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Commercial Grape Pest Control Recommendations for New Jersey

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GRAPE INSECT AND DISEASE CONTROL

This publication contains descriptions of various diseases and pests of grapes, cultural practices to reduce incidence (IPM strategies), and chemical control tactics should they be warranted.

All spray formulations are presented in amount of formulated product/A. Apply sprays so that uniform foliage coverage is achieved without excessive run-off. Sprayers must be calibrated based on the manufacturer's specifications for applications to be effective. Not all pesticide treatments recommended here are necessary to manage insect and disease problems in every field. Always use local scouting information on insects and diseases in arriving at insecticide and fungicide spray decisions. **Follow all label instructions when using pesticides.**

Good management practices will improve plant vigor and reduce pest problems, decreasing the need for pesticides. Themes to follow for good pest management include:

1. **Plant only disease-free vines of resistant or moderately susceptible varieties:**
   - avoid tight-clustered varieties
   - use certified planting stock where available
   - this is the best way to avoid crown gall but is difficult to find certified planting stock
2. **Exclude specific pests from the planting when possible:**
   - control disease hosts and vectors (weeds, insects)
   - reduce inoculum levels for indigenous or established pathogens and pests
   - remove and destroy diseased and dead plant parts
3. **Minimize mechanical injury.**
4. **Open the leaf canopy. Control vine vigor through balanced pruning to allow more light and air circulation for reduced drying time and improved spray penetration:**
   - thin shoots, position shoots, hedge, pull leaves
   - avoid excessive nitrogen and water
   - avoid excessive pruning to avoid excessive vigor
   - balance pruning = increased clusters = decreased berries/cluster and decreased berry size = looser clusters
   - prune to multiple trunk system (Eutypa dieback, crown gall).
5. **Walk rows and closely inspect plants regularly during the growing season to keep abreast of pest occurrence.**
6. **Practice stringent pest control during critical times early in the season, from bud swell through postbloom.**

Many of these practices are good basic horticulture and can reduce the need for protectant chemicals. If you follow these practices, let your clientele know that you are utilizing a responsible program designed to minimize chemical usage.

Pesticide mixing and evaluation for compatibility. A convenient and economical method for controlling several pest problems at once is through the use of pesticide mixtures. Fungicides and insecticides are commonly used in combination for disease and insect control. Many problems can arise from inappropriate use of mixtures. Chemicals that are physically incompatible form an insoluble precipitate that clogs nozzles and sprayer lines. Other mixtures may be phytotoxic and result in a crop loss. Mixing formulations of diazinon with captan or captec has caused crop injury. Therefore, diazinon and captan formulations should **not** be tank-mixed. This type of phytotoxicity results from either a direct interaction of the active ingredients or an interaction of the inert ingredients in one formulation that enhances the toxicity of the other one. A third type of incompatibility arises when one component of the mixture reduces efficacy of the other component. When using mixtures there are several guidelines to follow:

1. Read the label and follow the manufacturer directions. A section specifically addressing compatibility is usually included on the label. If you are in doubt contact the manufacturer, or a technical representative.
2. Obtain a compatibility chart and use it as a guideline only. Compatibility charts are frequently out of date because new pesticide formulations can alter compatibility. However, they provide useful baseline information.
3. Use a jar test to determine physical compatibility. Jar tests are conducted by mixing chemicals at approximately the same rate as specified on the labels. The volumes are scaled down to fit in a small (1 pint - 1 quart) container. Results are evaluated by observing the mixture for reactions such as formation of larger particles, the formation of layers or other changes that result in the formation of a precipitate (i.e. sludge at the bottom of the container).
4. Chemicals that are physically compatible may be phytotoxic. Therefore, mixtures of new chemicals should always be tested on a small number of plants before being sprayed on a larger area. Phytotoxicity may appear as wilting, spotting, dieback or other abnormalities in plant growth. The appearance of phytotoxicity may be environmentally controlled. For example, high temperatures may cause more severe expression of phytotoxicity. Environmental variables can play a big role in causing mixtures as well as single component sprays to perform not as predicted.
5. Use of spray additives, such as spreaders, stickers, or activators can greatly complicate chemical compatibility in mixtures. Unless recommended by the manufacturer these additives should be avoided.
6. Use of Aircraft – For aircraft sprays, apply at least 5.0 gals./A of spray mix. Use a jar test to check for compatibility of pesticides.

A final note. Mixtures provide an economical and efficient method for applying different classes of pesticides. Mixtures can provide enhanced activity through synergism and in some cases reduce the chance of resistance developing in the target population. Some chemical companies market pesticides pre-mixed. Thus, appropriate use of mixtures **requires** preliminary research to determine the compatibility.

See current recommendations for Section 18 materials:
http://www.pestmanagement.rutgers.edu/NJinPAS/PesticideRegistration?NJ18s.htm
Labels can be found on the CDMS website
http://www.cdms.net/LabelsMsds/LMDefault.aspx

FUNGICIDES AND INSECTICIDES WITH KNOWN PHYTOTOXIC REACTIONS IN GRAPES

The chemical compounds below are known to damage grapes. Grape varieties come from a diverse genetic background and differ widely in their susceptibility to the various phytotoxic compounds. If applying any of these chemicals to (or near) varieties of unknown susceptibility, apply to a small test area before spraying many vines.

Compound	Varieties with Known Susceptibility[1]	Effect	Notes
Sulfur	Many red hybrids and some natives; Chambourcin, Chancellor, Concord, Cynthiana (Norton), De Chaunac, Ives, Maréchal Foch, Mouvèdre, Rougeon, Van Buren.	Leaf stippling, burning (necrosis), defoliation.	Sensitivity to sulfur is increased by high temperatures, intense sunlight, frost, or rain. Temperatures of 80-95˚ F during or immediately after application may cause damage in otherwise tolerant varieties.
Copper-fungicides	Many hybrids and some natives: Aurore, Catawba, Cayuga White, Chancellor, Chelois, Concord, De Chaunac, Delaware, Elvira, Gewürztraminer, León Millot, Maréchal Foch, Merlot, Niagara, Cynthiana (Norton), Pinot blanc, Pinot noir, Rosette, Rougeon, Seyval blanc.	Leaf "bronzing", burning, reduced vigor.	Damage from copper-containing fungicides is increased under slow drying conditions. Cool or very humid conditions shortly after application may cause damage in otherwise tolerant varieties.
Paraffinic or Mineral oil (JMS Stylet Oil, Purespray Green	All varieties.	Leaf burning, removes waxy "bloom" from fruit. Oil applied near veraison may lower Brix values at harvest.	Use of Captan or Sulfur within two weeks after applying oil can result in severe vine damage and death. Do not use oil with copper when fruit are present.
Trifloxystrobin (Flint, in Adament)	Concord.	Leaf burning.	
Pyraclostrobin (in Pristine)	Concord, Noiret, and related varieties such as Fredonia, Niagara, Rougeon, Steuben, Worden.	Leaf burning.	
Difenconazole (in Revus Top, Inspire Super, and Quadris Top)	Brianna, Canadice, Concord, Concord Seedless, Frontenac, Glenora, Noiret, Skujinsh 675, St. Croix, Thomcord.	Leaf burning.	The Revus Top label cautions that: On *V. labrusca, V. labrusca* hybrids, and other non-viniferea *(sic)* hybrids where sensitivity is not known – the use of fungicides containing difenoconazole alone or in tank-mixtures with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects.
Carbaryl (Sevin XLR)	All varieties.	Leaf damage on tender foliage and growing tip	Damage is typically seen when application is followed by high humidity.
Captan	All varieties.	Leaf and fruit damage. In severe cases will kill entire plant.	Captan is considered a biocide and is specific to fungi only because of selective uptake. Mixing Captan with other pesticides or surfactants or spreader/stickers may increase uptake into plant tissue causing moderate to severe phytotoxicity.

1 Not all varieties have been thoroughly tested with all chemicals. Use caution and be aware that varieties that are closely related to susceptible varieties may also be susceptible.

Sources:

Product labels

2011 New York and Pennsylvania Pest Management Guidelines for Grapes.

Wine Grape Production Guide for Eastern North America. Tony Wolfe ed. NRAES-145.

Phytotoxicity in Tender Fruit and Grapes. Ontario Ministry of Agriculture, Food, and Rural Affairs. http://www.omafra.gov.on.ca/english/crops/hort/news/hortmatt/2006/08hrt06a4.htm

TIME	PEST	MATERIALS	RATE/A
DORMANT			
	Eutypa dieback. Infected trunks should be cut off below the canker, as close to the ground as possible, when foliar symptoms become evident in June. Infected wood should be disposed of immediately by burning or burying. If possible, prune the least tolerant cultivars when inoculum levels are lowest (early spring). A multiple trunk or periodic trunk renewal system is an effective way to combat this disease. Since this disease may be confused with other stem diseases be sure to obtain a proper diagnosis.		
	Phomopsis	Lime-sulfur	10.0 to 20.0 gals./A
	This treatment should be used when Phomopsis was severe the previous season. Prune to remove dead wood.		
	Black rot. Pruning practices that promote more rapid drying of the foliage will improve efficacy of other control practices. Mummies should be removed from vines and early-spring cultivation to cover the berries on the ground with a layer of soil will help reduce ascospore production.		
	Mealybugs	Actara 25WDG	1.5 to 3.5 oz., *or*
		Applaud 70DF	9.0 to 12.0 oz., *or*
		Assail WSP	1.1 oz., *or*
		Baythroid 2EC	2.4 to 3.2 fl. oz., *or*
		Belay 50WDG	6.0 fl. oz., *or*
		Provado Solupak	0.8 to 1.0 oz., *or*
		Scorpion 35SL	2.0 to 5.0 fl. oz. (foliar)
			9.0 to 10.5 fl. oz. (soil), *or*
		Venom 20SG	0.44 to 0.66 lbs.
	Grape scale	Dormant oil	2% solution
BUDSWELL			
	Cutworms overwinter in plant trash on vineyard floors. They climb grape trunks on warm spring nights and feed on swelling buds and early new growth. After this brief period, however, they are seldom a problem. Weed control and clean cultivation can help prevent the occurrence of cutworms and flea beetles. Cutworms have been hard to find in vineyards over the past 5 years. However, new canes should be inspected until there are 6 inches of new growth.		
	Flea beetles may become active on warm April days and are most numerous following mild winters. They cause injury by eating holes in buds, thereby destroying future canes. Flea beetles can be troublesome, particularly near woods and in vineyards containing abundant plant trash. Bud inspection is a must, at least until there is 1 inch of new growth.		
	Flea beetle	Baythroid 2EC	2.4 to 3.2 fl. oz., *or*
		Danitol 2.4EC	8.0 fl. oz., *or*
		Imidan 70WP	2.0 lbs., *or*
		Sevin 80WSP	1.25 to 2.5 lbs., *or*
		Sevin XLR Plus	2 qts.
	Climbing cutworms	Altacor 35WDG	3.0 to 4.5 oz., *or*
		Bacillus thuringiensis	Rates vary, *or*
		Baythroid 2EC	2.0 to 3.0 to 3.2 fl. oz., *or*
		Brigade 10WSB	8.0 to 16.0 oz., *or*
		Danitol 2.4EC	15.0 fl. oz., *or*
		Delegate 25WG	3.0 to 5.0 oz., *or*
		Entrust 80WP	2.5 oz., *or*
		Intrepid 2F	12.0 to 16.0 fl. oz., *or*
		Sevin XLR Plus	2.0 qts., *or*
		Tourismo	10.0 to14.0 fl. oz.

