



# 2016 Southeast Regional Muscadine 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. Because environmental conditions and grower application methods vary widely, suggested use does not imply that performance 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 application methods are on the pesticide label, and can change at any time. Always refer to and read the pesticide label before making any application! The pesticide label superseded the information contained in this guide, and it is the legal document referenced for application standards.

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## Pesticide Stewardship and Safety

### 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 severe symptoms! Dial 911!**
- **Pesticides with ‘DANGER’ or ‘DANGER/POISON’ on the product label can cause severe injuries or death very quickly. Take immediate action!**
- ***Other symptoms of pesticide poisoning:* headache, fatigue, weakness, restlessness, nervousness, profuse sweating, tearing, diarrhea, or irritation of the skin/ eyes/nose/throat. Consult the product Material Data Safety Sheet (MSDS) for symptoms of a particular pesticide.**

## Pesticide on Skin

- **WASH, WASH, WASH! Immediately wash pesticide from skin as thoroughly as possible with any available water to remove 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, and do not* 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 (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 breathing in pesticides. Do not 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 recovering from 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 from *all* pesticides. The signal word does *not* indicate environmental toxicity or other environmental effects.

## 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)

STATE	AGENCY	PHONE NUMBER
Georgia	Georgia State Patrol	Cell: call *GSP or
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 business hours
South Carolina	South Carolina Highway Patrol ----- South Carolina DHEC Emergency Response Section	Cell: call *HP ----- 1-888-481-0125 (T
Tennessee	Tennessee Emergency Management Agency (TEMA) State Emergency Operations Center	1-800-262-3300
Virginia	Virginia Emergency Operations Center	1-804-674-2400

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

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

## PESTICIDE LIABILITY and STEWARDSHIP

Pesticide applicators, supervisors, and business owners may all face severe criminal and/or civil penalties if pesticides are misused. Read and know the following:

**The pesticide label.** Federal and state laws require pesticide applicators to follow the directions on the pesticide label exactly. Do not 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 cha

**Restricted Use Pesticides (RUP).** These pesticides are clearly labeled “Restricted Use Pesticide” in a box at the top of the front label. Applying, or supervising the application of an RUP, must be certified or licensed through their state pesticide regulatory agency. So 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. This requires applicators to wear the label required PPE and requires agricultural employers to supply the label PPE and ensure that the applicator employees. Do not wear PPE items longer than it has been designed to protect you. Clean, maintain and properly store P pesticides.

**Reentry Interval (REI).** The REI is the period of time immediately following the application of a pesticide during which unprotected field.

**Pre-Harvest Interval (PHI).** The PHI is 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* 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 workplace, 3) providing and ensuring that applicators wear clean and properly maintained label required PPE, 4) providing decontamination facilities for pesticide residue exposures, and 5) providing timely access to medical assistance in the event of a suspected pesticide exposure. The WPS applies to 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 Act. If your state does not have its own pesticide recordkeeping requirements. Some states require records be kept for longer than the federal requirement. Records of all pesticide applications, not just RUP applications, indefinitely, cannot only help troubleshoot application problems, but also document 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 employees and family members, for pesticide fires, spills, and other emergencies. Assign responsibilities to be carried out in the event of pesticide emergencies. Keep all MSDS away from the area where pesticides are stored. Provide copies of product MSDSs to your community first responders. Consult your local Extension Service 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 Service for assistance.

## PESTICIDE APPLICATION

Information on pesticide use is available from the Pesticide Environmental Stewardship website (<http://pesticidestewardship.org>) in the sections on [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 to your material of choice:

1. Only use pesticides when necessary. Pesticide use is not economical unless the damage caused by the pest you are controlling justifies the cost of the pesticide application, and only then when no other practical, effective options are available.
2. Use the appropriate material for the pest.
3. Use the recommended rate of the material. Do not use a higher or 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.irac-online.org](http://www.irac-online.org)), and Weed Resistance Society of America (**WSSA**, <http://www.wssa.net>) have grouped pesticides into MOA categories, which are listed in this guide to assist with resistance management programs.

## POLLINATOR PROTECTION

Before making insecticide applications, monitor insect populations to determine if treatment is needed. If insecticide application is necessary:

1. Use selective pesticides to reduce risk to pollinators and other non-target beneficial insects.
2. Read and follow all pesticide label directions and precautions (Label is the Law!). EPA now requires the addition of a “Protection of Pollinators” advisory box on certain pesticide labels. Look for the bee hazard icon in the Directions for Use and within crop specific sections for instructions to protect bees and other insect pollinators.
3. Minimize infield exposure of bees to pesticides by avoiding applications when bees are actively foraging in the crops. Bee flower visitation rate is highest in early morning. Apply pesticides in the late afternoon or early evening to allow for maximum residue degradation before bees return the next morning. Bee foraging activity is also (temperature) and stage of crop growth. The greatest risk of bee exposure is during bloom.
4. Minimize off-target movement of pesticide applications by following label directions to minimize off target movement of pesticide applications when the wind is blowing towards bee hives or off-site pollinator habitats

# Muscadine Grape Integrated Management Guide

## Introduction

The muscadine grape (*Vitis rotundifolia*, syn. *Muscadinia rotundifolia*) is a thick-skinned native grape species found in the southern United States. It ripens in late summer/early fall and is generally harvested as single berries rather than in bunches. In the wild, muscadine vines are dioecious, with separate male and female plants. Cultivated varieties (cultivars) are usually either female or perfect-flowered (having both male and female flower parts on the same plant). Cultivars are available in many shades of bronze, purple or red. Cultivars have been developed for fresh consumption and winemaking. As the species name implies, the leaves are round and unlobed, though serrated at the edge.

**Diseases** – Muscadines can be grown in warm, humid areas where bunch grapes cannot, and have been grown organically for local markets. Some cultivars are resistant to the Pierce's Disease bacterium (*Xylella fastidiosa*) and are not affected by some major fungal diseases like grape downy mildew and grape rot. However, muscadines can still suffer extensive losses if diseases like powdery mildew, bitter rot, black rot and ripe rot are present. These diseases reduce yields and make berries unmarketable for either wine or fresh sales.

**Insects** – See text in each section below for specific comments. Grape root borers are an important pest of muscadine vines. Aphids are common but often do not require control. Grape berry moth occurs sporadically. Japanese beetles may feed on foliage and flowers in early summer. Other pests that feed on fruit include June beetles, as well as wasps, yellowjackets and other stinging insects that can pose a risk to pickers. The risk of infestation by the grapevine mealybug (*Phenacoccus vitifolius*) is considered low due to the thick skins of muscadine grapes; however SWD can be found in damaged fruit surfaces.

