not use an adjuvant. Do not make more than two sequential applications of Switch before switching to a fungicide with another mode of action. Fludioxonil can be photodegraded, thus, it may not provide a long protection (>7 days) under intense sunlight. (FRAC = 9 + 12)
	cyprodinil (Vangard 75WG)	5-10 oz	+++++	12 hrs	7 days	The rate depends on whether you will tank mix them with other product(s), please refer to the labels for more information. (FRAC = 9)
	pyrimetamil (Scala SC)	9-18 fl oz	+++++	12 hrs	7 days	The rate depends on whether you will tank mix them with other product(s), Please refer to the labels for more information. (FRAC = 9)
	cyprodinil + difenoconazole (Inspire Super)	16-20 fl oz	++++	12 hrs	14 days	Please note that many of pre-mixed materials contain the same mode of action of other products. (FRAC = 9 + 3) Note 2: Some of products may not have the same percentage + rate combination to make it equal application rate to the non-pre-mixed material

## Bunch Grapes (continued)

### Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Botrytis (cont.)	boscalid + pyraclostrobin (Pristine 38WG)	18.5-23 oz	+++++	24 hrs + 5 days for cane work	14 days	Pristine also has activity on black rot, Phomopsis, downy mildew, and powdery mildew. Do not apply to Concord, Worden, Fredonia, or Niagara. (FRAC = 7 + 11)
	boscalid (Endura 30WG)	8 oz	+++++	12 hrs	14 days	Endura will also control powdery mildew. (FRAC = 7)
	fluopyrum + tebuconazole (Luna Experience)	8-8.6 fl oz	+++++	12 hrs + 5 days for cane work	14 days	Do not apply more than 34 fl oz of Luna Experience per acre per season (FRAC = 7 + 3). Due to its 5-day cane work REI, this product may be suited more for late season applications. Luna Experience also works against powdery mildew
	Fluopyrum + pyrimethanil (Luna Tranquility)	16-24 fl oz/A	+++++	12 hrs	7 days	The maximum usage allowed is 54.7 fl oz/A per season (FRAC = 7 + 9)
Phomopsis Black rot Powdery mildew Downy mildew	Same as Prebloom recommendations					The needs for application depend on how bloom goes. E.g., if there is a long bloom period with cool weather, you may need to protect your blooms from downy and powdery mildews.
Anthracnose (Bird's-eye rot)	Same as Prebloom recommendations					

## Bunch Grapes (continued)

### Bloom

Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Powdery mildew ( <i>specific</i> )	Vivando or Tanos	10.3-15.4 fl oz	++++	12 hrs	14 days	Due to its short REI and PHI, you may want to save use of Tanos for late season PM management <b>FRAC = U8</b> (Vivando) and <b>U6</b> (Torino)
		3.4 fl oz	++++	4 hrs	3 days	
Bitter rot Ripe rot	Mancozeb or Captan	See label	++++	24 hrs	66 days	Some species of ripe rot pathogen is not sensitive to captan. In VA, several QoI resistant ripe rot isolates have been observed. <b>FRAC = M3</b> (mancozeb, ziram), <b>M4</b> (captan), and <b>11</b> (QoI)
	or ziram 76DF	See label	+++	48 hrs	0 day	
	or QoI fungicide	3-4 lb	+++	48 hrs	21 days	
	(Abound 25CS or Pristine 38WG or Flint 50WG)	11-15.5 fl oz 18.5-23 oz 1.5-2.0 oz	++++	12 hrs	14 days	
<b>Insect pests</b>						
Pest/Problem	Management Options	Amount of Formulation per Acre	Effectiveness (+) or Importance (*)	REI	PHI	Comments (FRAC/IRAC)
Thrips	spinosad (Entrust 80W)	1.25-2.5 oz	+++	4 hrs	7 days	OMRI approved. <b>(IRAC=5)</b>
	spinetoram (Delegate)	3-5 oz	+++	4 hrs	7 days	<b>(IRAC=5)</b>
	dinotefuran (Venom) (Scorpion 35 SL)	1-3 oz	+++	12 hrs	1 day	If a soil application of a Group 4 is made, at least one foliar application of a different mode of action should be made before a foliar application of a Group 4A material is made. <b>(IRAC=4A)</b>
		2-5 fl oz (foliar)	+++			
	azadirachtin (Aza-Direct)	1-2 pt	++	4 hrs	0 days	OMRI approved. <b>(IRAC=UN)</b>
pyrethrins (PyGanic 1.4EC) (PyGanic EC 5)	16-64 fl oz 4.5-18 fl oz	++ ++	12 hrs	0 days	OMRI approved. <b>(IRAC=3)</b>	

## Bunch Grape (continued)

### Postbloom (7-10 days after the prebloom spray)

#### General comments

**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.

#### Diseases

**This is one of the most important sprays for downy mildew, powdery mildew, Phomopsis, and black rot.**

From bloom to 4-5 weeks after bloom, grape berries become susceptible to infection by black rot, downy mildew, and powdery mildew, and all of these pathogens become active due to warmer temperature. Once again, mancozeb and sulfur combination is the backbone of the spray program. Mancozeb materials are effective against, Phomopsis, black rot, downy mildew, and sulfur materials are effective against powdery mildew.

Since this is the middle of the critical time to protect your berries from downy mildew, powdery mildew, and black rot infection, newer materials should be used in a conjunction with mancozeb + sulfur backbone. A DMI or QoI fungicide should provide an extra efficacy. The main idea here is try to prevent infection to take place while berries are susceptible to infection.

If black rot is a problem, combine mancozeb with Rally or Elite. Rally and Elite are more active on black rot than Procure or Rubigan. If there is a rain event that can be black rot infection and your vines are not protected by previous application, Rally should provide a good curative or kick-back activities as long as you apply within a few days after the infection event.

If downy mildew is a problem, substitute Ridomil Gold MZ at 2.5 lb/acre for mancozeb (or use a reduced rate of mancozeb) or add phosphonates (Prophyt etc). Do not make more than three applications per season of Pristine or 2-3 applications of the QoI fungicides (Flint, Sovran, or Abound). Do not make more than two sequential applications of Flint, Sovran, Abound, or Pristine.

If powdery mildew is a problem (i.e, you can see active powdery colonies on leaves and berries), use a potassium salt product such as Kaligreen or Armicarb. Through coverage is needed for these contact fungicides to be effective. Another product to be considered is Stylet Oil; however, the use of oil can be very difficult because it can cause phytotoxicity and other damages (e.g., delay of ripening). In addition, a mixture of oil and captan or sulfur can result in vine injury. Thus, it is often recommended to use no more than two applications per year, and to be applied earlier in the season. Check Michigan State University's extension publication (<http://ipmnews.msu.edu/fruit/Fruit/tabid/123/articleType/ArticleView/articleId/946/JMS-Stylet-Oil-can-be-used-to-knock-down-powdery-mildew-on-grapevines.aspx>) for more information on the use of Stylet Oil against powdery mildew.