TIME	PEST	MATERIALS	RATE/A
NEW GROWTH (when new growth is 1 inch long)			
	Climbing cutworms	Altacor 35WDG	3.0 to 4.5 oz., *or*
		Baythroid XL	2.4 to 3.2 oz., *or*
		Brigade 10WSB	8.0 to 16.0 oz., *or*
		Danitol 2.4EC	16.0 fl. oz., *or*
		Delegate WG	3.0 to 5.0 oz., *or*
		Entrust 80WP	2.5 oz., *or*
		Intrepid 2F	12.0 to 16.0 fl. oz., *or*
		Sevin 80 WSP	2.5 lbs., *or*
		Sevin XLR Plus	2.0 qts., *or*
	European red mites (ERM) and two-spotted spider mites (TSSM) are often found in mixed populations. Spider mite populations can develop at any time after bud break; however, particular attention is needed at the new growth stage and the postbloom period after early-July. As many as 5 to 8 generations occur each season. Heavy mite infestations can cause stunted shoots with bronzed leaves. In case of Nexter, use the lower rate for European red mite control. While ERM predominates in most years, TSSM is more damaging on a per mite basis, and is harder to control with some acaricides.		
	European red mites and Two-spotted spider mites	Acramite	0.75 to 1.0 lbs., *or*
		Agri-Mek 0.15EC (TSSM only[1])	8.0 to 16.0 fl. oz., *or*
		Envidor 25C	16.0 to 18.0 oz., *or*
		JMS Stylet Oil	1.0-2.0 gals., *or*
		Nexter	4.4 to 10.67 oz., *or*
		Onager 11.8 EC	12.0-24.0 fl. oz., *or*
		Vendex 50WP	1.0 to 2.5 lbs., *or*
		Zeal WP	2.0 to 3.0 oz.
	[1] Add nonionic surfactant		
	Phomopsis cane and leaf spot Begin at 1 inch shoot growth when pressure is high, otherwise wait until 3-5 inches of shoot growth.	Captan 50WP (**Note:** there are many formulations)	3.0 to 4.0 lbs., *or*
		Mancozeb 80WP (**Note:** there are many formulations of mancozeb)	3.0 to 4.0 lbs., *or*
		Ziram 76DF	3.0 to 4.0 lbs.
	Black rot This early application timing for black rot is useful only when pressure is high. The most important application timing begins at immediate prebloom and when conditions are conducive.	Abound 2.08F	11.0 to 15.4 fl. oz., *or*
		Bayleton 50DF	2.0 to 4.0 oz., *or*
		Captan 50WP (weak) (**Note:** there are many formulations)	3.0 to 4.0 lbs., *or*
		Elite 45DF	4.0 oz., *or*
		Ferbam 76 WDF	3.0 to 4.0 lbs., *or*
		Flint 50WG (**Note:** DO NOT apply Flint to Concord grapes; injury may result.)	2.0 oz., *or*
		Mancozeb 80WP (**Note:** there are many formulations of mancozeb)	3.0 to 4.0 lbs., *or*
		Nova 40WP/Rally 40WP	3.0 to 5.0 oz., *or*
		Pristine	8.0 to 10.5 oz., *or*
		Procure 50WS	4.0 to 8.0 oz., *or*
		Sovran 50WG	3.2 to 4.8 oz., *or*
		Ziram 76DF	3.0 to 4.0 lbs., *or*
		Adament (**Note:** This is a new fungicide that combines Flint and Elite. Do not apply to Concord grapes because injury may occur.)	6.0 to 7.2 oz.

TIME	PEST	MATERIALS	RATE/A
3-5 INCHES NEW GROWTH			
	Phomopsis	Same as for 1 inch growth	
	Black Rot	Same as for 1 inch growth	
	Powdery mildew, unlike many other diseases, does not rely on wet weather conditions to spread throughout the vineyard. It is very common in hot, dry climates and can continue to spread regardless of moisture conditions. Good air circulation and sun exposure may reduce the spread of infection to a certain degree.		
		Abound 2.08F	11.0 to 15.5 oz., *or*
		Bayleton 50DF	2.0 to 6.0 oz., *or*
		Elite 45DF	4.0 oz., *or*
		Endura	4.5 oz., *or*
DO NOT apply Flint, Pristine to Concord grapes; injury may result.		Flint 50WG	2.0 oz., *or*
		Inspire Super	16.0 to 20.0 fl. oz., *or*
		Nova 40WP/Rally 40WP	3.0 to 5.0 oz., *or*
		Pristine	8.0 to 10.5 oz., *or*
		Procure 50WS	4.0 to 8.0 oz., *or*
		Quintec	3.0 to 6.6 oz., *or*
		Revus Top	7.0 fl. oz., *or*
		Rubigan EC	2.0 to 5.0 fl. oz., *or*
		Sovran 50WG	3.2 to 4.8 oz., *or*
		Sulfur (many forms)	See label for specific instructions, *or*
		Vivendo	10.3 to 15.4 fl. oz.
PREBLOOM (when new growth is 6 to 10 inches long)			
Black Rot and Powdery Mildew control is critical at this stage of growth			
	Black rot	Same as for 1 inch growth	
	Powdery Mildew	Same as for 3-5 inch growth	
	Downy mildew may attack leaves, fruit, and wood of a plant. In severe cases, it may cause complete defoliation, and, if unchecked, can easily destroy 75% of a crop. Defoliation also results in reduced sugar accumulation in the fruit and reduced hardiness of overwintering buds. Preventive management practices consist of making sure soil is well-drained, removal of overwintering debris from the vineyard, and pruning out the ends of infected shoots. Control should not be delayed beyond the prebloom stage, even in dry years. Wet weather requires earlier application of fungicides. Postveraison sprays may be needed to protect foliage during a wet season or in dew pockets.		
	Downy mildew	Abound 2.08F	11.0 to 15.4 oz., *or*
		Captan 50WP	3.0 to 4.0 lbs., *or*
		Fixed-Copper	See label for specific instructions, *or*
		Gavel 75DF	2.0 to 2.5 lbs., *or*
		Mancozeb 80WP	3.0 to 4.0 lbs., *or*
		Maneb 75DF	3.0 to 4.0 lbs., *or*
		Phosphonate Fungicides	See label for specific instructions, *or*
This is a new fungicide and must be tank-mixed with another fungicide for resistance management		Presidio	3.0 to 4.0 fl. oz.
		Pristine	8.0 to 10.5 oz., *or*
		Revus	8.0 fl. oz., *or*
		Revus Top	7.0 fl. oz., *or*
DO NOT apply Ridomil Gold MZ within 66 days of harvest or Ridomil Gold Copper within 42 days of harvest		Ridomil Gold MZ[1]	2.0 to 2.5 oz., *or*
		Ridomil Gold Copper	1.0 to 2.0 lbs., *or*
		Sovran 50WG	4.0 to 6.4 oz., *or*
		Ziram 76DF	3.0 to 4.0 lbs.

TIME	PEST	MATERIALS	RATE/A
PREBLOOM (when new growth is 6 to 10 inches long) (cont.)			
	Grape berry moth	Altacor 35WDG	2.0 to 4.5 oz., *or*
		Avaunt 30WG	5.0 to 6.0 oz., *or*
		Baythroid 2EC	2.4 to 3.2 fl. oz., *or*
		Belay 50WDG	6.0 fl. oz., *or*
		B.t. various products	See label, *or*
		Brigade 10WSB	8.0 to 16.0 oz., *or*
		Danitol 2.4EC	10.6 fl. oz., *or*
		Delegate 25WG	3.0 to 5.0 oz., *or*
		Entrust 80WP	1.25 to 2.5 oz., *or*
		Imidan 70W	1.3 to 2.0 lbs., *or*
		Intrepid 2F	4.0 to 8.0 fl. oz., *or*
		Isomate-GBM Plus	400 dispensers, *or*
		Tourismo	10.0 to 14.0 fl. oz.
	Grape leafhopper	Actara 25WDG	1.5 to 3.5 oz., or
		Admire Pro	7.0 to 14 oz., *or*
		Assail 30SG	2.5 oz., *or*
		Danitol 2.4 EC	5.3 to 10.6 oz., *or*
		Malathion 8EC	1.8 pts., *or*
		Nexter 75WP	4.4 to 5.2 oz., *or*
		Provado Solupak 75WP	0.75 to 1.0 oz., *or*
		Sevin XLR Plus	2.0 qts., *or*
		Venom 20SG	0.13 to 1.32 lbs.[1]
	[1] **Note:** Venom is applied to the soil		
	Grape cane girdler	Imidan 70W	1.5 to 2.12 lbs.
	Eight spotted forester	Sevin 80WSP	2.0 to 2.5 lbs.
	Grape tumid gall, Grape plume moth	Danitol 2.4EC	6.0 to 8.0 fl. oz.
	Redbanded leafroller	Altacor 35WDG	3.0 to 4.5 oz., *or*
		B.t. various products	See label, *or*
		Danitol 2.4EC	6.0 to 8.0 fl. oz., *or*
		Delegate 25WG	3.0 to 5.0 oz., *or*
		Entrust 80WP	1.25-2.5 oz., *or*
		Imidan 70W	1.3 to 2.0 lbs., *or*
		Intrepid 2F	10.0 to 16.0 fl. oz., *or*
		Sevin XLR Plus	2.0 qts., *or*
	Grape scale	Applaud 70DF	9.0 to 12.0 oz., *or*
		Movento 2SC	6.0 to 8.0 fl. oz., *or*
		Provado Solupak	0.8 to 1.0 oz., *or*
		Assail 30SG	2.5 oz.
	Grape tumid gallmaker	Movento 25C	6.0 to 8.0 fl. oz.

TIME	PEST	MATERIALS	RATE/A
BLOOM (early-mid bloom)			
Critical period for PM, BR, Ph, DM	***Botrytis* bunch rot** is caused by the fungus *Botrytis cinerea*. Infections occur as flowers begin to senesce in late bloom, and again as berries begin to touch in fruit clusters. Control consists of improving air movement within the plant and avoiding varieties that form very tight fruit clusters. Pruning out all dead tissue prior to bloom and again shortly before the berries touch in the cluster will remove sources of inoculum. With varieties having very tight fruit clusters, some thinning out of the berries in each cluster will improve air movement and reduce disease incidence. Vegetative vigor may be limited through the use of appropriate rootstocks and judicious application of nitrogen. Proper trellising and leaf removal around fruit can improve aeration and sun exposure of clusters. Protecting against disease and insect injury (especially Grape berry moth), which results in open wounds, can reduce the number of entry points for the fungus. Fields that experience heavy dew and frequent fogs should be avoided. Chemical control can only be achieved through preventive sprays. A bloom spray is important. Where bunch rot has been a problem, make an application just before bunch closing and at the beginning of fruit ripening. The fungicides listed all have high activity against the fungus. Other materials having less activity are also listed in Table 2.		
	Bunch rot *(Botrytis)*	Elevate 50WDG	1.0 lb., *or*
		Inspire Super	16.0 to 20.0 fl. oz., *or*
		Luna Experience	8.0 to 8.6 fl. oz., *or*
		Rovral 50W or 4F	1.5.0 to 2.0 lbs., *or*
		Scala SC	18.0 fl. oz., *or*
		Vanguard WG	5.0 to 10.0 oz.
FIRST POSTBLOOM (immediately after bloom)			
	Black rot	Same as New Growth	
	Bunch rot *(Botrytis)*	Same as Bloom	
	Downy mildew	Same as Prebloom	
	Powdery mildew	Same as Prebloom, *or*	
		Sulfur[1]	1.0 to 2.0 lbs.

[1] **Note:** Be careful of varietal sensitivity to sulfur. Some fungicides have activity on multiple diseases; always check fungicide efficacy tables when making decisions.

Grape berry moth (GBM) is the most important potential pest at this time. GBM pheromone traps are reliable and reveal male flight occurrences (2, possibly 3 generations/year). The first generation male moth catches peak anytime from April to early-June, depending on the year. If an insecticide has not been applied up to this time and if the vineyard is not being monitored for pests, one should be applied 10 days postbloom. Subsequent insecticide applications are necessary only when more than 5% of the bunches show berry webbing.[2] Materials applied for Grape berry moth (except Delegate, Entrust, and Intrepid) will also control Grape leafhopper.

Grape berry moth	Altacor 35WDG	2.0 to 4.5 oz., *or*
	Avaunt 30WG	5.0 to 6.0 oz., *or*
	Baythroid 2EC	2.4 to 3.2 oz. *or*
	B.t. various products	See label, *or*
	Brigade 10WSB	8.0 to 16.0 oz., *or*
	Danitol 2.4EC	10.6 fl. oz., *or*
	Delegate 25WG	3.0 to 5.0 oz., *or*
	Entrust 80WP	1.25 to 2.5 oz., *or*
	Imidan 70W	1.3 to 2.0 lbs., *or*
	Intrepid 2F	4.0 to 8.0 fl. oz., *or*
	Tourismo	10.0 to 14.0 fl. oz.