**Weeds**—See comments beginning on page 22.

## Cultural Practices

**Cultivar selection** – Most muscadines grown for wine are high-yielding, medium to small size grapes that detach easily and thus are suitable for mechanical harvest. The cultivar Carlos is the most commonly used bronze muscadine for white wine, and Noble is the most common dark fruited muscadine. Fresh market and pick-your-own cultivars have grapes that are larger in size, with firmer flesh, and a more edible skin. Examples include dark-fruited Supreme and Nesbitt, and the bronze-fruited cultivars Triumph, Summit and Fry. Fry is rarely grown in NC.

**Site selection and establishment** – The most productive muscadine vineyards are on sites that have well-drained soils. Soils that are waterlogged for several months or that flood regularly are not satisfactory for muscadines. Sites where tobacco has been grown successfully are generally suitable. Where needed to improve drainage, plant in raised rows bedded 4-12 inches high and four feet wide. Provisions for drainage must be made.

**Land preparation** should begin the year before planting; have the soil tested, correct any deficiencies in P and K levels, and adjust limestone. Use contact or systemic herbicides to clean up infestations of johnsongrass, bermudagrass, or nutsedge in the year before planting. Use a wire trellis, and space rows 10 to 12 feet apart; set posts 20 ft apart within rows and plant one vine beside each post (rather than two vines per post). This positioning will help protect the vine and minimize fruit loss during harvest, especially if mechanical harvest is planned.

**Plant** in late April or early May (NC and GA/SC Piedmont) after danger of spring freezes has passed, or during the winter in South Carolina. “Plant tubes” (24-36 inches long and 3-4 inches in diameter) will accelerate growth and protect vines in the first growing season, but grower should be aware of development of vine cold hardiness in the fall, and for this reason they should be removed at the end of each growing season, in late October or early November.

## Pruning (training new vines)

**Trellising young vines** -- During the first two or three years, vines need regular training once a week throughout the growing season to maintain optimal shape and position of the vine. Proper training is accomplished by selecting a single shoot and training it up a bamboo stake. Remove all other shoots that appear in the leaf axils by pinching them out as soon as possible, leaving the leaf intact. The objective is to have a single shoot per node. Plastic vineyard tape is used for attaching vines to the bamboo stake and later to the trellis wire. Train the young vines up the wire, then pinch the tip back to approximately 10-12 inches below the wire. This will encourage a V-shaped branching. Choose the two strongest shoots and begin training them in opposite directions along the wire, as future “main arms” or cordons. Continually remove lateral suckers to direct all the plant’s growth into the growing tips of the cordons. Until the cordons reach full length, cut back side shoots along the wire to 6 inches during the growing season. Likewise, remove all fruit at the earliest possible stage on young vines, in order to direct growth to the cordons.

## Dormant

**Winter pruning** – Proper pruning aids in disease management. Hedge or hand prune vines, leaving only 3-4 inch stubs (spurs) on the main cordon or previous season’s wood. Selectively thin these spurs or spur clusters to space them approximately 4-6 inches apart. As vines age, remove some of the older spur clusters when crowding occurs. Young vines (1-4 yrs old) require special attention to remove tendrils that wrap around the new cordon. If not removed, these tendrils will girdle and kill the newly-trained arm. After the 3<sup>rd</sup> or 4<sup>th</sup> year, the cordons will be trained to wrap around the main cordon, and this girdling ceases to be a threat. Late winter is the best time to prune muscadines in areas subject to late frosts.

Pest/Problem	Management Options	Amount of Formulation per acre	Effectiveness (+)	Mode of Action Code	REI	PHI	Comments and H
Fruit rots and foliage diseases	Sanitation and pruning, canopy management		+++				Prune to remove debris that can harbor diseases. Remove vines with chemicals if needed, so shoots to grow from the ground. Train and drying under vine



## Prebloom (Bud break till bloom)

**Angular leafspot** – (*Mycosphaerella angulata*) has great potential to limit yield. It causes leaf spotting that leads to rapid defoliation prior to harvest, development of fruit ceases and grapes may fail to ripen. Total crop loss may occur. Fortunately, angular leafspot can be controlled with either mancozeb or captan. In wet seasons, however, control may be expensive due to the need for repeated fungicide applications.

**Dieback “dead arm” diseases** – Fungal dieback diseases (caused by *Botryosphaeria*, *Phomopsis*, *Fusicoccum*) can quickly kill cordon tips and dieback diseases are often observed on plants as they come out of dormancy or following initial fruit swell. Symptoms are rapid death of cordon tips back towards the main trunk. These fungi reside in pruning or other wounds, and they are generally present on all muscadine grapevines. Any actions to reduce plant stress throughout the year will be helpful (irrigation, proper fertilization, etc.). Cold injury may increase the incidence of “dead arm” diseases by causing wounds to trunks and cordons.

**Aphids** in muscadines are typically cool-season, spring pests. Natural enemies often moderate aphid numbers as the weather warms and new shoot tips or foliage are becoming malformed.

**Grape leafhoppers** are sucking pests that may be very abundant, causing colorless, cleared stippling on leaves; heavy infestations may cause leafhoppers may be present through much of the growing season, but often in numbers that appear to do no harm. Provisional treatment threshold is 10 leafhopper nymphs or adults per leaf based on samples from 10 vines per acre, or when leafhoppers and injury are seen (stippling on leaves).

**Flea beetles** are bud and foliage feeders. The primary concern is bud damage. Treat if flea beetles are abundant and injury is evident. Treatment threshold is 5% damaged buds in a sample of 10 vines per acre. Less than 10% foliar injury is unlikely to be harmful.

## Prebloom (Bud break till bloom)

Pest/Problem	Management Options	Amount of Formulation per acre	Effectiveness (+)	Mode of Action Code	REI	PHI	Comments and Precautions
Black rot Bitter rot Angular leaf spot Powdery mildew	myclobutanil (Rally 40W)	3-5 oz	++++	FRAC Code [3]	24 hrs	14 days	Do not apply more than once per acre per year. Interval should not exceed 14 days.
	thiophanate-methyl (Topsin M 70WSB)	0.75-1.5 lb	+++	FRAC Code [1]	2 days	7 days	Apply when foliage is present. Apply at 21 day intervals. Do not apply more than 4 lb. product per acre. Use only in combination with a labeled non-benzimidazole fungicide.