In addition, both ripe rot and bitter rot pathogens can infect flower parts to cause disease later in the season. Thus, if you have history of bitter rot or ripe rot, consider protecting flowers using mancozeb, QoI, captan, or ziram.

<b>Bunch Grape (continued)</b>						
<b>Postbloom (7-10 days after the prebloom spray)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<b>Diseases</b>						
Phomopsis Black rot Powdery mildew Downy mildew Bitter rot Ripe rot	<p>mancozeb (various formulations) + sulfur (various formulations)</p> <p><i>plus one of following:</i></p> <p>myclobutanil (Rally 40WSP) or tebuconazole (Elite 45DF) (Tebuzole 45DF) (Orius 45DF) or triflumizole (Procure 50WS) or tetraconazole (Mettle 1ME) or fenarimol (Rubigan EC) (Vintage SC)</p>	<p>see label</p> <p>3-5 oz</p> <p>4 oz</p> <p>4 oz</p> <p>8.6 oz</p> <p>4-8 oz</p> <p>3-5 fl oz</p> <p>4-6 fl oz</p>	+++++	24 hrs	66 days (The REI and PHI refer to the most stringent aspect of the combined spray)	<p>This should be the backbone of your fungicide program, especially early in the season. Mancozeb targets for Phomopsis, downy mildew, and black rot management, and sulfur targets for powdery mildew management. FRAC = M3 for mancozeb and M2 for sulfur</p> <p><i>Since it will be a very critical application, one of the newer materials for powdery mildew should be added.</i></p> <p>These materials for powdery mildew belong to a group called DMI fungicide. <b>FRAC = 3</b></p> <p>Ripe rot can be managed by mancozeb (please refer to bloom application).</p> <p>Fenarimol has been removed from the market. If you have the label, you can continue its use.</p>

<b>Bunch Grape (continued)</b>						
<b>Postbloom (7-10 days after the prebloom spray)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Phomopsis Black rot Powdery mildew Downy mildew Bitter rot Ripe rot (continued)	mancozeb (various formulations) + sulfur (various formulations)  <i>Plus one of following:</i>	See label	+++++	12 hrs	66 days	This class of fungicides is prone to resistance. <b>FRAC = 11</b>  Where possible, use of older chemistries, such as mancozeb and sulfur, provide good management during this timeframe, while allowing the class 11 materials to be utilized later.  Do not use Flint on Concords. This class of fungicides is prone to resistance.  Ripe rot can be managed by both mancozeb and azoxystrobin (please refer to bloom application).
	azoxystrobin (Abound 2SC) or kresoxim-methyl (Sovran 50WG) or trifloxystrobin (Flint 50WG)	11-15.5 fl oz  3.2-4.0 oz (PM) 4-6.4 oz (DM)  1.5-2.0 oz	++++  ++++  ++++			
	boscalid + paraclostrobin (Pristine 38WG) (mix with mancozeb or captan?)	8.0-12.5 oz	+++++	24 hrs (5 days for cane work)	14 days	Because it is a mixed material, Pristine can be applied by itself for protection against Phomopsis, black rot, powdery mildew, and downy mildew; however, this class of fungicides is prone to resistance. Thus, mix it with older chemistries, such as mancozeb and sulfur to provide good control during this timeframe. Do not apply Pristine to Concord, Worden, Fredonia, Niagara or related grape varieties due to possible injury. (FRAC = 7 + 11)

<b>Bunch Grape (continued)</b>						
<b>Postbloom (7-10 days after the prebloom spray)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<i>Section below shows materials for specific diseases. These materials should be mixed with other materials to provide protection against other major diseases.</i>						
Anthracnose (Bird's-eye rot)	boscalid + paraclostrobin (Pristine 38WG)	8.0-12.5 oz	+++++	24 hrs ( 5 days for cane work)	14 days	Do not apply Pristine to Concord, Worden, Fredonia, Niagara or related grape varieties due to possible injury. This class of fungicides is prone to resistance. (FRAC = 7 + 11)
	captan (various formulations)	see label	+++++	48 hrs	0 days	
<i>Section below shows materials for specific diseases. These materials should be mixed with other materials to provide protection against other major diseases.</i>						
Downy mildew	mefenoxam + copper (Ridomil Gold Copper)	2.0 lbs	+++++	48 hrs	42 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. (FRAC = 4)
	or mefenoxam + mancozeb (Ridomil Gold MZ)	2.5 lbs	+++++	48 hrs	66 days	
	Phosphonates (aka. Phosphorous acids, Phosphites, various formulations)	See label		+++++	See label	See label

<b>Bunch Grape (continued)</b>						
<b>Postbloom (7-10 days after the prebloom spray)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Downy mildew (cont.)	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. <b>(FRAC = 40)</b>
	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. <b>(FRAC = 43)</b>
<i>Section below shows materials for specific diseases. These materials should be mixed with other materials to provide protection against other major diseases.</i>						
Downy mildew (cont.)	Ametocradin + dimethomorph (Zampro SC)	14 fl oz	+++++	12 hrs	14 days	Please see the comment above. <b>(FRAC = 40 + 45)</b>
<b>Insect pests</b>						
Grape berry moth	See prebloom recommendations					
Sharpshooter leafhoppers (Pierce's disease suppression)	See prebloom recommendations					
Mealybugs	See bud swell recommendations					
Phylloxera (foliar)	Grape phylloxera has root feeding and foliar feeding forms. Rootstocks used in grape propagation are resistant to root feeding forms and do not require treatment. Foliar phylloxera may be problematic in European-American hybrid varieties (i.e., Vidal, Seyval, Chambourcin, etc.) and cause distinctive, wart-like galls on leaves. The mobile crawler stage of phylloxera is susceptible to insecticide treatment, but closed galls are not. Scouting for galls and crawlers should begin once leaves are expanded. If infested leaves are found in susceptible varieties, insecticide treatments should be timed to crawler emergence. The more damaging root form is controlled by resistant rootstocks.					
	acetamiprid (Assail 30SG)	2.5 oz	+++	12 hrs	7 days	<b>(IRAC=4A)</b>
	spirotetramat (Movento 2 SC)	6-8 fl oz	+++	24 hrs	7 days	Minimum application interval 30 days. <b>Movento also provides control of root infestations. (IRAC=23)</b>