[2] **Note:** Several populations of grape berry moth from Pennsylvania and New York have been shown to be resistant to carbaryl, the active ingredient in various Sevin formulations.

Scout: Monitoring for GBM larvae is accomplished by examining 10 bunches for larval damage 10 days postbloom on each of 5 vines in 4 locations (200 bunches, 2 at the wooded edge and 2 further in the vineyard.[3] Control for wine grapes is necessary when 5% of the bunches show berry webbing and GBM larval feeding signs. Often the 0.25 inch greenish-brown, active larvae can be found within the berry. For table grape growers, the percent injury would be considerably less.

[3] **Note:** Based on research conducted by entomologists from the New York Agricultural Experiment Station, Fredonia, NY.

TIME	PEST	MATERIALS	RATE/A
FIRST POSTBLOOM (immediately after bloom) (cont.)			
	Grape leafhoppers first appear about this time; however they are not always an economic pest of grapes in New Jersey. Some populations in the Finger Lakes region have developed resistance to Sevin formulations. If Sevin fails to control leafhoppers, do not repeat application of the material.		
	Grape leafhoppers	Actara 25WDG	1.5 to 3.5 oz., *or*
		Admire Pro	1.0 to 1.4 oz., *or*
		Applaud 70DF	9.0 to 12.0 oz., or
		Assail 30SG	2.5 oz., *or*
		Baythroid 2EC	2.4 to 3.2 fl. oz., *or*
		Belay 50WDG	2.0 to 4.0 fl. oz., *or*
		Brigade 10WSB	8.0-16.0 oz., *or*
		Danitol 2.4 EC	5.3 to 10.6 fl. oz., *or*
		Malathion 8EC	1.8 pts., *or*
		Movento 2SC	6.0 to 8.0 fl. oz., *or*
		Nexter 75WP	4.4 to 5.2 oz., *or*
		Portal 5EC	1.0 to 2.0 pts., *or*
		Provado Solupack 75WP	0.75 to 1.0 oz., *or*
		Sevin XLR Plus	2.0 qts., *or*
		Surround 95WP	12.5-50.0 lbs., *or*
		Venom 20SG	0.13 to 1.32 lbs.[1]
	Grape phylloxera, if present, commence crawling up vines at this time. Examine foliage regularly. Crawlers are lemon yellow and can be seen with a hand lens. Apply when first galls are detected; repeat application 10 to 12 days later, if fresh galls are seen on new growth. Phylloxera form pea-sized, warty galls on the upper leaf surface. Root feeding can kill susceptible vines. Be sure all vinifera vines are planted to a resistant rootstock.		
	Grape phylloxera	Assail 30SG	2.5 oz., *or*
		Danitol 2.4EC	1.1 fl. oz., *or*
		Movento 25C	6.0 to 8.0 fl. oz., *or*
		Venom 20SG	0.44 to 0.66 lbs.[5]
	[4] **Note:** Thionex should not be applied to sensitive varieties, i.e. Concord, Cascade, Baco, Colobel, and Chancellor		
	[5] **Note:** This is for a foliar application		
SECOND POSTBLOOM (7 to 10 days after first Postbloom spray)			
	Black rot	Same as New Growth	
	Downy mildew	Same as Prebloom	
	Powdery mildew	Same as First Postbloom	
COVER SPRAYS (begin 10 to 40 days after second Postbloom spray and repeat every 10 to 14 days to Harvest)			
	Downy mildew	Same as Prebloom	
	Powdery mildew	Same as First Postbloom	
	Botrytis rot	Elevate 50WDG	1.0 lb., *or*
		Inspire Super	16.0 to 20.0 fl. oz.*, *or*
		(**Note:** May be insufficient to control Botrytis at this growth stage. Supplement with 3.0 oz. Vanguard)	
		Rovral 4L	1.0 to 2.0 pts., *or*
		Rovral 50WP	1.0 to 2.0 lbs., *or*
		Vanguard WG	10.0 oz.
	Note: Before applying sprays, always check Hours to Re-Entry information (Tables 2 and 3). In wet weather, a fungicide should be used every 10 days, especially if black rot is troublesome. DO NOT use Rovral more than 4 times/season; DO NOT exceed 20.0 oz./season of Vanguard; DO NOT exceed 32.0 oz./season of Procure.		

TIME	PEST	MATERIALS	RATE/A
COVER SPRAYS (begin 10 to 40 days after second Postbloom spray and repeat every 10 to 14 days to Harvest) (cont.)			
	European red mite	Acramite 50WS	0.75 to 1.0 lb., *or*
		Agri-Mek 0.15EC	8.0 to 16.0 fl. oz., *or*
		Envidor 25C	16.0 to 18.0 fl. oz., *or*
		JMS Stylet Oil	1.0 to 2.0 gals., *or*
		Nexter 75WP	4.4 to 5.2 oz., *or*
		Onager 11.8EC	12.0 to 24.0 fl. oz., *or*
		Portal 5EC	1.0 to 2.0 pts., *or*
		Vendek 50WP	2.0 lbs., *or*
		Vendex 4L	1.0 qt., *or*
		Zeal WP	2.0 to 3.0 oz.
	Brown marmorated stink bug	Actara	1.5 to 3.5 oz., *or*
		Assail 70WP	1.1 oz., *or*
		Scorpion 35SL	2.0 to 5.0 fl. oz. (foliar)
			9.0 to 10.5 fl. oz. (soil)
	Spotted wing drosophila	Baythroid 2EC	2.4 to 3.4 fl. oz., *or*
		Delegate	3.0 to 5.0 oz., *or*
		Entrust	1.25 to 2.5 oz., *or*
		Malathion 8EC	1.8 pts., *or*
		PyGanic 1.4EC	64.0 fl. oz.
DAY BEFORE OR DAY OF HARVEST			
	Brown marmorated stink bug	Belay 50WDG	6.0 fl. oz., *or*
		PyGanic 1.4 EC	64.0 fl. oz.
POSTHARVEST VINES ONLY			
	Mealy bugs	Actara 25WDG	1.5 to 3.5 oz., *or*
		Applaud 70DF	9.0 to 12.0 oz., *or*
		Assail 70WP	1.1 oz., *or*
		Belay 50WDG	6.0 fl. oz., *or*
		Movento 25C	6.0 to 8.0 fl. oz., *or*
		Venom 20SG	0.44 to 0.66 lb.

PEST NOTES

Grape root borer

Grape root borer attack larger roots and crowns below the soil surface. Severe root pruning and girdling reduces vigor and can eventually cause vines to die. Adult borers (moths) lay eggs in July and August, and tiny larvae enter the soil and migrate to larger roots. Larvae feed on roots for approximately 2 years before emerging as adults, beginning in early-July and extending well into September. Recent research indicates that grape root borers are considerably more abundant in southern New Jersey vineyards than those in northern New Jersey. It appears that yearly control is needed in most of the former vineyards, whereas few, if any northern vineyards require treatment. Control, if needed, can be achieved by any of several means:

1. Soil mounding around the trunk. Around July 1, level soil in the row as close to the trunk as possible. Next, throw a 6- to 8-inch layer of soil back around the crown and over larger roots on or about July 10 and again in 3 weeks. This soil mounding will bury cocoons and prevent moth emergence. The mound must be pulled down before the next season.
2. Clean cultivation and weed control beneath vines facilitate soil mounding, described above, and a uniform deposit of the Lorsban spray, described below.
3. Apply Lorsban 4E to the soil surface around mid- to late-July at the rate of 4.5 pts./100 gals. of water. Apply 2.0 qts. of this mix over every 15.0 sq. ft. of soil surface. Good weed control is essential for satisfactory Lorsban deposit on the soil surface. Apply the spray from the vine trunk out at least 18 inches on both sides. Do not allow the spray to contact fruit or foliage. Application before a predicted rain should help the Lorsban reach the root zone.
4. Apply Isomate GRB at the rate of 100 dispensers/A. Mating disruption has been proven to be effective against this pest.

Grape berry moth

Second generation grape berry moth is not an automatic pest problem in New Jersey vineyards. The need for control is determined by examining bunches for larval activity, beginning in early-July, as described in the Postbloom section. Arbitrarily, an insecticide application is warranted when 5% of the bunches display larval feeding signs. Vineyard rows closest to woods may require treatment, where as vineyard middles may not; treat accordingly. See Postbloom for insecticide choices and rates.

Yellowjackets, hornets, and honey bees

These insects are troublesome toward the end of the growing season. They are especially fearsome in pick-your-own vineyards. Sevin 80WSP at 1.5 lbs./A should provide satisfactory control and is safe to use during the harvest season; wait 7 days before harvesting fruit. The wasp problem can increase if the fruit is damaged by birds, insects, or inclement weather. Sevin may cause mortality in honey bee hives.

European red mite and two-spotted spider mites

Mites suck plant sap from leaves causing them to become bronzed and eventually nonproductive. They may become troublesome following a Sevin application. Control when needed using a miticide from Table 4. See labels for additional use restrictions. ERM overwinters on cordons and trunks so may be present in early season. TSSM overwinters in the ground cover, and is usually most common in mid-late season, especially in hot, dry years.

Japanese beetles

Japanese beetles first appear in July and, if not checked, leaf-lacing can be severe. If damage is severe, Assail 30SG (2.5 oz./A), or Baythroid XL (2.4 to 3.2 oz./A), or Capture 2EC (3.2 to 6.4 oz./A), or Danitol 2.4EC (16.0 fl. oz./ A), or Imidan 70WP (2.12 lbs./A), or Sevin 80WSP (2.5 lbs./A) should provide the necessary control. Don't forget to check new plantings. While established vines can tolerate some foliar injury, young vines are very susceptible.

Note: Fixed-copper/lime can be incompatible with, or break down, certain insecticides in mid-summer. Check labels before mixing.

Angular leaf scorch

Angular leaf scorch is most likely to become a problem when high rainfall occurs during the period of early shoot growth. Fungicides such as benomyl and maneb (applied for control of mildews and black rot) have been shown to provide adequate control for angular leaf spot.

Anthracnose

This disease thrives in rainy, humid conditions. The youngest parts of the vine are most susceptible. Clusters are susceptible to infection from before flowering until veraison. In the past, Bordeaux mixture has been able to control anthracnose to the point where it has not been a serious problem. If using copper-free organic fungicides, growers should be aware of the possibility of renewed outbreaks.

Crown gall

Crown gall is a soil borne bacterial disease that is often initially transported into the vineyard on infected nursery stock. Growers should purchase pathogen-free vines and inspect carefully before planting. Crown gall normally enters healthy vines at, or around, the soil-line, through a wound in the trunk. The most common entry sites are cracks due to freezing injury and mechanical injuries caused by equipment. Once infected, infection may develop rapidly and completely girdle vines in 1 season. Infected vines should be removed immediately. Careful cultivation and chemical weed control within rows should reduce mechanical injury. Protection against freeze injury by burying vines or hilling soil around trunks can be effective, but is very labor intensive. Multiple trunk systems will not eliminate the incidence of disease, but can be used to insure against losing a crop to crown gall attack. Biological treatments and eradicants have been tried, but are largely ineffective on grapes.

Ozone

Ozone is the most common type of air pollution injury in New Jersey; many grape varieties are highly sensitive. It can adversely affect fruit set, thereby lowering yields and fruit quality. Bayleton has reportedly reduced ozone injury. Maintaining an adequate nitrogen level, good soil drainage, and the use of cover crops also have been shown to minimize ozone injury to grape foliage.

Figure 1. Timing for grape disease management

Grape Disease Management

2013

Target and growth stage

Bold lettering indicates critical timing whereas non-bold indicates timings useful in vineyards with high disease pressure

Botrytis

1" Growth	3-5" Growth	10-12" Growth	Immediate Prebloom	Bloom	1st Postbloom 10-14 days	2nd Postbloom	3rd Postbloom
Phomopsis Powdery Mildew	**Phomopsis** Black Rot Powdery Mildew	**Black Rot Powdery Mildew** Downy Mildew Phomopsis	**Black Rot Powdery Mildew Downy Mildew Phomopsis** Botrytis		**Black Rot Powdery Mildew Downy Mildew Phomopsis** Botrytis	**Black Rot Powdery Mildew Downy Mildew** Botrytis Phomopsis	Powdery Mildew Downy Mildew
Suggested materials							
Captan or Mancozeb + PM material	Captan or Mancozeb + PM material	Mancozeb + PM material Or DMI fungicide	Strobiliurin or Mancozeb + PM material Or Pristine alone		Strobiliurin or Mancozeb + PM material Or Pristine alone	Captan or Mancozeb or Phosphorous Acid + PM material Or Pristine alone	Captan or Mancozeb or Phosphorous Acid + PM material

Notes

These applications are important only when warm wet conditions prevail and if the problem was severe in the previous season. A 7-10 day spray schedule should be followed until the target disease is risk has ended.