**Prebloom (Bud break till bloom) -- continued from previous page**

Pest/Problem	Management Options	Amount of Formulation per acre	Effectiveness (+)	Mode of Action Code	REI	PHI	Comments and F
Black rot Bitter rot Angular leaf spot Powdery mildew (continued)	azoxystrobin (Abound 2.08SC)	10-15.5 fl oz	+++++	FRAC Code [11]	4 hrs	14 days	Do not make more Abound per acre per sequential sprays be fungicides having a
	trifloxystrobin (Flint 50WG)	2-3 oz	+++++	FRAC Code [11]	12 hrs	14 days	Do not apply more season, or more than apply more than two switching to a non- APPLY to CONCO may occur.
	pyraclostrobin + boscalid (Pristine WG)	8-12.5 oz	+++++	FRAC Code [11+7]	12 hrs (5 days for vine turning, tying)	14 days	Do not make more Pristine or related f carboxamide) per s two sequential appl a fungicide with a c not use on CONCO (Worden, Fredonia
	kresoxim-methyl (Sovran 50 WG)	3.2-4.8 oz	+++++	FRAC Code [11]	12 hrs	14 days	Do not make more Sovran per acre per sequential sprays be fungicides having a
	EBDCs (ethylene-bis- dithiocarbamates) Mancozeb, Dithane M45 Manzate ProStick Maneb 75DF Penncozeb 75DF	1.5-4 lb	+++	FRAC	24 hrs	66 days	Do not apply more Manzate 200DF, M 75DF per acre per s 7 to 10 day interval

## Prebloom (Bud break till bloom) – *continued from previous page*

Pest/Problem	Management Options	Amount of Formulation per acre	Effectiveness (+)	Mode of Action Code	REI	PHI	Comments and H
Black rot Bitter rot Angular leaf spot ONLY	Ziram 76 DF	3-4 lb	+++	FRAC Code [M3]	48 hrs	21 days	
	captan (Captan 50WP)	4 lb	+++	FRAC Code [M4]	48 hrs	0 day	Repeat Captan appl intervals. Do not ap
	captan (Captan 4L)	0.75-2 qt	+++		48 hrs	0 day	
Powdery mildew ONLY	wettable sulfur (Microthiol, various brands, 80 to 92% S)	3 to 10 lb	++++	FRAC Code [M2]	24 hrs	--	Must be applied eve gal of water per acre trellis wires. OMR not apply within tw products, or at temp injure Concord and
Aphids	malathion 57EC	1.5 pt	++++	IRAC Code [1B]	24 hrs (72 hrs for vine tying)	3 days	Treat if aphids are a foliage are becomin reach damaging lev
	imidacloprid (Admire Pro)	7 to 14 fl oz (soil) 1 to 1.4 fl oz (foliar)	++++	IRAC Code [4A]	12 hrs	30 days (soil) 0 days (foliar)	If a soil application least one foliar appl of action should be application of a Gro
Grape leafhoppers   <i>(continued on next page)</i>	malathion 57EC	1.5 pt	++++	IRAC Code [1B]	24 hrs (72 hrs for vine tying)	3 days	Grape leafhopper in cleared stippling on cause defoliation. P suggest treating for adults per leaf or w injury are evident (
	carbaryl (Sevin 80S)	1.25 to 2.5 lb	+++	IRAC Code [1A]	12 hrs	7 days	
	phosmet (Imidan 70W)	1.33 to 2.12 lb	++++	IRAC Code [1B]	14 days	14 days	

## Prebloom (Bud break till bloom) – *continued from previous page*

Pest/Problem	Management Options	Amount of Formulation per acre	Effect-Iveness (+)	Mode of Action Code	REI	PHI	Comments and H
Grape leafhoppers ( <i>continued</i> )	fenpropathrin (Danitol 2.4EC)	5 to 10 fl oz	+++	IRAC Code [3A]	24 hrs	21 days	
	imidacloprid (Admire Pro)	7 to 14 fl oz (soil) 1 to 1.4 fl oz (foliar)	++++	IRAC Code [4A]	12 hrs	30 days (soil) 0 days (foliar)	If a soil application least one foliar app of action should be application of a Gro
	thiamethoxam (Platinum) (Actara)	8 to 17 oz 1.5 to 3 oz		[4B]	12 hrs	60 days 5 days	Platinum is soil app Actara can be appli
	dinotefuran (Venom)	5 to 6 oz soil 1 to 3 oz foliar		IRAC Code [4A]	12 hrs	28 days 1 day	Only one soil appli
Grape flea beetles	carbaryl (Sevin 80WSP)	1.25 to 2.5 lb	++++	IRAC Code [1A]	12 hrs	7 days	Flea beetles chew h 10% foliar injury is if flea beetles are ab
	Malathion 57EC	1.5 pt	+++	IRAC Code [1B]	12 hrs	3 days	Grape flea beetle la Treatment is recom bud damage.
	phosmet (Imidan 70W)	1.33 to 2.12 lb	++++	IRAC Code [1B]	14 days	14 days	



**Bloom (Do Not Apply Insecticides During Bloom) – continued from previous page**

Pest/Problem	Management Options	Amount of Formulation per acre	Effect-Iveness (+)	Mode of Action Code	REI	PHI	Comments and F
<p>The disease <b>Ripe rot</b> (caused by <i>Colletotrichum</i> sp. fungi) is one of the most difficult fungal pathogens to control on muscadine grape cultivars are susceptible, while most purple-fruited muscadines are resistant. Fungicidal control has been most successful when st [FRAC code 11] are combined or alternated with fungicides having a different mode of action. Sprays should begin at bloom or i (first cover). Ripe rot is most severe in wet harvest seasons and when fruit is left hanging too long on the vine. Timely harvest and fruit aids in control.</p>							
Black rot Bitter rot Ripe rot Angular leaf spot Powdery mildew (continued)	EBDCs (ethylene-bis-dithiocarbamates) Mancozeb, Dithane M45 Manzate ProStick Maneb 75DF Penncozeb 75DF	1.5-4 lb	+++	FRAC Code [M3]	24 hrs	66 days	Do not apply more Manzate 200DF, M 75DF per acre per s 7 to 10 day interval
	Ziram 76 DF	3-4 lb	+++	FRAC Code [M3]	48 hrs	21 days	
	captan (Captan 50WP)	4 lb	+++	FRAC Code [M4]	48 hrs	0 day	Repeat Captan appl intervals. Do not ap
	captan (Captan 4L)	0.75-2 qt	+++		48 hrs	0 day	
Powdery mildew ONLY	wetable sulfur (Microthiol, various brands, 80 to 92% S)	3-10 lb	++++	FRAC Code [M2]	24 hrs	--	Must be applied eve 100 gal of water pe sprayers and trellis weeks of oil or oil-l temperatures above and other <i>Vitis labr</i>