<b>Bunch Grape (continued)</b>						
<b>Postbloom (7-10 days after the prebloom spray)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Grape rootworm	carbaryl (Sevin XLE Plus)	2 qt	++++	12 hrs	7 days	Apply when beetles first appear, usually in mid-June or early July. A second application may be necessary 10 days later. <b>(IRAC 1A)</b>
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. <b>(IRAC=UN)</b>
	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. <b>(IRAC=10B)</b>
	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. <b>(IRAC=21A)</b>
European red mite Twospotted spider mite (cont.)	abamectin (Agri-Mek 0.15EC) and others	16 fl oz	++++	12 hrs	28 days	With Agri-Mek, add a nonionic surfactant. <b>(IRAC=6)</b>
	pyridaben (Nexter 75WP)	10.67 oz	+++	12 hrs	7 days	Do not make more than two applications per season. <b>May be fatal if inhaled (IRAC=21A)</b>
	fenbutatin-oxide (Vendex 50WP)	2.5 lb	+++	48 hrs	28 days	Do not make more than two applications per season. <b>(IRAC=12B)</b>
	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. <b>(IRAC=23)</b>
	hexythiazox (Onager 11.8EC)	12-24 fl oz	+++	12 hrs	28 days	Ovicide only: if adults or larva are present use another miticide with activity against active stages <b>(IRAC=10A)</b>

<b>Bunch Grape (continued)</b>						
<b>Postbloom (7-10 days after the prebloom spray)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
European red mite Twospotted spider mite (cont.)	TriTek or Glacial Spray Fluid	1-2 gal per 100 gal water	+++ (performs better with 2-3 sequential 7-10 day applications)	4 hrs	0 days	OMRI approved. <b>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. (IRAC=UN)</b>

## Bunch Grape (continued)

### Fruit set

#### General comments

**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 or the north side of an east – west oriented row, 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.

#### Diseases

**This is still the critical period for downy mildew, powdery mildew, Phomopsis, and black rot infection.**

From bloom to 4-5 weeks after bloom, grape berries become susceptible to infection by black rot, downy mildew, and powdery mildew, and all of these pathogens become active due to warmer temperature. Once again, mancozeb + sulfur combination can be an economical and strong backbone of the spray program. Mancozeb materials are effective against, Phomopsis, black rot, downy mildew, and sulfur materials are effective against powdery mildew. Please see the notes on postbloom section for more details.

However, at or after second cover (20-28 days after postbloom), mancozeb product may not be used because either 1) some early varieties have less than 66 days to harvest or 2) the use of mancozeb reaches the season limit (19.2 lb/A of a.i.). Thus, another broad-spectrum fungicide, captan, can be used in substitution to mancozeb. Since captan does not provide much efficacy against black rot, either QoI (FRAC = 11) or DMI (FRAC = 3) fungicide should be added.

<b>Bunch Grape (continued)</b>						
<b>First cover (10-14 days after the postbloom spray) and Second cover (10-14 days after first cover)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<b>Diseases</b>						
Phomopsis Black rot Powdery mildew Downy mildew Bitter rot Ripe rot	captan (various formulations) + sulfur (various formulations)  <i>plus one of following:</i>  myclobutanil (Rally 40WSP) or tebuconazole (Elite 45DF) (Tebuzole 45DF) (Orius 45DF) or triflumizole (Procure 480SC) or tetraconazole (Mettle 1ME) or fenarimol (Rubigan 1E) (Vintage SC)	see label       3-5 oz  4 oz 4 oz 8.6 oz  4-8 oz  3-5 fl oz  3-5 fl oz	+++++	48 hrs	14 days	These are combinations of fungicides with DMI (FRAC=3) if you decided not to use mancozeb, and substitute it with captan. Captan has a very weak efficacy against black rot, thus, you need to tank-mix with either a QoI or a DMI fungicide to protect your vines from black rot.  If you decided to use mancozeb, please refer to prebloom recommendations.  For ripe rot management, either mancozeb or QoI fungicide seem to provide a good efficacy. (Unfortunately, we do not have solid data for other chemical groups.)

<b>Bunch Grape (continued)</b>						
<b>First cover (10-14 days after the postbloom spray) and Second cover (10-14 days after first cover)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Phomopsis Black rot Powdery mildew Downy mildew Bitter rot Ripe rot (cont.)	captan (various formulations) + sulfur (various formulations)  <i>plus one of following:</i>  azoxystrobin (Abound 2SC) or kresoxim-methyl (Sovran 50WG) or trifloxystrobin (Flint 50WG)	see label    10-15.5 fl oz  3.2-4 oz (PM) 4-6.4 oz (DM)  1.5 – 2 oz	+++++	48 hrs	14 days	These are another combinations of fungicides with QoI ( <b>FRAC=11</b> ), if you decided not to use mancozeb, and substitute it with captan. Captan has a very weak efficacy against black rot, thus, you need to tank-mix with either a QoI or a DMI fungicide to protect your vines from black rot.  If you decided to use mancozeb, please refer to prebloom recommendations.  For ripe rot management, either mancozeb or QoI fungicide seem to provide a good efficacy. (Unfortunately, we do not have solid data for other chemical groups.)
<i>Section below shows materials for specific diseases. These materials should be mixed with other materials to provide protection against other major diseases.</i>						
Anthracnose (Bird's-eye rot)	boscalid + paraclostrobin (Pristine 38WG)	8.0-12.5 oz	+++++	24 hrs + 5 days for cane work	14 days	Do not apply Pristine to Concord, Worden, Fredonia, Niagara or related grape varieties due to possible injury. This class of fungicides is prone to resistance. (FRAC = 7 + 11)
	captan (various formulations)	see label	+++++	48 hrs	0 days	
Downy mildew or Powdery mildew						See prebloom recommendations for a list of downy and powdery mildew specific materials

<b>Bunch Grape (continued)</b>						
<b>First cover (10-14 days after the postbloom spray) and Second cover (10-14 days after first cover)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<b>Insect pests</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Japanese beetle Green June beetle	carbaryl (Sevin 80S)	2.5 lb	++++	12 hrs	7 days	(IRAC=1A)
	phosmet (Imidan 70-W)	1.33-2.125 lb	+++	14 days	14 days	(IRAC=1B)
	azadirachtin (Neemix 4.5) + neem oil (Trilogy)	7-16 fl oz + 2% solution	+++	4 hrs	0 days	OMRI approved. (IRAC=UN)
	malathion (Malathion 8F or Malathion 5)	1.88 pt	++	12hrs	3 days	(IRAC=1B)
	acetamiprid (Assail 70 WP)	1.1 oz	+++	12 hrs	7 days	(IRAC=4A)
Japanese beetle (cont.)	indoxacarb (Avaunt 30 DG)	3.5-6.0 oz	+++	12 hrs	7 days	Very effective against lepidopteran pests such as grape berry moth. (IRAC=22A)
Grape berry moth	See prebloom recommendations					
Sharpshooter leafhoppers (Pierce's disease suppression)	See prebloom recommendations					
Mealybugs	See budbreak recommendations					