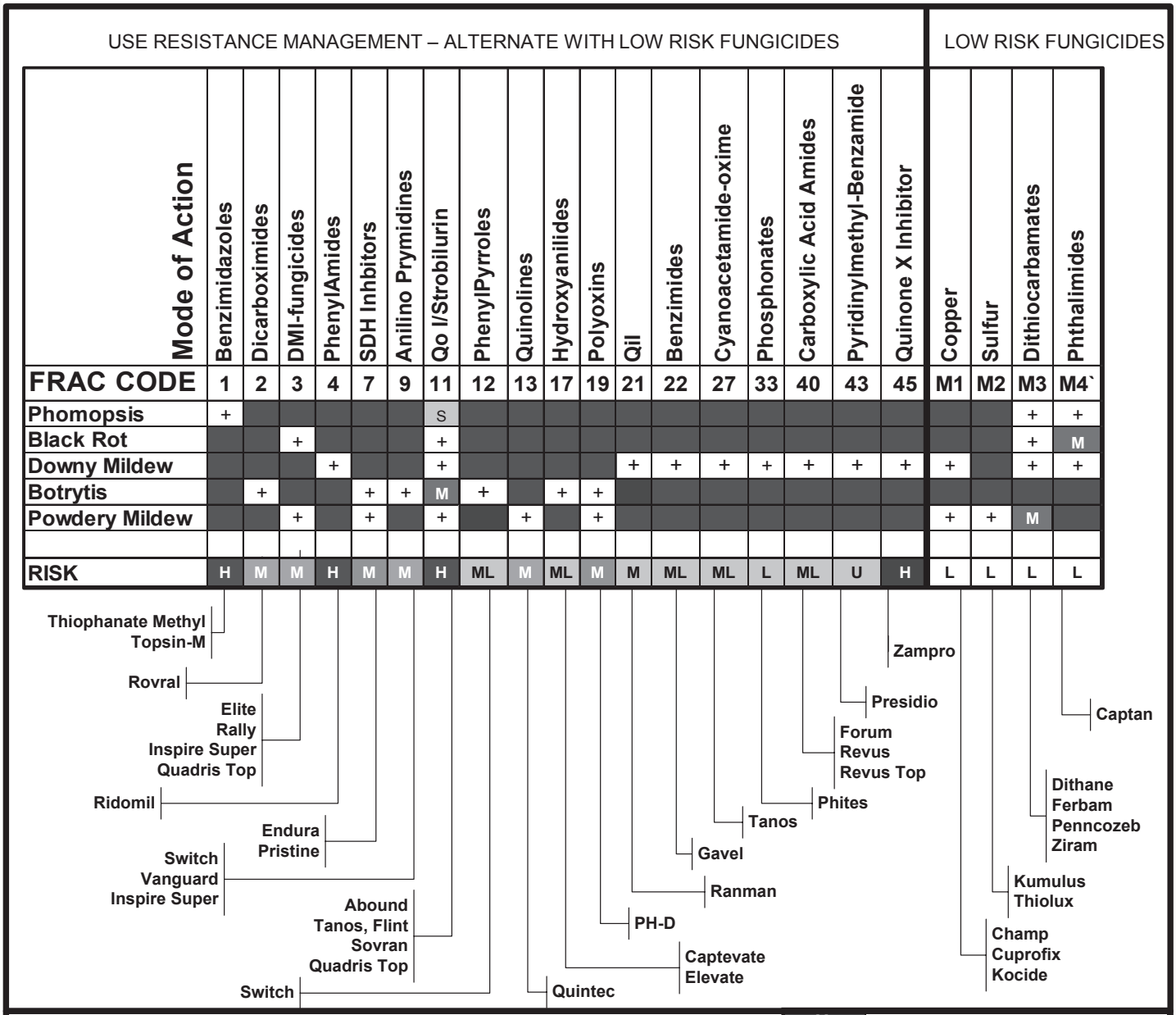
Botrytis should be controlled during bloom in wet years. Fungicides include Elevate, Pristine, Scala, Strobilurin Fungicides include: Abound, Flint, Pristine. These should not be used in more than two successive applications.

Continue the spray program emphasizing the diseases and conditions present

PM Materials
Powdery Mildew. There are a number of powdery mildew fungicides available. If sulfur is used remember that applications may need to be made more frequently.

The most critical timing for controlling fruit infections is from prebloom through the 2nd postbloom. Ensure that you emphasize uniform coverage and optimum rates for these applications. Do not skip or delay these applications

Figure 2. Fungicide activity and risk groupding for managing fungicide resistance.



Key:

	Most members of this class are not effective
M	Moderate activity
S	Some members of this class are effective
+	Most members of this class show activity

H	High risk for resistance
M	Moderate risk for resistance
ML	Low-moderate risk for resistance
U	As yet undetermined risk for resistance
L	Low risk for resistance

Notes: Mode of action groups on the left should never be used more than once or twice in succession. Always alternate with a fungicide that has the same target disease but a different mode of action. Low risk fungicides listed on the right can be used for resistance management. Always read the label. Some fungicides must be tank-mixed before applying. FRAC code is the numerical designation for each unique mode of action. See Table 2 for specific information on each fungicide within a FRAC code. Boxes with dark shading indicate little to no activity against a specific disease. Shaded boxes with a plus symbol indicate variable activity and white boxes with a plus symbol indicate generally good activity. Risk is a ranking for the likelihood of resistance development and should used as a guide for use pattern. Fungicides with higher risk rankings should be used infrequently. Avoid using these fungicides after an epidemic has exploded and avoid using on extremely susceptible cultivars.

Table 2. Fungicides and bactericides labeled for control of diseases of grape. Efficacy is a ranking of the effectiveness of the fungicide against each target disease. Ranking of +++ indicates highly effective, ++ indicates moderately effective, + indicates slightly effective, 0 indicates no effect and ? means the material has not been tested and no data exists for efficacy.

Name	Active Ingredient	EPA Registration	REI (hrs)	PHI (days)	A.I. %	FRAC Code(s)	Phomopsis	Black Rot	Downy Mildew	Powdery Mildew	Botrytis Rot
Abound	Azoxystrobin	100-1098	4	14	22.9	11	+	+++	+++	+++	+
Adament	Tebuconazole/trifloxy strobin	264-1052	24	14	25/2	3 + 11	++	+++	0	++	++
Agri-Fos	phosphorus acid	71962-1	4	0	45.8	33	0	0	+++	0	0
Aliette	phosphorus acid	264-516	12	15	80	33	0	0	+++	0	0
Armicarb 100	potassium bicarbonate	5905-54 1-aa	4	0	85	U	0	0	0	++	0
Basicop	tribasic copper sulfate	1812-300	24	14	95	M1	+	+	+++	++	+
Bayleton 50DF	triadimefon	264-737	12	14	50	3	0	+++	0	+++	0
BlightBan A506	P. fluorescens A506	64004-2-65343	4	–	71	U	?	?	?	?	?
Bordeaux Mixture	copper	33955-97	24	0	13.3	M1	+	+	+++	++	+
Captan 50WP*	captan		48	0	78.3	M4	+++	+	+++	0	+
Captan 80WDG*	captan		72	0	78.2	M4	+++	+	+++	0	+
Captec 4L*	captan		48	0	37.4	M4	+++	+	+++	0	+
Champ Dry Prill	copper hydroxide	55146-57	24	0	57.6	M1	+	+	+++	++	+
Champ Formula 2	copper hydroxide	55146-64	24	0	37.5	M1	+	+	+++	++	+
Champion WP	copper hydroxide	55146-1	24	0	77	M1	+	+	+++	++	+
Dithane DF	mancozeb	707-180	24	66	75	M3	+++	+++	+++	+	0
Dithane DF Rainshield	mancozeb	62719-402	24	66	75	M3	+++	+++	+++	+	0
Dithane F45	mancozeb	62719-396	12	66	37	M3	+++	+++	+++	+	0
Dithane M45	mancozeb	62719-387	24	66	80	M3	+++	+++	+++	+	0
Eco-Mate Armicarb	potassium bicarbonate	5905-541 -za	4	–	85	U	0	0	0	++	0
Elevate	fenhexamid	66330-35	12	14	50	17	0	0	0	+	+++
Elite 45WP	tebuconazole	264-749	12	14	45	3	0	+++	0	+++	+
Endura	boscalid	7969-197	12	14	70	7	0	0	0	+++	++
Ferbam	ferbam	45728-7	24	7	76	M3	++	++	+	0	0
Flint	trifloxystrobin	100-919	12	14	50	11	+	+++	+	+++	++
Forum	dimethomorph	241-427	12	28	43.5	40	0	0	+++	0	0
Fosphite	phosphorus acid	68573-2	4	0	53	33	0	0	+++	0	0
Gavel 75DF	zoxamide /mancozeb	62719-441	48	66	8.3/66.7	22 + M3	?	?	+++	?	?
Inspire Super	difenoconazole cyprodinil	100-1317	12	14	8.4/24.1	3 + 9	0	+	0	+++	++
Iprodione 4L AG	iprodione	51036-340	48	7	41.6	2	0	0	0	0	+++
Iprodione 50	iprodione	51036-341	48	1,7*	50	2	0	0	0	0	+++
K Phite	phosphorus acid	68573-2-73806	4	0	53	33	0	0	+++	0	0
Kocide 101	copper hydroxide	1812-288	24	0	77	M1	+	+	+++	++	+
Kocide 2000	copper hydroxide	1812-358	24	0	53.8	M1	+	+	+++	++	+
Kocide 4.5	copper hydroxide	1812-303	24	0	37.5	M1	+	+	+++	++	+
Kocide DF	copper hydroxide	1812-334	24	0	61.4	M1	+	+	+++	++	+
KOP Hydroxide 50W	copper hydroxide	19713-321	24	0	77	M1	+	+	+++	++	+
KOP Hydroxide 50	copper hydroxide	19713-321	24	0	77	M1	+	+	+++	++	+
Kumulus DF	sulfur	51036-352	24	0	80	M2	+	0	0	++	0
Liquid Sulfur 6	sulfur	5905-437	24	0	52	M2	+	0	0	+++	0
Luna Experience	fluopyram tebuconazole		240	14	–	–	–	+++	0	+++	++
ManKocide	mancozeb	1812-360	24	66	61.1	M3 + M1	+++	+++	++	+	+
Manzate 75	mancozeb	1812-414	24	66	75	M3	+++	+++	+++	+	0

* There are several manufacturers of Captan products. Consult label for correct REI and EPA registration number.