## First Cover (post-bloom) – *continued from previous page*

Pest/Problem	Management Options	Amount of Formulation per acre	Effectiveness (+)	Mode of Action Code	REI	PHI	Comments and F
Black rot Bitter rot Ripe rot Angular leaf spot Powdery mildew <i>(continued)</i>	kresoxim-methyl (Sovran 50 WG)	3.2 to 4.8 oz	++++	FRAC Code [11]	12 hrs	14 days	Do not make more Sovran per acre per two sequential spra applications with o different mode of a
	EBDCs (ethylene-bis- dithiocarbamates) Mancozeb, Dithane M45 Manzate ProStick Maneb 75DF Penncozeb 75DF	1.5 to 4 lb	+++	FRAC Code [M3]	24 hrs	66 days	Do not apply more Manzate 200DF, M 75DF per acre per s 7 to 10 day interval <u>cannot be used post</u> <u>cultivars.</u>
	Ziram 76DF	3 to 4 lb	+++		48 hrs	21 days	
	captan (Captan 50WP)	4 lb	+++	FRAC Code [M4]	48 hrs	0 day*	Repeat Captan appl intervals. Label allo harvest; however; r
	captan (Captan 4L)	0.75 to 2 qt	+++		48 hrs	0 day*	
Powdery mildew ONLY ( <i>Sulfur will not control other diseases</i> )	wettable sulfur (various brands, 80 to 92% S)	2 to 5 lbs	++++	FRAC Code [M2]	24 hrs	--	Must be applied eve 100 gal of water pe sprayers and trellis weeks of oil or oil- temperatures above and other <i>Vitis labr</i>



**First Cover (post-bloom) – continued from previous page**

<b>Pest/Problem</b>	<b>Management Options</b>	<b>Amount of Formulation per acre</b>	<b>Effectiveness (+)</b>	<b>Mode of Action Code</b>	<b>REI</b>	<b>PHI</b>	<b>Comments and F</b>
Sooty blotch (Primarily seen on the cultivar 'Fry')	captan (Captan 50WP) (Captan 4L)	2.0 to 4.0 lb 0.75 to 2.0 qt	+++	FRAC Code [M4]	48 hrs	0 days	*Label allows appl however; note 48 h
	azoxystrobin (Abound 2.08SC)	10.0 to 15.5 fl oz	+++++	FRAC Code [11]	4 hrs	14 days	Do not make more Abound per acre pe than two sequential applications with o different mode of a
	trifloxystrobin (Flint 50WG)	2 to 3 oz	+++++	FRAC Code [11]	12 hrs	14 days	Do not apply more season. Do not ma of Flint per season. applications of Flin strobilurin fungicid
	pyraclostrobin + boscalid (Pristine)	8.0 to 12.5 oz	+++++	FRAC Code [11+7]	12 hrs (5 days for vine turning, tying)	14 days	Do not make more Pristine or related f carboxamide) per s two sequential appl alternating with a f of action (neither st

## Summer cover (post-bloom) sprays until harvest

**Fruit rots: Bitter rot and black rot** – These rots are usually controlled by fungicide applications pre-bloom to first cover. Properly managed vineyards with clean, healthy vines and no infected berries, leaves and old fruit stems from the previous winter may reduce disease. If bitter rot is very heavy, fungicides can be applied at first cover, 3-5 inches, 8-10 inches and at 7-10 day intervals until fruit set. Black rot-susceptible cultivars can be sprayed with a fungicide at the start of new growth until after bloom. Black rot control is particularly needed on highly susceptible cultivars such as Carlos and Fry. Black rot can be particularly severe on susceptible cultivars such as Higgins, Magnolia, Summit, Watergate, Carlos, Fry, Dixieland, and Seibel. QoI fungicides are the materials of choice in vineyards where ripe rot is a problem. **Sooty blotch** causes a dark, superficial discoloration of otherwise healthy fruit; the disease is common on unsprayed vines of the cultivar Fry. **Macrophoma rot** – control can be improved with Captan, particularly on susceptible cultivars such as Cowart, Fry, Higgins, Summit and Triumph.

**Cover spray insecticides** are often not needed in muscadines due to moderate insect pressure. Growers should rely on “as-needed” insecticides and an IPM approach of scouting frequently for insect damage, including detailed plant examination of 10 vines per acre for insect or mite damage.

**Grape berry moth** is somewhat sporadic, but if present can be very damaging. This moth has several generations per season, beginning in late May. In muscadines, grape berry moth is normally a mid- to late-season pest. Eggs are laid on the berry clusters, and young larvae enter berries to feed. Feeding, webbing and frass can damage multiple berries within a cluster. Spray promptly if infested clusters are seen or if a vineyard has a history of moth infestations.

**Grape curculio** is a small weevil (snout beetle) that typically emerges in mid-June (in GA). Grape curculio initially feeds on the leaves, creating a shallow zigzag pattern before beginning to lay eggs in the berries. Spray if grape curculio are present or if either foliar or fruit injury is observed. Grape curculio is a pest that is sometimes a problem in unmanaged vineyards where weeds and wild hosts thrive.

**Green June beetle** and **Japanese beetle** populations can get out of hand rapidly. Moderate defoliation by Japanese beetles is seldom seen in muscadine vineyards. In other years these insects can be found feeding on flowers, and this can greatly reduce the crop. Fruit feeding by green June beetle is seen in muscadine vineyards. Japanese beetles tend to feed heavily on and become abundant in blocks with ripe fruit. Beware of heavy emergence and migration to blocks with ripe fruit. Insecticide applications are often necessary to maintain control if populations are allowed to build up. Ripening fruit and aggregation pheromones can attract beetles to your vineyard after successful applications.

**Wasps, hornets, yellowjackets and imported fire ants** may be attracted to ripening fruit. Feeding injury or the presence of insects can be damaging, and stinging insects discourage pick-your-own customers. Pre-harvest insecticide options are limited; monitor and control as needed.

**Spider mites and others** – Mites are capable of explosive population growth. Treat if more than 10 mites per leaf are found or if leaves are webbed or bronzed. Drought and heavy crop load aggravate mite injury, especially early in a growing season. Two treatments are needed if using a material that only kills adult mites. **Brevipalpid** mites (flat mites) cause russetting around leaf veins and at the stem. This mite may occasionally warrant control.