<b>Bunch Grape (continued)</b>						
<b>First cover (10-14 days after the postbloom spray) and Second cover (10-14 days after first cover)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Grape rootworm	(carbaryl) Sevin XLR plus	2 qts	+++	12 hrs	7 days	This is a sporadic pest. Apply when beetles appear, usually mid-June or July. A second application may be needed 10 days later.
European red mite Twospotted spider mite	See postbloom recommendations					

<b>Bunch Grape (continued)</b>						
<b>Berry touch and bunch closure</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
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.
Botrytis Ripe rot Bitter rot	See bloom recommendations for chemical management options					
Grape berry moth	See prebloom recommendations					
Sharpshooter leafhoppers (Pierce's disease suppression)	See prebloom recommendations					
Mealybugs	See budbreak recommendations					
European red mite Twospotted spider mite	See postbloom recommendations					
Japanese beetle	See first cover recommendations					
Spotted wing drosophila	While too early for conventional control of SWD, an application of Surround just before clusters close may aid subsequent control of this pest. Oviposition sites often occur in the interior of clusters, out of reach of insecticide sprays closer to harvest. Use block history as a guide in decision making.					

## Bunch Grapes (continued)

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

#### Diseases

**At this moment, berries are matured and become resistant against black rot, downy mildew, and powdery mildew.**

(The second cover was applied 20-28 days after postbloom with 10-14 days of protection → 34-42 days postbloom protection was achieved) However, rachis is still susceptible to powdery mildew infection, and Phomopsis can cause fruit rot late in the season. In addition, Botrytis and other late season rots can become active (please see berry touch and bunch closure section for Botrytis management). Also, some of *V. vinifera* varieties are susceptible to black rot up to 7-8 weeks after bloom. Please check susceptibility to black rot with nursery or other sources.

If you do not see major downy mildew and powdery mildew infection at this point, you can shift your downy and powdery mildew management target from protection of fruit to protection of healthy foliage on the vines. One of options is to use captan and sulfur as a backbone of your fungicide program, and add a phosphonate product as needed. Also, you need to be aware that some of product such as mancozeb has a long PHI (66-day for mancozeb) and it may become not practical to use these materials at some point.

Some winemakers do not want to have sulfur residues on berries. If sulfur cannot be used, one of DMI or QoI or other newer materials can be used; however, please note that repeated use of these materials can be resulted in fungicide resistance development. Typically, a cut off point for sulfur and copper is 30 days before the harvest.

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) + sulfur (various formulations) + a newer material	see label	+++++	48 hrs	0 days	Please see the previous sections for detailed list of materials. Make sure to rotate the mode of action, and watch for the number of application. None of newer materials should be applied more than three time per season.
Anthracnose (Bird's-eye rot)	boscalid + paraclostrobin (Pristine 38WG)	8.0-12.5 oz	+++++	24 hrs	14 days	Do not apply Pristine to Concord, Worden, Fredonia, Niagara or related grape varieties due to possible injury. This class of fungicides is prone to resistance. <b>(FRAC = 7 + 11)</b>
	captan (various formulations)	see label	+++++	48 hrs	0 days	

<b>Bunch Grapes (continued)</b>						
<b>Third and subsequent cover sprays (10-14 day intervals until the preharvest spray)</b>						
Botrytis 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.
<b>Insect pests</b>						
Grape berry moth	See prebloom recommendations					
Sharpshooter leafhoppers (Pierce's disease suppression)	See prebloom recommendations					
Mealybugs	See budbreak recommendations					
European red mite Twospotted spider mite	See postbloom recommendations					
Japanese beetle	See first cover recommendations					

<b>Borer control</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
Grape root borer	Isomate-GRB	100 dispensers	****			Pheromone-based mating disruption has provided 90% reduction of pupal counts in Virginia. Apply at the beginning of flight.
	chloropyrifos (Lorsban Advanced)	----	++	24 hrs	35 days	Apply 2 qt dilute mixture to soil at base of vine, for 4.5 pt per 100 gal. Make a single application 35 days before harvest or post harvest, depending upon moth flight timing. Moths can be monitored using pheromone baited traps. Spray should not contact fruit or foliage. Application can be made with flood nozzles and low pressure (40 to 60 psi). <b>(1B)</b>
	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 1 <sup>st</sup> .

## Bunch Grape (continued)

### Veraison

In terms of disease management, it is recommended to manage crop yield by crop thinning at or before veraison. Once berries start to accumulate sugar, dropped berries may attract birds and insects, which could find hanging berries and puncture them. Wounding is a major entry point for late season rots such as Botrytis and sour rot, thus proper insect and bird management can significantly reduce the risk of later season rot development.

### Diseases

Botrytis	See bloom recommendations
Ripe rot	If you have a susceptible variety, make sure to have two applications of Botrytis material(s). Once at bunch closure (so that chemical will penetrate into inside of the cluster), and once at veraison when there are many spores in the air.
Bitter rot	

### Insect pests

Grape berry moth	See prebloom recommendations
Sharpshooter 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
Spotted wing drosophila	Closely examine berries for oviposition beginning when berries reach 15 degrees Brix. (maybe combine with the comments below), - mention about previous history, confirmation from the clinic or specialist or entomologist, etc. how it relate to sour rot and other diseases? Risk appears to be related to skin thickness and penetration pressure; this is an active area of investigation. Control decisions should be influenced by history, since vineyard blocks are not uniform in infestation. Infestation by SWD may increase incidence of sour rot.