Name	Active Ingredient	EPA Registration	REI (hrs)	PHI (days)	A.I. %	FRAC Code(s)	Phomopsis	Black Rot	Downy Mildew	Powdery Mildew	Botrytis Rot
Manzate 80WP	mancozeb	1812-415	24	66	80	M3	+++	+++	+++	+	0
Manzate Flowable	mancozeb	1812-416	24	66	37	M3	+++	+++	+++	+	0
Meteor	iprodione		48	7	–	–	–	–	–	–	+++
Micro Sulf	sulfur	55146-75	24	–	80	M2	+	0	0	+++	0
Nova 40 / Rally 40	myclobutanil	62719-411	24	14	40	3	0	+++	0	+++	0
Nutrol	P, K	na	0	0	100	U	0	0	0	++	0
Phostrol	Na-, K- and ammonium phosphites	55146-83	4	0	53.6	33	0	0	+++	0	0
Presidio	Fluopicolide	59639-140	12	21	39.5	43	0	0	+++	0	0
Pristine	pyraclostrobin + boscalid	7969-199	24	14	12.8/25.2	11 + 7	++	+++	+++	+++	++
Procure 50WS	triflumazole	400-431	12	–	50	3	0	++	0	+++	0
Quintec	quinoxyfen	62719-375	12	14	22.6	13	0	0	0	+++	0
Ranman	cyazofamid	71512-3-279	12	30	34.5	21	0	0	+++	0	0
Reason	fenamidone	264-695	12	30	44.4	11	0	0	+++	0	0
Revus	mandipropamid	42519-22-5905	4	14	23.3	40	0	0	+++	0	0
Revus Top	mandipropamid difenoconazole	100-1278	12	14	21.9/21.9	3 + 40	0	?	+++	+++	0
Ridomil Gold Copper	mefanoxam + copper hydroxide	100-804	48	44	4.8	4 + M1	+	+	+++	0	0
Ridomil MZ	mefanoxam + mancozeb	100-803	48	66	68	M3	+	++	+++	0	0
Rovral	iprodione	264-453	48	7	50	2	0	0	0	0	+++
Rovral 4	iprodione	264-482	24	7	41.6	2	0	0	0	0	+++
Scala SC	pyrimethanil	264-788	24	7	54.6	9	0	0	0	0	+++
Sovran	kresoxim-methyl	7969-154	12	14	50	11	+	+++	++	+++	++
Switch 62.5WG	cyprodinil/ fludioxonil	100-953	12	7	37.5/25	9 + 12	0	0	0	++	+++
Tanos	cymoxanil/ famoxadone	352-604	12	7	25/25	27 + 11	0	0	+++	0	0
Tenncop 5E	copper salts of fatty and rosin acids	1812-381	12	0	58	M1	+	+	+++	++	+
Thiolux Jet	sulfur	100-1138	24	–	80	M2	+	0	0	+++	0
Topsin M70WP	thiophanate-methyl	4581-403	48	14	70	1	++	+	0	0	0
Trilogy	neem oil	70051-2	4	–	70	U	0	0	0	++	0
Vangard WG	cyprodinil	100-828	12	7	75	9	0	0	0	0	+++
Vivando	metrafenone	7969-284	12	14	25.2	LL8*	0	0	0	+++	0
Ziram 76DF	zinc dimethyl dithiocarbamate	4581-140	48	21	76	M3	++	+++	++	0	0

* Unknown mode of action; treat Vivando as medium risk.

Table 3. Note on Fungicide Mixtures.

Fungicides are more commonly being sold as prepackaged mixtures for a variety of reasons. Fungicides with different modes of action also have different spectra of action meaning they are effective against different diseases. By packaging them as a mixture, more diseases can be controlled with one product. In certain cases, mixtures may also exhibit synergism where the combined effect is greater than the sum of the components. Finally, mixtures can also help reduce the development of fungicide resistance. For resistance management, fungicides with overlapping spectra of action are typically mixed.

Prepackaged mixtures commonly used in vineyards are shown in the table below. To understand the efficacy of mixtures you need to understand the spectrum of action of each of the components. For example, Luna Experience contains a Group 7 and a Group 3. Group 7 fungicides have good activity against Botrytis and Powdery Mildew. Group 3 fungicides have good activity against Black Rot and Powdery Mildew. So with the mixture you are able to combat three diseases.

You should ensure that you are applying the same amount of fungicide with the mixture as you would with the standalone product. For example, by comparing labels you fund that the 4.0 oz. rate of Elite (active ingredient is tebuconazole) is equivalent to the 8.6 fl. oz. rate of Luna Experience.

Trade Name	Manufacturer/EPA Reg.	Common Name	FRAC Group
LUNA EXPERIENCE	Bayer CropScience 264-1091	Fluopyram Tebuconazole	Group 7 Group 3
INSPIRE SUPER	Syngenta Crop Protection, LLC 100-1317	Cyprodinil Difenoconazole	Group 9 Group 3
QUADRIS TOP	Syngenta Crop Protection, LLC 100-1313	Azoxystrobin Difenoconazole	Group 11 Group 3
PRISTINE	BASF Ag Products 7969-199	Boscalid Pyraclostrobin	Group 7 Group 11
TANOS	DuPont Crop Protection 352-604	Cymoxanil Famoxadone	Group 27 Group 11
SWITCH 62.5WG	Syngenta Crop Protection, LLC 100-953	Cyprodinil Fludioxonil	Group 9 Group 12
REVUS TOP	Syngenta Crop Protection, LLC 100-1278	Difenoconazole Mandipropamid	Group 3 Group 40
SANCTION	Loveland Products, Inc. 34704-1040	Potassium phosphate Sulfur	Group 33 Group M2

Table 4. Insecticides and miticides labeled for use on grapes.

NAME	ACTIVE INGREDIENT	EPA REGISTRATION	REI*	PHI (days)	A.I. (%)	CATEGORY[1]
Acramite	Bifenazate	400-503	12 h	14	50	M
Actara 25WDG	Thiamethoxam	100-938	12	5	25	I
Agri-Mek 0.15EC	Abamectin	100-898	12 h	28	2	I, M
Altacor 35 WDG	Chlorantraniliprole	352-730	4 h	14	35	I
Assail 30SG	Acetamiprid	8033-36-4581	12 h	7	30	I
Assail 70WP	Acetamiprid	8033-36-4581	12 h	7	30	I
Avaunt 30DG	Indoxacarb	352-597	12 h	7	30	I
Baythroid	Cyfluthrin	264-745	12 h	3	25	I
Belay	clothianidin	59639-150	12 h	0	50	I
Brigade	Bifenthrin	279-3313	12 h	30	25.1	I
Danitol 2.4EC	Fenropathrin	59639-35	1 d	21	30.9	I, M
Delegate 25WG	Spinetoram	62719-541	4 h	7	25	I
Entrust 80WP	Spinosad	62719-282	4	7	80	I
Envidor 2SC	Spirodiclofen	264-831	12 h**	14	22.3	M
FujiMite 5EC	Fenpyroximate	71711-19	12 h	14	5	I, M
Imidan 70WP	Phosmet	10163-169	14 d	14	70	I
Intrepid 2F	Methoxyfenozide	62719-442	4 h	30	22.6	I
JMS Stylet Oil	paraffinic oil	65564-1	12 h	0	99.1	I, M
Lorsban 75WG	Chloropyrifos	62719-301-10163	1 d	35	75	I
Lorsban 4E	Chloropyrifos	62719-220	1 d	35	44.9	
Nexter	Chloropyridazin	81880-4-10163	12 h	7	75	M
Onager	Hexythythiazox	10163-277	12 h	28	11.8	M
Provado 2F	Imidacloprid	264-763	12 h	0	17.4	I
PyGanic	pyrethrins	1021-1771 1021-1772	12	0	1.4	I
Scorpion	dinotefuran	10163-317	12 h	1 (foliar) 28 (soil)	35	I
Sevin 80WSP	Carbaryl	264-526	12 h	7	80	I
Sevin XLR Plus	Carbaryl	264-333	12 h	7	44.1	I
Surround WP	Kaolin	61842-18	4 h	0	95	I
Thionex 50W	Endosulfan	66222-62	1 d	7	50	I
Thionex 3E	Endosulfan	66222-63	1 d	7	33.7	I
Vendex 50WP	fenbutatin-oxide	352-658	2 d	28	50	I
Venom	Dinotefuran	33657-17-59639	12 h	28	20	I
Zeal WP	Etoxazole	59639-123	12 h	14	72	M

*REI h= hour, d= day

**6 day REI for vine girdling, cane turning, cane tying

1 I=Insecticide; M=Miticide

Table 5. Relative effectiveness of selected insecticides and acaricides in grapes. Effectiveness ratings are from Virginia Cooperative Extension publication 456-017. The ratings are given as general guides to aid the user in pesticide selection. Results vary among locations, years, pest pressures, vine sizes, formulations of pesticides, and application methods.

	Insecticides and acaricides and ratings[1]																														
Insects and mites	**Acramite**	**Actara**	**Agri-Mek**	**Applaud**	**Assail**	**Avaunt**	**Baythroid**	**Bt**	**Belay**	**Brigade**	**Danitol**	**Delegate**	**Diazinon**	**Entrust**	**Envidor**	**Imidan**	**Intrepid**	**Lannate**	**Lorsban**	**Malathion**	**Movento**	**Nexter**	**Onager**	**Provado**	**PyGanic**	**Sevin**	**Spinosad**	**Sytlet Oil**	**Surround**	**Thionex**	**Vendex**	**Venom**	**Zeal**
Brown marmorated stinkbug	–	G	–	–	–	–	–	–	G	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cutworms	–	–	–	–	–	–	G	G	–	G	G	G	–	G	–	–	G	–	–	–	–	–	–	–	–	G	G	–	–	–	–	–	–
Drosophila flies	–	–	–	–	–	–	–	–	–	–	–	–	E	E	–	–	–	–	–	E	–	–	–	–	G	–	–	–	–	–	–	–	–
Grape berry moth	–	–	–	–	–	G	E	F	G	E	E	G	G	G	–	G	E	G	–	–	–	–	–	–	–	G	G	–	–	–	–	–	–
Grape cane girdler	–	–	–	–	–	–	E	–	–	–	E	–	–	–	–	G	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Grape flea beetle	–	–	–	–	–	–	E	–	–	–	E	–	–	–	–	G	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Grape leafhopper	–	G	–	E	E	–	E	–	G	E	E	–	G	–	–	G	–	G	–	G	–	G	–	E	–	E	–	–	G	F	–	–	–
Grape rootworm	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	–	–	–	–	–	–	–	–	–
Grape root borer	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Grape scale	–	–	–	E	F	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	–	–	–	–	–	–	–	–	–	–	–	–
Japanese beetle	–	G	–	–	F	G	–	–	G	–	E	–	–	–	–	–	–	–	–	G	–	–	–	–	–	G	–	–	E	–	–	–	–
June beetle	–	G	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	–	–	–	–	–	G	–	–	–	–	–	–	–
Mealybugs	–	G	–	E	G	–	G	–	G	–	–	–	–	–	–	–	–	–	–	–	G	–	–	G	–	–	–	–	–	–	–	–	–
Phylloxera (leaf form)	–	–	–	–	–	–	–	–	–	–	E	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	E	–	–	–
Redbanded leafroller	–	–	–	–	–	–	–	G	–	–	–	F	–	E	–	G	E	–	–	–	–	–	–	–	–	–	F	E	–	–	–	–	–
Rose chafer	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	–	–	–	–	–	–	–
Sharpshooter	–	–	–	–	G	–	–	–	G	G	–	–	–	–	–	–	–	–	–	–	–	–	–	G	–	–	–	–	–	–	–	–	–
Spider mites	G	–	G	–	–	–	–	–	–	–	E	–	F	–	E	–	–	–	–	F	–	E	E	–	–	–	–	G	–	–	G	–	G
Spotted wing drosophila	–	–	–	–	–	–	–	–	–	–	–	–	–	E	–	–	–	–	–	F	–	–	–	–	G	–	–	–	–	–	–	–	–
Wasp	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G	–	–	–	–	–	–	–

[1] E=Excellent, G=Good, F=Fair, P=Poor, — = information lacking or not registered

WEED CONTROL IN VINEYARDS

Introduction

The control of unwanted vegetation in vineyards provides several advantages. Weeds harm the crop in the following ways:

1. Competing for light, water, nutrients, and space.
2. As alternate hosts for harmful insects, diseases, and nematodes, and by providing food and cover for undesirable birds, rodents, and other animals.
3. Adversely affecting crop quality and/or reducing yield.
4. Impeding or preventing harvest.

Control Measures

Weed identification is the first step in a successful weed control program. Knowledge of the weed species in a vineyard is needed for control measures to be successful and economical. Plan control measures when the weed is most susceptible.

Good **cultural practices** can reduce many weed problems. Control difficult perennial weeds before planting a new vineyard. Sow areas in the vineyard where bare ground is not desired to a cool season grass that will not compete vigorously with the vines, but will suppress weeds. **Prevent weed seed production.** Many weeds can produce 10,000 to over 100,000 seeds per plant. Most will be "hard" seed that will not germinate for several years. One good year of weed seed production can result in a supply that will last many years. Preventing seed production of new hard to control weeds is particularly important.