**Stink bugs** – The impact of stink bugs and other piercing/sucking insects in muscadine grapes is unclear, but their feeding may cause fruit to abort. No threshold has been developed for these pests.

## Summer cover (post-bloom) sprays until harvest— *continued from previous page*

Pest/Problem	Management Options	Amount of Formulation per acre	Effectiveness (+)	Mode of Action Code	REI	PHI	Comments and H
Black rot Bitter rot Ripe rot Macrophoma rot Angular leaf spot Sooty blotch	Same as sprays for <b>First Cover</b>						Manzate products c applications. These but use is limited by interval. Other effe include tank mixes Captan or Captec, C or Rally with Abou
Stink bugs	phosmet (Imidan 70W)	1.33 to 2.125 lb	+++++	IRAC Code [1B]	14 days	14 days	Imidan seldom pro pests such as mites.
	fenprothrin (Danitol 2.4EC)	10 to 21 fl oz	+++++	IRAC Code [3A]	24 hrs	21 days	Danitol is effective and is the material Danitol is a pyrethr rebound of mite nu
Japanese beetle	carbaryl (Sevin 80WSP)	1.25 to 2.5 lbs	++++	IRAC Code [1A]	12 hrs	7 days	Use of Sevin may e Do not concentrate residue may result. Do not apply more
	carbaryl (Sevin XLR Plus)	1 to 2 qt	++++		12 hrs	7 days	Repeat applications times but not more Do not apply more
	fenprothrin (Danitol 2.4EC)	10 to 21 fl oz	+++++	IRAC Code [3A]	24 hrs	21 days	Danitol is a pyrethr rebound of mite nu
	acetamiprid (Assail 30SG)	2.5 oz	+++	IRAC Code [4A]	12 hrs	7 days	Do not make more season.
	imidacloprid (Admire Pro)	1.3 to 1.4 fl oz	++++		12 hrs	0 days	Do not apply by air
	clothianidin (Clutch 50WDG)	3 oz	+++		12 hrs	0 days	Do not make more season.
<i>(continued on next page)</i>							

## Summer cover (post-bloom) sprays until harvest – *continued from previous*

Pest/Problem	Management Options	Amount of Formulation per acre	Effectiveness (+)	Mode of Action Code	REI	PHI	Comments and Precautions
<i>(continued)</i> Japanese beetle	Surround	25 to 50 lbs	+++	none	4 hrs	0 days	Surround coats leaves and makes them unattractive to Japanese beetle. Also decrease other insecticide applications. OMRI listed for use. Residue may persist.
Grape berry moth	carbaryl (Sevin 80WSP)	2.5 lbs	++++	IRAC Code [1A]	12 hrs	7 days	Use of Sevin may encourage other insects. Do not concentrate applications. Residue may result. Do not apply more than 2 times.
	carbaryl (Sevin XLR Plus)	2 qt	++++		12 hrs	7 days	Repeat applications 2-3 times but not more than 2 times. Do not apply more than 2 times.
	clothianidin (Clutch 50 WDG)	3 oz	+++	IRAC Code [4]	12 hrs	0 days	
	spinosad (Entrust 80W) (Entrust 2SC)	1.25 to 2.5 oz 4 to 8 fl oz	+++	IRAC Code [5]	4 hrs	7 days	Treatments should be applied 2-3 times. Is OMRI listed.
	spinetoram (Delegate)	3-5 oz	+++		4 hrs	7 days	
	methoxyfenozide (Intrepid)	4 to 8 fl oz	+++	IRAC Code [18]	4 hrs	30 days	Treatments should be applied 2-3 times.
Spider mites	fenbutatin-oxide (Vendex 50WP)	1 lb	+++	IRAC Code [12B]	48 hrs	28 days	Do not retreat with Vendex. Use Pesticide.
<i>(continued on next page)</i>	pyridaben (Nexter 75WP)	4.4 oz	++++	IRAC Code [21]	12 hrs	7 days	Nexter is an excellent miteicide.

## Summer cover (post-bloom) sprays until harvest – *continued from previous*

Pest/Problem	Management Options	Amount of Formulation per acre	Effectiveness (+)	Mode of Action Code	REI	PHI	Comments and F
<i>(continued)</i> Spider mites	bifenazate (Acramite 50WS)	0.75-1 lb	+++++	IRAC Code [UN]	12 hrs to 5 days	14 days	Acaramite provides mite control. Fujim larvae and adult spi scout before consid
	abamectin (Abba 0.15 EC, Agri-Mek 0.15EC and others)	8 – 16 fl oz	+++++	IRAC Code [6]	12 hrs	28 days	Abamectin product They should be app surfactant. Test for phytotoxicity prior not reapply within 2 Do not apply by air applications per sea and will not impact Pesticide.
	fenpyroximate (Portal)	2 pt	++++	IRAC Code [21]	12 hrs	14 days	Portal and Acramite spider mites. After considering a second more than two appl

## Grape root borer control

**Grape root borers** – Left unchecked, borers can kill grapevines. Borers tunnel inside vines at or below ground level, weakening (bunch, muscadine and vinifera) are susceptible. There are three control options. Mounding (cultural control), Lorsban ( chemical (mating disruption). **Mounding** uses layers of soil to make it more difficult for young larvae to reach the roots or adults to emerge mound soil 1 foot high and 1½ feet out from the base of each vine to cover the entire area around the base of each vine. This prac inhibit adult emergence from the soil; the time for this function will vary by location (early to mid-June for Georgia but 1 August examples), so check with your county agent for the appropriate time for your location. It is equally important to knock these mou November and late December. **Alternatively, one may use plastic mulch to cover the soil.** To determine whether to use **Lorsb** on a block by block basis during September or October for damage, borers or cast pupal skins. Look at 100 vines in each vineyard **year if 2% or more of the vines are infested or damaged. If possible, treat before adult borers emerge, at least 35 days bef** is effective but expensive and is only one part of an integrated approach to pest management. *(Continued on next page)*

Pest/Problem	Management Options	Amount of Formulation per acre	Effectiveness (+)	Mode of Action Code	REI	PHI	Comments
Grape root borer	Mounding		+++				Mounding is an org
	Isomate GRB	100 Dispensers	****	Mating disruption			Pheromone-based r 90% reduction of p Virginia. Growers i disruption (based o males) in muscadin
	chlorpyrifos (Lorsban 4E)	4.5 pt/100 gals water, apply 2 qt of mixture/ vine	++++	IRAC Code [1B]	24 hrs	35 days	Apply 2 qt. of the d surface on a 15 squ each vine or apply i <b>not allow spray to</b> Apply Lorsban bef least 35 days prior t made with flood no 60 psi).