<b>Bunch Grape (continued)</b>
<b>Preharvest (10-14 days before harvest)</b>
<b>General comments</b>
<b>Diseases</b>
<p><b>Preharvest</b></p> <p><b>What can you do when diseases get out of hand at this time of season?</b></p> <p><b>Downy mildew:</b> There is a strong possibility that you can have late-season outbreak of downy mildew, especially when a tropical storm or related rain comes to the area. You should keep eye on your younger foliages because it will be the first one to be infected. Once you observe symptoms on young leaves, apply phosponates (+ captan, if you wish).</p> <p><b>Powdery mildew:</b> As with downy mildew, younger leaves are more susceptible, thus, once you start to see powdery on them, apply sulfur and/or other materials. The other option is a use of potassium salt (Kaligreen, Armicarb, etc) or JMS Stylet Oil.</p> <p><b>Botrytis:</b> We do not have any curative materials against Botrytis. Thus, make sure to protect your berries, and also, use cultural control (leaf removal, bird and bee control). If Botrytis is an issue for you, make sure to rotate mode of action, and tank-mix a newer material with captan. Botrytis is known to develop resistance to chemicals rapidly.</p> <p><b>Phomopsis:</b> We do not have any curative materials against Phomopsis. Captan , Ziram, and a QoI material are good protective materials.</p> <p><b>Ripe rot:</b> A combination of QoI (Abound or Pristine) + captan is probably the best material that you can use. Cultural control measures such as leaf removal can reduce the risk of infection as well.</p> <p>Please remember that the prevention of the development of disease in early part of the season is the best way to minimize the risk of outbreak late in the season. If you have a late season outbreak, please re-examine your early season spray schedule. Contact your local extension agents for suggestions.</p>
<b>Insect pests</b>
<p>Spotted wing drosophila (SWD) is a recently introduced invasive insect pest of soft skinned fruits. It is unclear how significant SWD will be as a grape pest. Growers should carefully monitor adult presence in vineyards (using a 60:40 blend of red wine and apple cider vinegar, <b>other commercial lures (Scentry, Trece (with accent on ‘e’s etc.), check weekly</b>) and larval presence in fruit. Wine grapes can likely sustain greater injury than fresh market grapes; results are mixed on differential varietal susceptibility, and this is a current research area. If adult SWD are present soft fruit may be a risk. Larvae begin to infest fruit as they ripen, so insecticide treatments should be applied on a weekly basis and reapplied in the event of rain. While risk begins at véraison, risk increases significantly when fruit reach 15 degrees Brix. When berries reach a vulnerable stage, applications may be needed every 5-7 days. If SWD will be a target, effective SWD materials should not be used against other pest early in the season, if other alternatives exist. Do not exceed maximum allowed applications per season.</p>

<b>Bunch Grape (continued)</b>						
<b>Preharvest (10-14 days before harvest)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<b>Diseases</b>						
Botrytis Bitter rot Ripe rot	See bloom recommendations					
Phomopsis Black rot Powdery mildew Downy mildew	See second and subsequent cover sprays					
<b>Insect pests</b>						
Spotted wing drosophila	beta-cyfluthrin (Baythroid XL)	1.6-3.2 fl oz	++++	12 hr	3 days	3
	imidacloprid & cyfluthrin (Leverage 2.4)	3-8 fl oz	+++	12 hrs	3 days	4A & 3
	spinetoram (Delegate)	3-5 fl oz	+++	4 hrs	7 days	5
	malathion (Malathion 8F)	1.88 pt	++++	12 hrs	3 days	1B
	zeta-cypermethrin (Mustang)	2.15-4.3 fl oz	++++	12 hrs	1 day	3
	spinosad (Entrust)	1.25-2.5 oz	+++	4 hrs	7 days	Entrust is OMRI listed. 5
Sharpshooter 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					
Japanese beetle Green June beetle	carbaryl (Sevin 80S)	2.5 lb	++++	12 hrs	7 days	<b>(IRAC=1A)</b>

<b>Bunch Grape (continued)</b>						
<b>Preharvest (10-14 days before harvest)</b>						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
	phosmet (Imidan 70-W)	1.33-2.125 lb	+++	14 days	14 days	(IRAC=1B)
	azadirachtin (Neemix 4.5) + neem oil (Trilogy)	7-16 fl oz + 2% solution	+++	4 hrs	0 days	OMRI approved. (IRAC=UN)
	malathion (Malathion 8F or Malathion 5)	1.88 pt	++	12hrs	3 days	(IRAC=1B)
	acetamiprid (Assail 70 WP)	1.1 oz	+++	12 hrs	7 days	(IRAC=4A)
Japanese beetle (cont.)	indoxacarb (Avaunt 30 DG)	3.5-6.0 oz	+++	12 hrs	7 days	Very effective against lepidopteran pests such as grape berry moth. (IRAC=22A)

<b>Bunch Grape (continued)</b>						
<b>Postharvest (14-21 day intervals from harvest until the first killing frost)</b>						
<b>General comments</b>						
Often time, there is enough time between harvest and the end of the season (i.e., hard frost event) for grapevines to be photosynthetically active to accumulate carbohydrate for the winter. In addition, grapevines may need an extra care because some growers choose not to apply fungicides prior to harvest. Since a copper product can provide efficacy against both downy and powdery mildews, it can be a very convenient and economical tool at this time of the season.						
<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per Acre</b>	<b>Effectiveness (+) or Importance (*)</b>	<b>REI</b>	<b>PHI</b>	<b>Comments (FRAC/IRAC)</b>
<b>Diseases</b>						
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	----	
	phosphonates	see label	+++++	4 hrs	----	
Powdery mildew	sulfur products	see label	+++++	24 hrs	----	
	copper compounds (various formulations)	see label	+++	24 hrs	----	Copper product can provide enough protection against both downy and powdery mildew at this time of the season.