Vineyard Floor Management. Recommended management of the vineyard floor includes maintaining a vegetation free zone in the row and establishment of a perennial grass sod between the rows. Integration of vegetation management with insect and disease control programs is essential. Maintain the vegetation free zone in the row to prevent competition with the crop. The width of the vegetation free zone should be about 30 to 40% of the distance between the rows in most vineyards. The width may vary, however, depending on soil fertility, water holding capacity and exposure to erosion. Do NOT reduce the width of the vegetation free zone in young nonbearing vineyards. Maintain the full width of the vegetation free zone in newly planted vineyards to achieve maximum growth.

Sod between the rows prevents soil erosion, provides traction for equipment, increases soil organic matter, improves soil structure and water permeability, and furnishes shelter for beneficial insects. The sod should not include plants that are an alternate host for insect pests, or diseases and nematodes that attack the crop. In addition, the sod should be easily maintained, tolerant to drought, require little or no fertilization, and compete minimally with the crop.

Tall fescue or hard fescue perennial grass sods are recommended for vineyard row middles. Both types of fescue are tolerant to disease, drought, low pH and low fertility. They compete effectively with weeds, do not spread or creep into the row by rhizome or stolen growth, and are semi-dormant during the hot dry summer months. Tall fescue is more vigorous and is more easily established, but requires more frequent mowing. Newly developed "turf type" tall fescue varieties are vigorous, and have a lower mowing requirement than the traditional 'Kentucky 31' tall fescue, but have not been evaluated in vineyards. Hard fescue grows more slowly and close to the ground, and has a minimal mowing requirement, but is moderately slow and difficult to establish.

The addition of clover or other legumes is not recommended. Although legumes do fix nitrogen, release for plant use is unpredictable and often at the wrong time of year, which can reduce winter hardiness. Legumes can also be alternate hosts for nematodes and viruses. The use of certain pesticides is excluded by the label when bloom is present in the vineyard.

Preparation for sod establishment should begin before the vineyard is planted. Control perennial weeds and nematodes, correct soil pH and nutrient deficiencies first. Complete primary tillage operations the summer before the vines will be planted. Build gently sloping raised ridges to improve drainage, if needed, in the future rows **before** sowing grass or planting vines. Vineyards planted flat can develop depressions in the row between the strips of sod due to the improving soil structure in the sod compared with the vegetation free strip.

The success of a sod planting will depend on accurate seeding and timing. Sow tall or hard fescue in late-summer into a well-prepared seedbed. Use 50.0 to 75.0 lbs. of seed/broadcast A to establish tall fescue, or 25.0 to 50.0 lbs. of seed/broadcast A to establish hard fescue. Blend up to 5.0 lbs. of perennial ryegrass/100 lbs. of hard fescue seed to provide a fast, thin cover while the hard fescue gets established. The perennial ryegrass will be eliminated from the stand by disease and drought in a few years.

Use a seeder manufactured to sow grass and other similar sized seed that will ensure proper seed placement, a firm seedbed, and good seed and soil contact. Failure to use adequate equipment for seeding frequently results in poor establishment. Seeding should be completed by September first in the northern counties of New Jersey, and by September twentieth in the southern counties. Apply 50 lbs. of nitrogen (N/A at seeding and repeat in late-fall or early-spring to encourage rapid establishment.

Excellent results have been obtained by seeding perennial grass in the future row as well as between the rows. Use perennial ryegrass in the row rather than fescue. Rapid establishment and growth, and susceptibility to herbicides make perennial ryegrass a better choice. Kill the sod in the row before the vines are planted and "no-till" the vines into the dead sod. Use recommended herbicides to control weeds. The sod's roots increase soil organic matter, and improve soil structure and water permeability, and the dead sod acts as a mulch to conserve water and prevent erosion during the establishment year of the vineyard. By fall, the dead sod deteriorates and is not attractive to birds and rodents.

Establishment of a dense sod that is competitive with weeds will require 15 to 20 months. Some additional effort during this period will ensure success. Apply Gallery 75DF plus Prowl H_2O 3.8SC to the sod early each spring while the vineyard is nonbearing, to control large crabgrass and other summer annual grasses. Use 1.0 lb. of Gallery (0.75 lb. of active ingredient) and 1.0 to 2.0 qts. of Prowl H_2O 3.8SC (0.95 to 1.9 lbs. of active ingredient)/A. This is the same rate of Gallery and about half the Prowl rate recommended for use in the row on newly planted vines. Use Dri-Clean, or other labeled formulations of 2,4-D to suppress or control broadleaf weeds in the sod in the late-fall in vineyards that are more than 3 years old. Apply 16.0 to 25.0 dry oz./A.

Warning: Grapes that are not dormant are very sensitive to 2,4-D. Delay application in the fall until the abscission layer has formed at the base of the petioles, and the vines have dropped ALL their leaves and petioles. Do NOT spray vineyards or near vineyards that have not dropped ALL their leaves. Do NOT treat in late-winter (after January 1st), when grapes may have acquired the hours of chilling necessary to break physiological dormancy. Do not allow the spray to contact young trunks that do not have layers of old "dead" bark or trunks that have swollen viable buds. Use waxed cartons or other impermeable shields to protect varieties that require frequent trunk replacement due to cold or other injury.

Mechanical weed control methods include plowing, disking, and harrowing before planting a vineyard and disking, mowing, and hand-weeding after the vines are planted. Many weeds, including established perennials, can be controlled mechanically by starving the roots. The weed begins to send food to the roots 10 to 14 days after the shoot emerges from the soil. Repeated close mowing or shallow cultivation within 7 to 10 days after any new shoots appear can eventually kill the weed. Many repeated cultivations are usually needed. A single late or missed cultivation can "save" the weed. Mechanical weed control has disadvantages. Close cultivation can injure trunks, and cultivating too deep can prune roots. Repeated cultivation can destroy soil structure and reduce the organic matter content.

Chemical weed control has many advantages.

1. It is effective.
2. It is economical.
3. It is safe, when used correctly.
4. It eliminates trunk injury from close cultivation.
5. It eliminates root pruning from cultivating too deep.
6. It reduces rodent injury by eliminating cover near the vine.

HERBICIDES

Residual

Residual herbicides remain in the soil and kill weeds through their roots for up to several months. Application should be made before weeds germinate. Weeds begin to compete with most crops within 2 to 4 weeks after they appear, and some products are effective only on germinating seeds. If weeds are present, a postemergence herbicide should be combined with the residual herbicide. Residual herbicides are applied incorporated or preemergence.

Incorporated

Incorporated herbicides are mechanically mixed with the soil. This application method is NOT well suited to vineyards. It is difficult or impossible to incorporate herbicides near the trunk, and roots may be pruned by the equipment.

Preemergence

These herbicides are applied to the soil surface. Rainfall or overhead irrigation before weeds emerge is usually needed to move the herbicide into the soil and make it available to the weeds. Use a postemergence herbicide if weeds are present or if they emerge soon after a preemergence herbicide is applied, unless the preemergence herbicide will also work on weeds that have emerged.

Postemergence

Postemergence herbicides kill weeds through their leaves rather than through the roots. They can be safely used in vineyards by carefully applying the herbicide to the weeds without allowing it to contact the crop. The herbicide should be applied when weeds are growing rapidly. Do not treat weeds that are dormant or under stress from drought, extreme heat, cold, or other adverse growing conditions. The optimum stage of growth depends on the herbicide used and the weed species. Most herbicides that enter the plant through the leaves need a minimum rain-free period of at least 8 hours after application for maximum effectiveness. Postemergence herbicides may be selective or nonselective, and work only where they contact the plant or translocate throughout the plant.

Selective postemergence herbicides kill only certain weeds. Plants that are not susceptible will not be harmed. Poast and Fusilade DX are examples of selective postemergence herbicides. Poast and Fusilade DX kill only grasses.

Nonselective postemergence herbicides kill or injure any treated plant. They may be *contact* or *translocated*.

Contact herbicides work only where they are placed. Thorough spray coverage is essential for good results. Roots of established perennial weeds often survive.

Translocated herbicides move in the plant after treatment. Application at the proper growth stage will often result in good control of the roots as well as tops of established and perennial weeds. Translocated herbicides work slowly to provide time for movement throughout the plant. Results may not be evident for several weeks.

CAUTION: Strict rate control is necessary.

Improperly applied herbicides or herbicides applied above recommended rates may cause crop damage.

Residual herbicide rates must be matched with soil type and percentage of organic matter to obtain good weed control and crop safety (see Table 8). Adjust by changing tractor speed and maintaining pressure when spraying a vineyard with soil that requires different herbicide rates. Determine type and percentage of organic matter for each soil on the farm with a separate soil test for each soil.

Herbicide application should be accomplished with a "conventional" fixed-boom sprayer calibrated to accurately deliver 20.0 to 60.0 gals. of water/A using flat fan nozzles and 30 to 40 psi, unless otherwise stated. **Herbicide rate recommendations are made on a broadcast basis** (amount of herbicide applied/sprayed A).

Good agitation is needed for uniform distribution of the chemical in the spray solution. It is most important when wettable powders or water dispersible granules/dry flowables are sprayed. Good agitation can be achieved mechanically with paddles or hydraulically with spray material from a bypass line. Do not use the pressure regulator bypass for agitation. If hydraulic agitation is used, be sure the pump has the capacity to spray and agitate at the same time. Tank shape also affects agitation. Corners and edges in tanks increase the agitation requirement. The boom should be modified to reach under the crop canopy. The outside nozzle may be of the offset type to reach into the middle of the row.

Nozzle tips may be made from many materials, including plastic, brass, stainless steel, and tungsten carbide. Plastic and brass tips wear more rapidly and should be replaced annually. Use ONLY stainless steel or tungsten carbide nozzles if wettable powders are used regularly. These products are abrasive and wear other tips too quickly.

Flat fan nozzle tips are designed for herbicide application. Most herbicides should be applied with an 8002 to 8004 nozzle. Larger nozzles deliver too much water to be practical. Smaller nozzles clog easily and produce more "fine" spray particles, which drift easily. Flat fan nozzles have a wide spray angle so the boom can be kept close to the ground to reduce drift. They produce spray droplets that are large enough not to drift easily and small enough to provide good coverage of weeds with postemergence herbicides with little or no run-off. Most herbicides can be applied effectively with flat fan nozzles using between 15.0 and 50.0 gals. of water/A.

Table 6. Crop Safety of Herbicides Used in Grapes

	New	Established
Incorporated (residual)		
Treflan	L	L
Preemergence (residual)		
Chateau	F/G	G
Devrinol	G	G
Gallery	G	–
Goal 2XL	G	G
Karmex/diuron	–	F/G
Matrix FNV	–	G
Norosac/Casoron	L	G
Princep/simazine	–	F/G
Prowl	G	G
Sinbar	–	F
Solicam	F/G	G
Surflan	G	G
Postemergence (selective)		
Dri-Clean	P/G	P/G
Fusilade DX	G	–
Kerb	–	G
Poast	G	G
Select	G	–
Postemergence (nonselective)		
Gramoxone Max	G[1]	G[1]
Glyphosate Products[1]	G[1]	G[1]
Rely 200[1]	G[1]	G[1]

G = Good, F=Fair (use with care), P=Poor (not rec.)
L = Labeled (data insufficient or not recommended)
– = NOT LABELED **(DO NOT USE)**
[1] Do NOT allow spray to contact young or green (living) bark or leaves.

Table 7a. Herbicide Effectiveness on Major Summer Annual Weeds in Grapes.