## Fire ant control

**Fire ants** – Fire ants may be controlled through the use of bait products. These products are often not fast-acting, but operate by sterilizing (they lay sterile eggs). They must be applied when the ants are actively foraging -- test for foraging behavior by placing food (hot dog piece, etc.) and checking 30 min later for ant activity. Apply during dry weather; moisture reduces the effectiveness of bait products. Insecticides applied for control of other insect pests will also aid in suppression of fire ants. Fire ant populations are at their highest in late summer. The number of mounds drops rapidly after the vines develop a mature canopy that shades the vineyard floor.

Imported Fire Ant	pyriproxyfen (Esteem Ant Bait)	1.5-2.0 lbs	++++	IRAC Code [7C]	12 hrs	1 day
	methoprene (Extinguish Professional Fire Ant Bait)	1.0 to 1.5 lbs	++++	IRAC Code [7A]	4 hrs	0 day

## Efficacy of selected fungicides against diseases of muscadine grape<sup>1</sup>

Fungicide	PHI (Pre-Harvest Interval)	Mode-of-Action (MOA) Grouping <sup>2</sup>	FRAC code <sup>3</sup>	Bitter rot	Powdery mildew	Ripe rot	Macro-phoma rot	Black rot
Myclobutanil ( <b>Rally</b> )	14 days	G	3	++ <sup>2</sup>	++++	NA	+	++++
Thiophanate-methyl ( <b>Topsin- M</b> )	7 days	B	1	++	+++	+	+	+++
Wettable Sulfur ( <b>Microthiol</b> and other trade names)	1 day (re-entry)	Multi-site	M 2	NA	++++	NA	NA	NA
Pyraclostrobin + boscalid ( <b>Pristine</b> )	14 days	C	7+11	+++	++++	++++	+++++	++++
Kresoxim-methyl ( <b>Sovran</b> )	14 days	C	11	+++	+++	+++	++	+++
Azoxystrobin ( <b>Abound</b> )	14 days	C	11	+++	++++	++++	++++	++++
Trifloxystrobin ( <b>Flint</b> )	14 days	C	11	+++	++++	++++	+++++	++++
Ziram ( <b>Ziram</b> )	21 days	Multi-site	M 3	++	++	+++	++	+++
Captan ( <b>Captan, Captec</b> )	0 days (72 hrs re-entry)	Multi-site	M 4	++	++	++++	+++	+++
EBDCs (includes <b>Maneb, Manex, Penncozeb, Manzate, Dithane M-45</b> )	66 days	Multi-site	M 3	+++	++	NA	++	+++

<sup>1</sup> NA = no significant activity, ??? = unknown activity; + = very limited activity, ++ = limited activity, +++ = moderate activity, ++++ = good activity

<sup>2</sup> Alternation of fungicides with different modes of action helps prevent the development of pest resistance to a particular class of fungicide. The tank-mixing fungicides with the same mode of action. Fungicides listed as “multi-site” are the least likely to be overcome by a resistant strain of pest.

<sup>3</sup> In addition to MOA grouping, the FRAC code also indicates fungicides that can be alternated to discourage pest resistance; alternate or tank-mix with different FRAC codes.

# Weed Management

## Grape Vineyards

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

## Herbicide Resistance Management

The development of herbicide resistant weed species has increased significantly across the Southeast during the past few years. Resistance to glyphosate has been the most common resistance development which is largely related to the widespread use of glyphosate in other crops. The utilization of herbicides have differing modes of action (MOA) during the growing season or tank mixing herbicides are strategies that can be utilized to prevent the development of herbicide resistant weeds. As a means to assist growers in making decisions on herbicides having like MOA a number system identifying herbicides by MOA has been developed and is being utilized. In the table below is a number for each herbicide active ingredient to aid 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. Using multiple herbicide programs growers not only minimize the risk of herbicide resistance developing but they also minimize the likelihood of 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 vine formulations may require the label for details on controlling
<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 v Rely for postemergence weed vineyards tank mix with sima 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 P soil has settled after transplan established vineyards Prowl r harvest, through winter, and i exceed 6 qt per acre per year. Prowl should be tank mixed v glufosinate for postemergence

<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 annual grasses and small seeded broadleaf weeds. Temperatures do not exceed 50°F. Do not apply if rain is expected within 24 hours of application. Do not apply if rain is expected within 24 hours of application. Do not apply if rain is expected within 24 hours of application.
	<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 with coarse textured soils. Tank mix with glyphosate or glufosinate for control of weeds. Control is expanded when SoliSimazine 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 when temperatures increase volatilization. Irrigation may be used for activation in spring. The Casoron CS formulation is used under well established vines. The 4G formulation may be used for newly 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 break</b> in vineyards that are trellised and after transplanting.
	<b>Rimsulfuron, MOA 2</b> Matrix 25 WG Pravin 25 WG Solida 25 WG	4 oz	Vines established at least 1 year.	4	Tank mix with oryzalin, diuron, or glyphosate for broad spectrum of residual control. Do not apply 14 days of harvest. Rimsulfuron provides control of certain species like pigweed, chickweed, and henbit. Do not tank mix with glufosinate, glyphosate, or paraquat for weed control. Tank mixes with oryzalin provide partial control of yellow nutsedge.

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
<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 on soils low in clay and <2% organic matter can cause severe injury and this risk is avoided by tank mixing with glyphosate, paraquat or other non-selective 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	Controls broadleaf weeds germinating. Tank mix with oryzalin will be necessary for annual grass weeds. Rainfall is required for application for activation. Tank mix with addition of glufosinate, glyphosate or glyphosate recommended for non-selective control.
<b>PREEMERGENCE</b> Broadleaf weeds and some annual grasses	<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 other postemergence weed control. (Surflan) or norflurazon (Soligo) with simazine will extend control for 2-3 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 equipment. Grapes established less than 2 years should be in grow tubes. <b>Chateau may only be applied after completing harvest and wine or juice after bud break. Tuscany may be applied in vineyards after bud break if application equipment is used. Do not use glyphosate after bud break.</b> 6 to 12 oz per acre to vines established in vineyards on soils having a sand plus gravel texture. Chateau has a 60 day PHI.