<b>Efficacy of selected fungicides against diseases of bunch grapes</b>							
<b>Chemical name (Fungicide product name)</b>	<b>Anthracnose</b>	<b>Black rot</b>	<b>Bitter rot</b>	<b>Botrytis rot</b>	<b>Downy mildew</b>	<b>Phomopsis cane and leaf spot</b>	<b>Powdery mildew</b>
Azoxystrobin ( <b>Abound</b> )		+++++ <sup>a</sup>	+++++	+++ <sup>b</sup>	+++++ <sup>b</sup>	+++	+++++ <sup>b</sup>
Boscalid ( <b>Endura</b> )				+++++ <sup>b</sup>			++++ <sup>c</sup>
Boscalid + Pyraclostrobin ( <b>Pristine</b> )	++++	+++++	+++++	+++++ <sup>b</sup>	+++++ <sup>b</sup>	+++++	+++++
Captan ( <b>Captan, Captec, etc.</b> )	+++	+++	+++++	++	++++	++++	NA
Fixed coppers and Bordeaux mixture (various)		+++	++	+++	+++	++	++
Cyflufenamid ( <b>Torino</b> )		NA	NA	NA	NA	NA	++++
Cyprodinil ( <b>Vanguard</b> )		NA	NA	+++++ <sup>b</sup>	NA	NA	++
Cyprodinil + Fludioxonil ( <b>Switch</b> )				++++ <sup>b</sup>			
Cyprodinil + Difenconazole ( <b>Inspire Super</b> )		++++		++++ <sup>b</sup>			++++
Famoxadone + cymoxanil ( <b>Tanos</b> )					+++ <sup>b</sup>		
Fenhexamid ( <b>Elevate</b> )		NA	NA	+++++ <sup>b</sup>	NA	NA	NA
Ferbam ( <b>Ferbam</b> )		++++	+++	NA	++	++	NA
Fenarimol ( <b>Rubigan</b> )		++	NA	NA	NA	NA	+++++ <sup>b</sup>
Fluopicolide ( <b>Presidio</b> )	NA	NA	NA	NA	+++++	NA	NA
Fluopyrum + tebuconazole ( <b>Luna Experience</b> )	NA	+++++	NA	+++++ <sup>b</sup>	NA	NA	+++++
Fluopyrum + pyrimethanil ( <b>Luna Tranquility</b> )	NA		NA	+++++ <sup>b</sup>	NA	NA	+++++
Iprodione ( <b>Rovral, Meteor</b> )	NA	NA	NA	+++ <sup>b</sup>	NA	NA	NA
Kresoxim-methyl ( <b>Sovran</b> )		+++++	+++++	++ <sup>b</sup>	+++ <sup>b</sup>	+++	+++++ <sup>b</sup>
Lime Sulfur (dormant application)	+++			NA	NA	+++	++
Mancozeb (various: Penncozeb, Dithane, etc)		+++++	+++++	NA	+++++	+++++	NA
Mandipropamid ( <b>Revus</b> )	NA	NA	NA	NA	+++++	NA	NA
Mandipropamid + Difenconazole ( <b>Revus Top</b> )		++++	++++ <sup>c</sup>	NA	+++++	+++ <sup>c</sup>	++++
Mefanoxam + Copper ( <b>Ridomil Gold Copper</b> )		++	++	++	+++++	++	++
Mefanoxam + Mancozeb ( <b>Ridomil Gold MZ</b> )		+++	+++	NA	+++++	+++	NA
Metrafenone ( <b>Vivando</b> )		NA	NA	NA	NA	NA	++++
Myclobutanil ( <b>Rally</b> )		+++++	++	NA	NA	NA	+++++ <sup>b</sup>
Phosphonate ( <b>ProPhyt, Phostrol, etc.</b> )					++++		
Sulfur <sup>d</sup> (various)		NA	NA	NA	NA	++	+++++
Tebuconazole ( <b>Elite</b> )		+++++	NA	NA	NA	NA	+++++ <sup>b</sup>
Tetraconazole ( <b>Mettle</b> )							++++ <sup>b</sup>
Thiophanate-methyl ( <b>Topsin M</b> )		++	+++	NA	NA	+++	+++++ <sup>b</sup>
Trifloxystrobin ( <b>Flint</b> )		+++++	+++++	++++	+++	++	+++++ <sup>b</sup>
Triflumazole ( <b>Procure and Viticure</b> )		+++ <sup>b</sup>	NA	NA	NA	NA	+++++
Ziram ( <b>Ziram</b> )		++++	NA	++	++++	+++	NA

<sup>a</sup> The efficacy rating: NA = no significant activity; + = very limited activity, ++ = limited activity, +++ = moderate activity, ++++ = good activity, +++++ = excellent activity

<sup>b</sup> 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.

<sup>c</sup> Insufficient data for the pathogen-chemical combination. The rating was given based on the general knowledge on the material.

<sup>d</sup> Sulfur will cause burn on sensitive varieties, especially on hot days, >85F.

<b>Fungicide classes with high risk of resistance development (generally single sites of action)</b>	
Anilinopyrimidines (Group 9)	Vangard (cyprodinil) Switch (cyprodinil + fludioxinil) Inspire Super (cyprodinil + difenoconazole) Luna Tranquility (pyrimethanil and Fluopyram) and Scala (pyrimethanil)
Benzamides (Group 43)	Presidio (fluopicolide)
Benzimidazoles (Group 1)	Topsin M (thiophanate methyl)
Carboxylic acid amides (Group 40)	Revus (mandopropimid) Revus Top (mandopropimid + difenoconazole) Zampro (dimethomorph + amethoctradin)
Demethylation Inhibitors (DMIs) or Sterol Inhibitors (Group 3)	Bayleton (triadimefon) Elite and generics (tebuconazole) Rally/Nova (myclobutanil) Procure/Viticure (triflumizole) Rubigan/Vintage (fenarimol) Inspire Super (cyprodinil + difenoconazole) Revus Top (mandopropimid + difenoconazole) Luna Experience (tebuconazole + Fluopyrum)
Dicarboximides (Group 2)	Rovral (iprodione)
Hydroxyanilides (Group 17)	Elevate (fenhexamid)
Phenylamides (Group 4)	Ridomil Gold (mefanoxam)
Phenylpyrroles (Group 12)	Switch (cyprodinil + fludioxinil)
QoI: Quinone outside Inhibitors (Group 11)	Abound (azoxystrobin) Flint (trifloxystrobin) Pristine (pyroclostrobin; one component of a two-part mixture) Sovran (kresoxim-methyl) Tanos (famoxadone; one of component of a two-part mixture) Reason (famoxadone)
Quinone X Inhibitor (Group 45)	Zampro (dimethomorph + amethoctradin)
SDHI: Succinate dehydrogenase inhibitors (Group 7)	Pristine (boscalid; one component of a two-part mixture) Endura (boscalid) Luna Experience and Luna Tranquility (Fluopyrum; one component of a two-part mixture)

**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, Penncozeb (mancozeb)  
Maneb, Manex (maneb)  
Phosphonates (ProPhyt, etc.)  
Thiram (thiram)  
Sulfur  
Ziram (ziram)

## Seasonal 'at a glance' fungicidal spray schedule options for bunch grapes

Developmental Stage	Diseases to be considered, and target tissues							Fungicide(s) to be used		Note
	Anthracnose	Bitter Rot, Ripe Rot	Black Rot	Botrytis	Downy Mildew	Phomopsis	Powdery Mildew	Basic	Options	
Dormant (7-10 days prior to bud break)	***					***			Lime sulfur (10 g/A)	Dormant application is recommended if either Phomopsis or anthracnose has been a major issue in the previous years
Bud Break and New Shoot (Very important sprays for Phomopsis management)	Leaf and cane					Leaf and cane	Initial leaf infection	mancozeb + sulfur		If PM outbreak was observed in the previous season, consider adding a newer PM material near prebloom
Prebloom (Critical period)			Leaf		Leaf	Leaf and cane	Leaf and rachis	mancozeb + sulfur	Add a newer PM material, especially for a high PM vineyard	This is the start of critical period for berry infection by various diseases
Bloom (Critical period)		Flower	Leaf and berry	Flower				Botrytis specific material: Elevate, or Vanguard, or Scala, or Endura, or Pristine, etc	If ripe rot has been an issue, consider Pristine or add mancozeb to the mix	It will reduce the risk of Botrytis outbreak.
1st and 2nd cover (Critical period)		Berry	Leaf and berry		Leaf and berry	Leaf, cane, and berry	Leaf and berry	mancozeb + sulfur + a newer PM material	Downy mildew specific material (Revus - protectant, Ridomil products - curative), Black rot (Rally - curative)	Under wet conditions, add Ridomil or Phosphite product for DM and Rally for Black rot
3rd cover (Critical period is almost over)		Berry	Berry		Leaf	Berry	Leaf and rachis	Captan + sulfur (+ a newer PM material, if needed)	Downy mildew specific material, + Rally, if Black rot is a concern	Mancozeb may not be available due to its 66-day PHI