Herbicide	Barnyardgrass	Crabgrass, large	Fall panicum	Foxtail sp.	Goosegrass	Johnsongrass (seedlings)	Annual Sedge	Carpetweed	Cocklebur, common	Galinsoga, hairy	Jimsonweed	Lambsquarter, common	Morning glory sp.	Nightshade, eastern black	Shepherdspurse	Pigweed sp.	Purslane, common	Ragweed, common	Smartweed, Pennsylvania	Velvetleaf
Preemergence (residual)																				
Chateau	F	F	F	F	–	–	P	G	G	G	G	G	G	G	G	G	G	G	G	G
Devrinol	G	G	G	G	G	G	P/F	G	N	F/P	N	F/G	N	N	–	G	F	P/F	P	N
Gallery	N	N	N	N	N	N	N	F	–	G	G	G	G	G	G	G	G	G	G	G
Goal 2XL/Galigan	F	F	F	F	–	–	P	G	–	G	G	G	G	G	G	G	G	G	G	G
Karmex	G	F/G	G	G	F/G	N	F/G	G	–	G	G	G	G	G	G	G	G	G	F	G
Matrix FNV	G	F	F	G	P	–	G	–	F/G	–	F	F	F	P	G	G	F	P	P/F	F
Norosac/Casoron	F/G	F/G	F/G	F/G	F/G	F/G	G	–	–	–	–	G	–	–	G	G	–	G	–	–
Princep	F	P/F	F	G	F/G	P	F/G	–	F/G	G	G	G	G	G	G	F	G	G	G	–
Prowl	G	G	G	G	G	G	P	G	–	N	N	F/G	P	–	–	F/G	F/G	–	–	F/G
Sinbar	G	G	G	G	G	–	G	G	–	G	G	G	G	G	G	F	G	G	G	G
Solicam	G	G	G	G	G	–	F/G	P	P	–	F	F	–	–	–	F	G	F/G	–	F
Surflan	G	G	G	G	G	G	N	F/G	N	N	N	F/G	N	P	N	F/G	F/G	N	P	P
Postemergence (selective)																				
Fusilade DX	G	F/G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Kerb	G	G	G	G	G	–	N	G	N	P	N	G	–	–	–	G	G	P	–	P
Poast	G	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Select	G	G	G	G	G	G	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Postemergence (nonselective)																				
Paraquat products	F/G	F/G	F/G	G	F/G	–	G	–	G	G	G	F/G	F/G	–	–	G	F/G	G	–	–
Glyphosate products	G	G	G	G	G	G	F	G	G	G	G	G	F	G	G	G	G	F	G	G
Rely 200	G	G	G	G	G	F/G	F/G	G	G	G	G	G	F	F/G	G	G	G	F	G	G

Herbicide performance is affected by weather, soil type, herbicide rate, weed pressure, and other factors. These ratings indicate ONLY relative effectiveness in tests conducted by the University of Maryland and Rutgers, The State University of New Jersey, on coarse- to medium-textured soils. Actual performance may be better or worse than indicated in this table.

G = Good F = Fair P = Poor N = None — = Insufficient data

Table 7b. Herbicide Effectiveness on Major Winter Annual and Perennial Weeds in Grapes.

Herbicide	Annual Bluegrass	Annual Bromegrass	Chickweed sp.	Corn Chamomile	Groundsel	Henbit	Horseweed	Mustard sp.	Bermudagrass	Quackgrass	Yellow Nutsedge	Aster sp.	Bindweed sp.	Canada Thistle	Goldenrod sp.	Hemp Dogbane	Red Sorrel	Mulberry	Poison Ivy	Virginia Creeper
Preemergence (residual)	**Winter Annuals**								**Perennials**											
Chateau	P/F	P/F	G	G	G	G	G	G	N	N	P	P	P	P	P	P	P/F	N	N	N
Devrinol	G	G	F	P	N	P	N	P	N	N	P	N	N	N	N	N	N	N	N	N
Gallery	G	G	G	G	G	G	–	G	N	N	P	P	P	P	P	P	P	N	N	N
Goal 2L|XL/Galigan	P/F	P/F	G	G	G	G	G	G	N	N	P	P	P	P	P	P	P/F	N	N	N
Karmex	G	F	G	G	P	G	G	G	N	P	P	P	P	P	P	P	P	N	N	N
Matrix FNV	G	–	G	–	G	G	P/F	G	P	F	F/G	P	P	P	P	P	P	P	P	P
Norosac/Casoron	F	G	G	G	G	G	G	G	F	F	F/G	F/G	F/G	F/G	F/G	F/G	F/G	P	P	P
Princep	F	F	G	G	P	G	G	G	N	P	P	P	P	P	P	P	P	N	N	N
Prowl	G	G	F	P	N	P	P	P	N	P	P	N	N	N	N	N	N	N	N	N
Solicam	G	G	F	F	P	F	P/F	F	P	F	F	P	P	P	P	P	P	P	P	P
Sinbar	F/G	F/G	G	G	P	G	G	G	N	P	P	P	P	P	P	P	P	N	N	N
Surflan	G	G	F	P	N	P	P	P	N	P	P	N	N	N	N	N	N	N	N	N
Velpar	G	G	G	G	–	G	F/G	G	P	F	F	F/G	F	F	F	F	F	P	P	P
Postemergence (selective)																				
Fusilade DX	P	G	N	N	N	N	N	N	G	G	N	N	N	N	N	N	N	N	N	N
Kerb	G	G	N	N	N	N	N	N	P	G	N	N	N	N	N	N	N	N	N	N
Poast	P	G	N	N	N	N	N	N	G	G	N	N	N	N	N	N	N	N	N	N
Select	G	G	N	N	N	N	N	N	G	G	N	N	N	N	N	N	N	N	N	N
Postemergence (nonselective)																				
Paraquat products	G	G	G	G	F	G	F	G	P	P	P	P	P	P	P	P	P	P	P	P
Glyphosate products	G	G	G	G	G	G	P/G	G	F	G	G	G	G	G	G	G	G	G	G	G
Rely 200	G	G	G	G	G	G	G	G	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P	P	P

Herbicide performance is affected by weather, soil type, herbicide rate, weed pressure, and other factors. These ratings indicate ONLY relative effectiveness in tests conducted by the University of Maryland and Rutgers, The State University of New Jersey, on coarse- to medium-textured soils. Actual performance may be better or worse than indicated in this table.

G = Good F = Fair P = Poor N = None — = Insufficient data

Table 8. Recommended Preemergence Herbicide Rates (in Active Ingredients) for Common Vineyard Soil Types.

Soil Type	Sand		Loamy Sand		Sandy Loam			Loam		Silt Loam		Clay Loam	
	0.0-1.0	1.0-2.0	0.0-1.0	1.0-2.0	0.0-1.0	1.0-2.0	2.0-4.0	1.0-2.0	2.0-4.0	1.0-2.0	2.0-4.0	1.0-2.0	2.0-4.0
Chateau	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38	0.19-0.38
Devrinol[1]	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4 .0	2.0-4.0
Gallery	0.75	0.75	0.75	0.75	0.75	0.75	1.0	0.75	1.0	1.0	1.0	1.0	1.0
Goal 2XL/Galigan 2E	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Karmex[2]	—	—	—	—	—	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0
Kerb	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.5	3.0	3.0	3.5	3.5	4.0
Matrix FNV	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
Norosac/Casoron	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6 .0	4.0-6.0	4.0-6.0	4.0-6.0	4.0-6.0
Princep[2]	—	—	—	—	—	2.0	2.0	2.0	3.0	2.0	3.0	3.0	4.0
Prowl	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0	2.0-6.0
Sinbar[2]	—	—	—	—	—	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0
Solicam	—	—	—	2.0	—	2.0	2.5	2.5	2.5	2.5	3.0	3.0	4.0
Surflan[1]	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0

[1] **Use the lower recommended rate when tank-mixing with another preemergence herbicide, unless annual grass pressure is severe.**
[2] **Use one-half the recommended rate when tank-mixing with another preemergence herbicide.**
— = NOT LABELED (DO NOT USE).

Flood jet nozzle tips are economical to use but do not provide the uniform coverage obtained with flat fan nozzles. They are suitable for applying preplant incorporated and preemergence herbicides, but are less suited for postemergence herbicide application. The droplets produced by flood jet nozzles are too large to wet existing weed foliage uniformly without dripping or run-off.

Postemergence herbicide results, using flood jet nozzle tips, can be improved and may be acceptable by using the following procedures to improve spray coverage:

1. Reduce the distance between nozzles on the boom by one-half. For example, space the flood jet nozzles 20 inches apart instead of the standard 40-inch spacing. This will result in an overlapping spray pattern, wetting both sides of a weed.
2. Spray at the maximum recommended pressure for the flood jet nozzles being used.
3. Increase the amount of water sprayed/A. Use 40.0 to 60.0 gals./A.

VINEYARD HERBICIDE RECOMMENDATIONS

A good vineyard floor management program eliminates and prevents the reestablishment of undesirable vegetation. Weeds compete with the vines for water, nutrients, and light; increase foliage wetting periods by reducing air flow, serve as alternate hosts for diseases and harmful insects; harbor birds and rodents; and impede harvest. Herbicides used to control weeds must have a good margin of crop safety to minimize the risk to the vine.

Choose herbicides for use in the row that are labeled, have adequate crop safety (Table 6), and control the weed species in your vineyard (Table 6). Use the correct amount of residual herbicides for each soil type (Table 8). The use of a single herbicide repeatedly will lead to an increase in resistant weeds or weed species. The use of herbicide combinations, herbicide rotations, and sequential or spot treatments in a well-managed weed control program will eliminate or minimize problems. The recommended herbicides have been evaluated for crop safety and effectiveness. Information on all varieties is incomplete. Use herbicides with care on new varieties.

Weeds can be classified by their life cycle. **Annual weeds** live less than 1 year. **Summer annual weeds** germinate in the spring or early-summer, grow, flower, produce seed, and die in the fall. **Winter annual weeds** germinate in late-summer or in the fall, grow vegetatively through the fall, overwinter, flower, produce seed, and die in the spring. **Biennial weeds** live more than one year but less than 2 years, produce seed, and die. **Perennial weeds** live more than 2 years. They often reproduce vegetatively, as well as by seed, and are much more difficult to control. Consider summer annuals, winter annuals and biennials, and perennial weeds separately when planning a control program.

"IN-ROW" WEED CONTROL

New Plantings
Weed control in a newly planted vineyard should be planned to provide a maximum margin of crop safety. Tillage and/or herbicides prior to planting should control established biennial and perennial weeds. Apply a combination of herbicides to control annual grasses and broadleaf weeds. Apply in early-spring after 1 to 2 inches of rainfall or irrigation has settled the soil around the roots of the newly planted vines, but before weeds emerge or the vines' buds break. "Grow tubes" or waxed paper cartons are effective and recommended shields, and add an additional margin of safety when installed prior to herbicide application.

Established Vineyards
Apply herbicides to the crop row in established vineyards twice annually, in late-fall and in the spring. Herbicides applied in late-November or early-December control winter annuals, certain perennials, and early-season summer annuals. Spring herbicide applications extend summer annual weed control through harvest. Advantages of 2 herbicide applications/year include:

1. Control of winter annual weeds, including camphorweed, wild lettuce and horseweed (marestail) and summer annual weed control for the same cost as most single application weed control programs.
2. Improved spring labor and equipment distribution requirements by controlling early-summer annual weeds with residual herbicides applied the previous fall, thus delaying the need to spray until later in the spring.
3. Increased consistency of weed control treatments, especially control of summer annual weeds when dry weather follows the spring herbicide application.
4. Decreased risk of crop injury, since each herbicide application must last less than a full year. Herbicides can be alternated and rates can be reduced or split to improve crop safety.
5. Decreased competition from established winter annual weeds and summer annual weed seedlings in March, April, and May for fertilizer and water when the crop begin to grow.

Late-Fall Herbicide Applications should all include a residual broadleaf herbicide. Use Casoron to control annual and to suppress or control susceptible perennial weeds. Casoron is more costly than other broadleaf weed herbicides, but can provide very effective control.

The use of Princep or Karmex is less costly, and will provide good annual broadleaf weed control. Use Princep in vineyards that are not irrigated or are watered with overhead irrigation, and rotate to Karmex in the spring. If trickle irrigation is used, apply Karmex in the fall, and use Princep in the spring. Small seedling annual broadleaf weeds will be controlled by the residual herbicide, but if well established annuals are present, add a postemergence herbicide such as Gramoxone to the tank. Consider spot treating with a labeled glyphosate product if perennial weeds are present and treatment is recommended in the fall.

The use of a grass herbicide in the fall depends on the product chosen. Kerb 50WP is the only grass herbicide that must be applied in the fall, if it is used, to control cool season perennial grasses. An additional residual annual grass herbicide is needed in the spring to provide full season summer annual grass control following a fall application of Kerb 50WP.