Weed/Timing	Material	Amount of Formulation per Acre	Crop Age Restrictions	REI (hrs)	Comments
<b>PREEMERGENCE</b> Annual broadleaf and grass weeds (Continued)	<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 California.</b> Alion may be used on soils having a particle size of 20 microns or finer and less than 20% gravel. Do not use with paraquat, glyphosate, or glufosinate. Alion is for pre-emergence weed control. Only use in vineyards that have not been planted at least 12 inches from the vine. Use a soil barrier (berm) between soil and vine root system. DO NOT exceed 12 months of use in a 12 month period.
<b>PREEMERGENCE</b> Annual broadleaf, some grass weeds, and yellow nutsedge	<b>Carfentrazone + Sulfentrazone, MOA14</b> Zeus Prime	7.7 to 15.2 fl. oz	Vines established 2 years or more	12	<b>DO NOT</b> allow spray solution to contact desirable foliage. Zeus Prime may be used with oryzaline for broadspectrum control of grass weeds. Sequential application of the herbicide strip width is 50 feet. Allow 60 days between applications with flumioxazin. A 1/2 inch of rain within 30 days of application to insure herbicide activity with glyphosate, glufosinate or POST weed control.
<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	<b>DO NOT</b> allow spray solution to contact grapevines or suckers. Tank mix with pre-emergence residual control. <b>Do not apply</b> to established vines. Generic formulations may require a non-ionic surfactant. Refer to label for application instructions to control perennial species.
	<b>Glufosinate, MOA 10</b> Lifeline, Reckon 280, Rely 280	48 to 82 oz	Newly planted (shielded) and established vineyards	12	Do not allow herbicide to contact grapevines, immature, uncallused bark. A minimum application volume of 20 gal./A. <b>Do not harvest.</b>



<b>POSTEMERGENCE</b> Annual and perennial grasses (continued)	<b>Fluazifop,</b> <b>MOA 1</b> Fusilade DX	12 to 24 oz	Newly planted and non-bearing vineyards	12	Sequential applications will be needed for (bermudagrass, etc.) control. Add a nonionic surfactant (1 qt/100 gal of spray) to the concentrate (1 gal./100 gal. of spray) for optimum results. Do not harvest.
	<b>Sethoxydim,</b> <b>MOA 1</b> Poast	1 to 2.5 pt	Newly planted and established vineyards	12	Sequential applications will be needed for (bermudagrass, etc.) control. Add a nonionic surfactant (1 qt/100 gal of spray) to the concentrate (1 gal./100 gal. of spray) for optimum results. <b>Do not harvest.</b> Total use cannot exceed 1.5 pt per acre.

## Suggested Herbicide Programs for Grape Vineyards

Crop Age	Fall	Winter	Spring	Summer
Newly Planted	Glyphosate (Pre-Plant to kill weeds in herbicide strip)		Oryzalin	Oryzalin + Paraquat or Poast, or Clethodan
			Flumioxazin (Once soil settles after transplanting)	Flumioxazin + Paraquat or Poast or Fusilade, or Poast
			Trellis + Oryzalin	Paraquat (multiple applications), Fusilade, or Poast
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 (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)  *See flumioxazin label for application made after bud break
	Glyphosate (spot treat for perennial weeds)	Solicam (vines est. 2 yrs) + glyphosate, paraquat, or Glufosinate		Glyphosate, Paraquat, or Glufosinate (as needed)

	Glyphosate (spot treat for perennial weeds); Flumioxazin + Glufosinate (after harvest)		Flumioxazin* + Paraquat, or Glufosinate (late May)	Glufosinate or P *See flumioxazin made after bud br
	Glyphosate (spot treat for perennial weeds)	Flumioxazin + Glyphosate (prior to bud break)		Glufosinate or Pa
<b>Crop Age</b>	<b>Fall</b>	<b>Winter</b>	<b>Spring</b>	<b>Summer</b>
Vines Established at least 3 years	Glyphosate (spot treat for perennial weeds)	Glyphosate (mid March)	Simazine + Oryzalin + Glyphosate, or Karmex + Glyphosate	Paraquat, Glufos
	Glyphosate (spot treat for perennial weeds)	Flumioxazin + Glyphosate (mid to late March)	Flumioxazin * + Glyphosate (early June)	Poast (as needed flumioxazin restr after bud break.
	Glyphosate (spot treat for perennial weeds); Simazine + Paraquat or Glufosinate (after harvest)		Flumioxazin* + Glyphosate (mid to late May)	Paraquat, Glufos *See flumioxazin made after bud br

# Weed Response to Vineyard Herbicides

Herbicides	Annual Grasses					Annual Broadleaf 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
<b>Preemergence</b>																					
Alion	E	E	E	G	G	E		E	E		E	G	E	E	E	E	G	E	G	G	E
Casoron	G	G	G	G	G	G	G	F	G	G	G	G	G	F	F	G	G	G		G	G
Flumioxazin	E	E	E	G	G	E		G	G		E	G	E	E	E	E	G	G	E	G	E
Diuron	G	G	G	F	G	G		G	F		G	G	G	G	G	G	G	G	G	G	N
Kerb	G	G	G	G	G	G		P			G		F	F	F	P	F	F		F	
Rimsulfuron	F	F	P	P	P	G				G	G	E	G	G	F	E	G	F			G
Oryzalin	E	E	E	G	G	G	N	N		F	F		E	F	P	E	P	P	P	P	F
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
Solicam	E	E	E	E	G	E		G		F	G	G	F	F	G	P	G	G	E	G	F
Trellis	N	N	N	N	N	G	F	G	G	G	E	E	E	F	G	E	E	E	G	E	G
<b>Postemergence</b>																					
Aim	N	N	N	N	N							P	G	E	G	G	F			G	
Clethodim	E	E	E	E	E	N	N	N	N	N	N	N	N	N	N	N	N	N	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
Glyphosate	E	E	E	E	E	E	G	G	G	E	F	E	E	G	E	E	G	E	G	F	G
Paraquat	G	G	G	G	G	G		G	F	F	F	P	G	G	G	G	F	G	G	G	G
Poast	E	E	E	E	G	N	F	N	N	N	N	N	N	N	N	N	N	N	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

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



# Wildlife Damage Prevention

## Pest/Problem

## Management Options

Efforts to control birds and other wildlife that damage fruit crops should be focused on the perimeter of the planting first, especially in areas with favorable wildlife habitat. This is where the first damage will be observed and, in some cases, it may be sufficient to head off the damage. Discontinue monitoring for wildlife damage throughout the planting.

### Birds

Crop losses to birds appear to be increasing in small fruit crops. Not only do birds consume fruit, but the damage also leads to increased problems with fruit rots and other pests such as bees and yellow jackets. Several different types of birds cause damage. Robins, starlings and mockingbirds are among the more common ones, but orioles, cedar waxwings and finches also damage fruit crops.