## Seasonal 'at a glance' fungicidal spray schedule options for bunch grapes

Developmental Stage	Diseases to be considered, and target tissues							Fungicide(s) to be used		Note
	Anthracnose	Bitter Rot, Ripe Rot	Black Rot	Botrytis	Downy Mildew	Phomopsis	Powdery Mildew	Basic	Options	
Bunch closure		Berry		Berry				Botrytis specific material: Elevate, or Vanguard, or Scala, or Endura, or Pristine, etc	Canopy management, and bird and bee control are very important for Botrytis (+ sour rot) management.	This is the last opportunity to deliver the material into the cluster
4th cover		Berry			Leaf	Berry	Leaf and rachis	Captan + sulfur (+ a newer PM material)	Downy mildew specific material (Phosphite)	Scout young leaves for DM and PM. If the early season protection was successful, you maybe able to relax the schedule a bit.
Veraison		Berry		Berry				Botrytis specific material: Elevate, or Vanguard, or Scala, or Endura, or Pristine, etc	Bird and bee management	We only have protective materials against Botrytis.
Preharvest		Berry		Berry	Leaf	Berry	Leaf	Captan + sulfur + a Botrytis material (Captan has some efficacy against sour rot and other general rots)	Downy mildew specific material (Phosphite)	Need to adjust the spray program based on field condition
Postharvest					Leaf		Leaf	Phosphite+ sulfur Or mancozeb + sulfur	Copper material	Clean-up for the next season. Vines still need leaves for accumulation of carbohydrates for the winter.

# **Weed Management**

## **Grape Vineyards**

The primary goal of any weed management program is to minimize competition in order to direct as much resources, like water, nutrients, and light, as possible toward crop growth. It is essential to minimize or eliminate competition in newly planted and young vineyards so that vine growth can be maximized to bring that vineyard into productivity as soon as possible. Research has shown that failure to control weeds through July in newly planted vineyards will reduce vine growth and may increase vine mortality due to water stress. In older, established vineyards competition will reduce grape yields. The weed management programs outlined in this publication are designed to control weeds at levels to prevent competition and maximize fruit yields.

## **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
<b>PREPLANT/ SITE PREPARATION</b>	<b>Glyphosate, MOA 9</b> 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.
<b>PREEMERGENCE</b> Annual grasses and small seeded broadleaf weeds	<b>Oryzalin, MOA 3</b> Surflan 4 AS or Oryzalin	2 to 6 qt	Newly Planted (once soil has settled after transplanting) and Established Vineyards.	12	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.
	<b>Pendimethalin MOA 3</b> Prowl H <sub>2</sub> O	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 glufosinate for postemergence weed control.

<b>Weed/Timing</b>	<b>Material</b>	<b>Amount of Formulation per Acre</b>	<b>Crop Age Restrictions</b>	<b>REI (hrs)</b>	<b>Comments</b>
<b>PREEMERGENCE</b> Annual grasses and small seeded broadleaf weeds (Continued)	<b>Pronamide, MOA 3</b> Kerb 50 WP or Kerb SC	2 to 8 lb 2.5 to 9.5 pt	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° F. The need for activation is tied directly to air temperature. Under warmer conditions more degradation and herbicide loss occurs until activated by rainfall or overhead irrigation.
	<b>Norflurazon, MOA 12</b> 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 glufosinate for control of emerged weeds. Residual control is expanded when Solicam is tank mixed with simazine or Karmex.
<b>PREEMERGENCE</b> Annual weeds and some perennial weeds	<b>Dichlobenil, MOA 20</b> 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. The Casoron CS formulation should only be used under well established vines (1 year or older). The Casoron 4G formulation may be used as early as 4 weeks after transplanting young vines.
<b>PREEMERGENCE</b> Broadleaf weeds	<b>Oxyfluorfen, MOA 14</b> Goal or Galigan or OxiFlo 2 EC	2 to 8 pt	Newly planted (once soil has settled after transplanting) and established vineyards.	24	<b>DO NOT apply after bud swell.</b> Use in newly planted vineyards that are trellised and once soil has settled after transplanting.
	<b>Rimsulfuron, MOA 2</b> Matrix 25 WG Pruvin 25 WG Solida 25 WG	4 oz	Vines established at least 1 year.	4	Tank mix with oryzalin, diuron, or simazine to broaden spectrum of residual control. <b>DO NOT</b> apply within 14 days of harvest. Rimsulfuron 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).

<b>Weed/Timing</b>	<b>Material</b>	<b>Amount of Formulation per Acre</b>	<b>Crop Age Restrictions</b>	<b>REI (hrs)</b>	<b>Comments</b>
<b>PREEMERGENCE</b> Broadleaf weeds and some annual grasses	<b>Diuron, MOA 7</b> Karmex 80 DF Or Direx 80 DF	2 to 3 lb	Vines established at least 3 years.	12	Heavy rainfall soon after application to grapes planted in soils low in clay and <2% organic matter may result in severe injury and this risk is assumed by the user. Apply with glyphosate, paraquat or glufosinate for postemergence weed control.
<b>PREEMERGENCE</b> Broadleaf weeds only	<b>Isoxaben MOA 21</b> Trellis	0.66 to 1.33 lb	Newly planted and established vineyards	12	Trellis controls broadleaf weeds germinating from seed. A tank mix with oryzalin will be necessary for PRE control of annual grass weeds. Rainfall is needed with 21 days of application for activation. Trellis has a 60 day PHI. The addition of glufosinate, glyphosate, or paraquat is recommended for non-selective POST weed control.
<b>PREEMERGENCE</b> Broadleaf weeds and some annual grasses (continued)	<b>Simazine, MOA 5</b> 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 glufosinate for postemergence weed control. The addition of oryzalin (Surflan) or norflurazon (Solicam) or pendimethalin (Prowl H <sub>2</sub> O) with simazine will extend residual grass control several weeks.
<b>PREEMERGENCE</b> Annual broadleaf and grass weeds	<b>Flumioxazin, MOA 14</b> Chateau 51 WDG Tuscany 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. <b>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 or juice after bud break so long as hooded application equipment is used. DO NOT tank mix with glyphosate after bud break. DO NOT</b> 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.

	<b>Indaziflam, MOA 29</b> Alion 1.67 SC	5 oz	Vines established at least 5 years	12	<b>DO NOT apply to grapes grown in Georgia or Florida.</b> Alion may be used on soils having a texture of sandy loam or finer and less than 20% gravel content. Tank mix with paraquat, glyphosate, or glufosinate for non-selective POST weed control. Only use in vineyards where grapes have been planted at least 12 inches deep or there is 12 inches of soil barrier (berm) between soil surface and major portion of root system. DO NOT exceed 5 oz of Alion per acre within a 12 month period.
<b>Weed/Timing</b>	<b>Material</b>	<b>Amount of Formulation per Acre</b>	<b>Crop Age Restrictions</b>	<b>REI (hrs)</b>	<b>Comments</b>
<b>POSTEMERGENCE DIRECTED</b> Non-selective control	<b>Glyphosate, MOA 9</b> 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. <b>Do not apply within 14 days of harvest.</b> Generic formulations may require the addition of a surfactant. Refer to label for application directions for hard to control perennial species.
	<b>Glufosinate, MOA 10</b> LifelineReck on 280 Rely 280	48 to 82 oz	Newly planted (shielded) and established vineyards	12	Do not allow herbicide to contact desirable foliage or immature, uncallused bark. Apply in a minimum spray volume of 20 gal./A. <b>Do not apply within 14 days of harvest.</b>
	<b>Paraquat, MOA 22</b> Firestorm, Parazone, or Paraquat Concentrate 3SL  Gramoxone 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).

<b>POSTEMERGENCE DIRECTED</b> Certain broadleaf weeds	<b>Carfentrazone, MOA 14</b> Aim	1 to 2 fl. oz	Vines established 1 year or longer.	12	Do not allow herbicide to contact desirable fruit or foliage. The addition of a non-ionic surfactant at 0.25 % v/v (1 qt per 100 gal of solution) or crop oil concentrate at 1% v/v (1 gal per 100 gal. of solution) is necessary for optimum herbicide performance. Ammonium sulfate may be used in addition to a non-ionic surfactant, refer to label for details. Aim may be tank mixed with glyphosate or Rely or various preemergence herbicides. For chemical removal of suckers use the maximum rate and refer to label for details. Aim has a 3 day PHI.
<b>Weed/Timing</b>	<b>Material</b>	<b>Amount of Formulation per Acre</b>	<b>Crop Age Restrictions</b>	<b>REI (hrs)</b>	<b>Comments</b>
<b>POSTEMERGENCE</b> Annual and perennial grasses	<b>Clethodim, MOA 1</b> Select, Volunteer, Intensity, and others 2EC	6 to 8 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. Do not apply within 1 year of harvest.
	SelectMax, Intensity One	12 to 16 oz			
	<b>Fluazifop, MOA 1</b> 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. Do not apply within 1 year of harvest.
	<b>Sethoxydim, MOA 1</b> 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. <b>Do not apply within 50 days of harvest.</b> Total use can not exceed 5 pt/A per year.



# Suggested Herbicide Programs

## Grape Vineyards

Crop Age	Fall	Winter	Spring	Summer
Newly Planted	Glyphosate (Pre-Plant to kill weeds in herbicide strip)		Oryzalin	Oryzalin + Paraquat (May or June); Fusilade, or Poast, or Clethodim (as needed).
			Flumioxazin (Once soil settles after transplanting)	Flumioxazin + Paraquat (June or July); Fusilade, or Poast, or Clethodim (as needed).
			Trellis + Oryzalin	Paraquat (multiple applications as needed); Fusilade, or Poast, or Clethodim (as needed)
Vines Established 1 to 2 years or more	Glyphosate (spot treat for perennial weeds)	Glyphosate (Mid March)	Oryzalin + Rimsulfuron + Paraquat, Glyphosate, or Glufosinate (Early May)	Paraquat or Glufosinate (multiple applications as needed)
	Glyphosate (spot treat for perennial weeds)	Flumioxazin + glyphosate, paraquat or Glufosinate (mid to late March)	Flumioxazin* + Paraquat or Glufosinate (early June)	Poast (as needed for POST grass control)
	Glyphosate (spot treat for perennial weeds)	Solicam (vines est. 2 yrs) + glyphosate, paraquat, or Glufosinate		Glyphosate, Paraquat, Glufosinate, or Poast (as needed)
	Glyphosate (spot treat for perennial weeds); Flumioxazin + Glufosinate (after harvest)		Flumioxazin* + Paraquat, or Glufosinate (late May)	Glufosinate or Paraquat or Poast (as needed)
	Glyphosate (spot treat for perennial weeds)	Flumioxazin + Glyphosate (prior to bud break)		Glufosinate or Paraquat or Poast (as needed)
Vines Established at least 3 years	Glyphosate (spot treat for perennial weeds)	Glyphosate (mid March)	Simazine + Oryzalin + Glyphosate, or Karmex + Glyphosate	Paraquat, Glufosinate, or Poast (as needed)
	Glyphosate (spot treat for perennial weeds)	Flumioxazin + Glyphosate (mid to late March)	Flumioxazin * + Glyphosate (early June)	Poast (as needed for POST grass control)

	Glyphosate (spot treat for perennial weeds); Simazine + Paraquat or Glufosinate (after harvest)		Flumioxazin* + Glyphosate (mid to late May)	Paraquat, Glufosinate, or Poast (as needed)
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\*See flumioxazin restrictions for applications made after bud break.

## 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	Mornigglory, Annual	Nightshades	Pigweed	Radish, Wild	Ragweed	Sida, Prickly	Smartweed	Spotted Spurge	Bermudagrass	Dandelion	Johnsongrass	Nutsedge, Yellow	Virginia Creeper	
<b>Preemergence</b>																											
Alion	E	E	E	G	G	E		E	E		E	G	E	E	E	E	G	E	G	G	E	N	G		P	N	
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	
Flumioxazin	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	
Rimsulfuron	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 <sub>2</sub> O	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	
Trellis	N	N	N	N	N	G	F	G	G	G	E	E	E	F	G	E	E	E	G	E	G	N	G	N	N	N	
<b>Postemergence</b>																											
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
Glufosinate	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

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J. Scott Angle, Dean and Director