Feeding pressure will be heavier in fields that are close to roosting or nesting sites such as woodlands, hedgerows, fence lines and individual trees. Birds may feed, fly to these resting sites, and then return to the crop later in the day. Because of the fairly long distances to feed, the further they have to fly, the more apt they are to not find the fruit crop or to find a better source. The presence of a pond, creek or other water source nearby is another factor that may lead to increased damage. Typically, bird damage tends to be more severe in the earlier parts of the growing season, and damage less severe later in the season.

There are several control techniques which may be of value in decreasing losses to birds. They include visual deterrents, repellents and exclusion (netting). For any method to be successful, it must be instituted before birds establish a feeding pattern. Generally means that they should be in place and operating at the time that color change occurs in the fruit. For exclusion, no one method should be relied on for control.

### **Auditory repellants**

Auditory scare devices such as propane cannons, noise makers or distress calls may offer temporary relief from bird damage. Regardless of which one or ones is/are used, the following points should be considered to attain the best results.

- Assess the potential for objections to the noise from your neighbors.
- Start before birds establish a feeding pattern.
- Operate control devices beginning shortly before sunrise and continuing until just after sunset, as early as possible during the most intense feeding times.
- Vary the frequency, the direction and the timing in which auditory devices are operated. Propane cannons should be used sparingly.

<p>Birds (Continued)</p>	<p>closer than 3 minutes.</p> <ul style="list-style-type: none"> <li>- Consider using more than one type of auditory device and possibly combine them with visual repellents.</li> <li>- If using distress calls, it is essential to identify the type(s) of birds you want to discourage and get distress.</li> <li>- Reinforce the sense of danger by shooting (if allowed).</li> </ul> <p><b>Visual repellants</b>  Visual repellents include such things as scare eyes suspended above the crop, mylar tape on the canopy of plastic owls and plastic snakes. These range from ineffective to moderately effective for a short period of time quickly if they are not moved around or if another type of repellent is not used along with it. Yellow scare and allowed to move freely have been reported to have some impact on blackbirds, however, robins do not.</p> <p><b>Chemical repellants</b>  Methyl anthranilate is registered as a bird repellent. While it is sometimes advertised as a taste repellent, when sprayed on a crop, it causes an unpleasant sensation in the bird's mouth. Methyl anthranilate is a naturally occurring compound in the food service industry. Early reports have been inconsistent in regards to its effectiveness. It has also been reported to have an undesirable foxy flavor to certain grape varieties. Methyl anthranilate has a short residual, so frequent reapplications are needed to achieve lasting results. Results may vary depending on the type of birds. Combining with another type of repellent may have a greater effect than when used alone. As with other types of deterrents, applications need to start before birds establish themselves.</p> <p><b>Exclusion</b>  Exclusion (netting) is the only consistently effective method of reducing bird damage. Netting is more expensive than other deterrents and can require fair amounts of labor, so it may not be an economically viable alternative in all situations. The netting can be placed over the canopy of the crop or suspended from a framework over the crop. The fruiting area of the plant needs to be completely covered. Birds will enter the canopy of the plant from below the net if it is open under the plant. If used with care, nets can last for several years. For crops requiring multiple harvests such as blueberry, suspending the netting over the crop and allowing the field will allow easier access to the crop. If nets are placed directly on the crop canopy, birds can perch on them.</p> <p>Wild turkeys are becoming more of a problem in many areas of the country. While there is no doubt that they are causing some damage, some research has shown that the turkeys are often after insects instead of the fruit. They do not appear to be deterred by sounds. While netting will work, turkeys can tear holes in it for access to the fruit.</p>
<p>Deer</p>	<p>Deer can damage small fruit plantings by foraging on succulent new growth during the growing season or by rubbing and damage plants by rubbing. This is more of a problem in tree fruits than small fruits. Deer can also puncture irrigation tape underneath, resulting in loss of weed control. Deer numbers are increasing and incidents of damage are increasing. Deer populations vary from year to year as a result of weather conditions, food supply and population pressure.</p> <p>Locating the planting away from favorable habitat for deer will help to lessen losses. However, this is not always possible. Other options do exist. Determining which one or ones to use depends on the deer population, availability of other deterrents, favorable habitat, the duration for which protection is needed, and the value of the crop to be protected.</p>

<p>Deer (Continued)</p>	<p><b>Repellants</b> Both taste and smell repellents exist. Smell repellents include commercially available products or material putrified egg solids, certain soaps and human hair. Repellants will not provide long-term control and will not work if deer populations are high or alternate food sources are scarce.</p> <p><b>Exclusion</b> Exclusion (fencing) is the only truly effective long-term control for deer damage prevention. Fences can be designed to go under a fence, through a fence, or over it. For non-electrified fences, the lowest wire needs to be with the lowest point in the ground around the fruit crop planting and tight enough to prevent deer from pushing under it. Other low spots in the ground around the field, because the deer will find them. The fence needs to be at least 4 feet high. Deer can easily clear this height. Wire mesh fences are more desirable than multiple strands of barbed wire.</p> <p>For electric fences, several different designs have been used and, under certain conditions, each can be effective. The most expensive electric fence uses a single high-tensile wire at about 30 inches above ground level. A solar charger is not an option. Peanut butter can either be smeared on the wire or on aluminum foil strips which are attached to the wire. Plastic flagging may also be tied to the fence to make it more visible to the deer. Deer are curious animals and they are not being chased. Touching the fence results in getting shocked and turning the deer away from the fence. A single-wire, baited fence is relatively inexpensive, easy to construct and often adequate to protect the crop. However, when available alternate food sources are scarce or when deer have already established a feeding pattern in the field, a fence may not be adequate.</p> <p>More substantial electric fences for deer control have multiple wires with the alternate wires being electrified. A fence is constructed at a 45 degree angle facing away from the area to be protected. The bottom wire is within 1 foot of the ground and electrified to keep deer from going under the fence. The middle wire is also electrified to prevent deer from going under the top wire, which may be only about 5 feet above ground is electrified to keep deer from going over the fence. This manner presents a barrier to the deer that has height and depth, a combination that generally will discourage deer from entering the field. Poly Tape electric fence often used to contain cattle and horses works well for deer fences.</p> <p>Numerous other fence designs exist including a non-electrified mesh fence with a hot wire on top. If electric fencing is important to keep weeds, grasses and other materials away from the fence to prevent it from shorting out and becoming ineffective.</p>
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