Solicam 90DF, Surflan 80WP, Devrinol 50WP and Prowl H_2O are annual grass herbicides that should be applied in late-fall or as a split application, half in the fall and the second half in the spring. Use the split application when grass pressure is heavy for best results. The use of these herbicides in spring only has resulted in inconsistent weed control when dry weather followed the application. Sinbar 80DF applications for annual grass control should be applied only in late-spring. The relatively high solubility of Sinbar 80DF results in leaching when applied in the fall. Increased risk of crop injury and poor weed control can result.

Follow-up Late-Spring Applications should include a residual annual grass herbicide, and a different residual broadleaf weed herbicide, unless Casoron was applied in late-fall. No additional annual broadleaf weed herbicide is needed in the spring, if the full labeled and recommended rate of Casoron was applied in late-fall. Add a postemergence herbicide only if needed.

Use Karmex 80DF for residual broadleaf weed control if Princep was used in the fall, or use Princep if Karmex 80DF was used in the fall. Switch to Chateau in vineyards where the annual broadleaf weed control obtained with Karmex and Princep has become less effective.

Also apply a residual annual grass herbicide or the second half of a split herbicide treatment of Solicam 80DF, Surflan 4AS, Devrinol 50DF or Prowl H_2O for annual grass control. Include Gramoxone if seedling annual weeds are observed. Spot treat with a labeled glyphosate product to control established perennial grasses and broadleaf weeds. Sinbar 80DF is also effective for seedling weed control postemergence. No other postemergence herbicide may be needed if no established weeds are present and seedling annual weeds are sprayed with Sinbar 80DF before they exceed 1 inch in height.

INFLUENCE OF SOIL AND WATER (RAINFALL & IRRIGATION) ON HERBICIDES

Weed control programs rely on nonresidual postemergence (knockdown) herbicides, and residual preemergence herbicides to control weeds. Applications are typically sprayed in vineyards once a year in early-spring, or twice a year, in late-fall and later in the spring. Residual herbicides applied at these times are relied on to control weeds through the summer months and harvest.

After application to the soil surface, most residual herbicides must be moved into the soil by rainfall or overhead irrigation to be effective. The amount of rain or overhead irrigation needed depends on weeds targeted, soil properties, and the chemical properties of the herbicide.

Weeds Targeted: Many weeds, such as pigweed species, produce huge numbers of tiny seeds. Small seeds must germinate at or very near the surface of the soil. Other weeds, such as morningglory seeds or yellow nutsedge tubers, can germinate or sprout from several inches deep. Early in the season, herbicides must be moved further into the soil to control weeds that germinate or sprout from deeper in the soil. Later in the season, shallow germinating weeds may become established and escape control if the herbicide has moved too deep into the soil to be available during weed emergence and establishment.

Soil Properties: Soil can have a strong influence on weed growth and residual herbicide effectiveness. The soil characteristics that influence herbicide effectiveness include texture, percent organic matter and pH. Soil maps list soil texture and standard soil tests use the "feel" method and may be inaccurate. A mechanical analysis of your soil will determine the amounts of sand, silt and clay in the mineral portion of the soil. Have soil texture determined by mechanical analysis 1 time. The texture will not change unless soil is lost by erosion or other means. Sand particles are the largest, silt is medium in size, and clay particles are the smallest. Soils with a large percentage of large sand particles are considered to be coarse in texture and are called sand, loamy sand, or sandy loam. Soils with a moderate amount of each size soil particle are considered to be medium in texture, and are called loam, or silt loam. Soils with a large percentage of small clay particles are considered to be fine in texture and are called silty clay loam, clay loam, or clay.

Soil particles are negatively (-) charged. The negative charge of soil particles attracts positively (+) charged fertilizer molecules such as $H_2PO_4^+$, K^+, Ca^{++}, Mg^{++} and many herbicides. The attraction of the positive charge to the negative charge of the soil particles slows leaching. Other fertilizer molecules, such as NO_3^- and a few herbicides, have a negative charge. Since like charges repel each other, negatively (-) charged molecules are not bound to the soil and are more subject to leaching, especially if they are highly soluble in water. Since substances that are positively (+) charged are called cations, the measure of a soil's ability to hold onto cations is called the **Cation Exchange Capacity** or **CEC**. Sand is the largest particle in size and has the lowest **CEC** value, less than 1. Silt is intermediate in size and has an intermediate **CEC** value, near 5. Clays are the smallest soil particles and have the highest **CEC** value of the mineral component of soil, near 35, depending on the type of clay.

Organic matter makes up only a small part of most soils, usually between 0.5 and 5.0% in soils across the northeastern United States, but it has the highest **CEC** value, near 200. Even small changes in the percent organic matter in soils, especially sandy soils, can have a strong influence on herbicide performance. That is the reason small changes in percent organic matter may require herbicide rate changes. Rate tables may have several columns with different herbicide rates for different levels of organic matter in each soil type.

Soil pH also affects the performance of some herbicides by influencing the degree of attraction to soil particles. Recommended soil pH levels for many crops range between 6.0 and 7.0. Low pH, below 6.0, or high pH, above 7.0, may affect the availability of certain herbicides by changing the positive (+) charge of the molecule. Weed control may be reduced and/or herbicide carryover may be increased if the herbicide is more tightly bound to the soil than at "recommended" pH levels. The risk of crop injury may increase if a herbicide is less tightly bound to the soil, and more available, than at "recommended" pH levels. Herbicides that are affected by pH may have **DO NOT USE** warnings on the label if the soil pH is above or below a value that increases the risk of crop injury, herbicide carryover, or poor weed control.

Chemical Properties of the Herbicide: The solubility, or the ease with which a herbicide dissolves in water affects the rate of movement through the soil (Table 9). A herbicide that is more soluble in water may be "activated" by less rainfall or irrigation, but may not provide the length of control that could be obtained with a less soluble herbicide, especially in a coarse-textured soil low in organic matter.

In addition, most residual herbicides can become bound to soil particles. When attached, or bound to the soil, these individual molecules of herbicide are not available to the weeds or the crop.

Herbicides can be held onto by the soil to varying degrees (Table 10). The degree of binding is influenced by the chemistry of the herbicide and the **Cation Exchange Capacity (CEC)** of the soil. Lower herbicide rates are needed to prevent crop damage in soils with a low **CEC**. Plant nutrients, such as NO_3^-, and herbicides with a negative (-) charge are not held by the soil, leach rapidly in all soils, and are less affected by soil texture than those with a positive (+) charge.

Table 9. Residual Herbicide Water Solubility and Soil Adsorption Characteristics.

Herbicide	Solubility	Soil Adsorption
Chateau (flumioxazin)	Very Low	Not Available
Devrinol (napropamide)	Moderate	Strong
Gallery (isoxabin)	Very Low	Strong
Goal 2XL/Galigan 2E (oxyflurorfen)	Very Low	Strong
Karmex (diuron)	Low	Strong
Kerb (pronamide)	Low to Moderate	Strong
Matrix FNV (rimsulfuron)	Low	Not Available
Norosac/Casoron (dichlobenil)	Low	Moderate
Princep (simazine)	Very Low	Moderate
Prowl (pendimethalin)	Very Low	Strong
Sinbar (terbacil)	Moderate	Weak
Solicam (norflurazon)	Low to Moderate	Strong
Surflan (oryzalin)	Very Low	Strong

Nonresidual postemergence herbicides have no activity after application for 1 of 2 reasons (Table 10). Some herbicides are too tightly bound to the soil to be available to plants after application. Care must be exercised in soil-less growing environments, where surprising residual activity can be observed from these herbicides. Other herbicides are highly soluble in water and are not bound to soil particles. Residual activity from these herbicides can be observed in the soil, but it often lasts only a few days. They are rapidly degraded and/or leached out of the zone of weed seed germination.

Glyphosate, including Roundup products, Touchdown products, Glyphomax Plus and OLF (other labeled formulations) and Gramoxone products (paraquat), are too tightly bound to the soil to have residual activity. These herbicides are completely unavailable to plants after application. They remain tightly bound to the soil until broken down. Glyphosate can be degraded or digested by soil microorganisms. Residual activity from glyphosate has been observed when used in greenhouses, on plastic mulch, and near hydroponic growing systems. Gramoxone Max (paraquat) is degraded by sunlight, and is less likely to cause problems when used on plastic mulch, in greenhouses, or near soil-less growing systems.

2,4-D amine is highly soluble in water and has a negative (-) rather than a positive (+) charge, which is repelled by the soil particles. This herbicide is not bound tightly to the soil. It is available for chemical or biological degradation and is subject to leaching. Disappearance of 2,4-D amine in the soil environment is rapid. Residual activity in the soil can be observed, but it often lasts only a few days to a week.

Table 10. Nonresidual Herbicide Solubility and Soil Adsorption Characteristics.

Herbicide	Solubility	Soil Adsorption
2,4-D amine	Very High	Very Weak
Fusilade (fluazifop butyl)	Very Low	Very Strong
Gramoxone (paraquat)	Very High	Very Strong
Poast (sethoxydim)	Moderate to Very High[1]	Moderate
Select (clethodum)	NA	Weak
Glyphosate Products	Very High	Very Strong
Rely 200	Very High	Weak

[1] pH dependent

TRICKLE IRRIGATION

Efficiency, water conservation, and disease control are reasons to consider trickle irrigation in vineyards. The crop can be irrigated using less water provided by a smaller pump delivered at lower pressure than with traditional overhead sprinkler systems. In addition, evaporation losses are lower. Since trickle lines and micro-sprinklers operate under the crop, the fruit and foliage remain dry, reducing the incidence of many diseases. **Unfortunately, improved weed control is NOT a benefit of trickle irrigation. Expect higher herbicide and application costs, and less effective and less consistent weed control in trickle irrigated vineyards.**

No herbicide, not even the least soluble in water and most tightly bound to the soil, can withstand leaching from the volume of water that flows from an emitter hole in trickle irrigation tubing. Herbicide failure can be first observed in fields under trickle irrigation by small tufts of weeds growing at each emitter. As the season progresses, the weeds grow more readily, and the spot enlarges as a wider area is leached free of herbicide. Although the irrigation prevents the crop from water stress, weeds can be fierce competitors for nutrients and sunlight, and can interfere with harvest. In vegetable production, the increased weed pressure and interference with cultivation observed has restricted trickle irrigation to use with plastic mulch for weed control.

Modifications to the trickle irrigation system can moderate the weed control problem. Any change in the system that reduces the volume of water applied at a point source will reduce herbicide leaching. Unfortunately, reducing the distance between the holes in traditional trickle tubing or suspending the tubing from a trellis wire to increase distribution by splashing is not likely to eliminate the weed problem. Burying the tubing more than 4 inches deep will effectively reduce the adverse affects on residual herbicides, since their effectiveness is usually confined to the upper 2 to 4 inches of soil. Switching from trickle tubing that drips, to micro-sprinklers in crops where they can be used also effectively reduces the adverse affects of the irrigation on weed control.

When trickle irrigation will be used, choose herbicides for the residual herbicide weed control program during the irrigation season that are least soluble in water and most tightly adsorbed by the soil (Table 9). These include Prowl and Surflan for annual grasses, and Princep, Karmex, or Chateau for annual broadleaf weeds.

On coarse-textured sandy soils low in organic matter, Prowl (pendimethalin) and Princep (simazine) for annual grass and annual broadleaf weed control respectively, are the best choices, based on very low water solubility of both herbicides. On fine-textured soils and soils higher in organic matter, Prowl (pendimethalin) and Karmex (diuron) for annual grass and annual broadleaf weed control respectively, are the best choices, based on coast and their very low and low water solubility and strong adsorption to the soil. Switch to Chateau where the summer annual broadleaf weed control obtained with Karmex and Princep throughout the vineyard has become less effective.

Unfortunately, certain weeds, including yellow nutsedge, escape this herbicide combination. Adjust the application timing in the spring so the herbicides can be "activated" by 1 to 2 inches of rainfall or overhead irrigation before the trickle irrigation is used. This will allow the herbicides to move into and be attached to the soil before being subjected to the intense leaching of the trickle irrigation. Remember that choosing the herbicide(s) that are least soluble in water and most strongly adsorbed to the soil will delay, but not prevent, herbicide failure and weed breakthroughs in trickle irrigated crops. Coarse-textured sandy soils and soils low in organic matter that require frequent irrigation, increase the likelihood of weed control failure, especially during prolonged periods of heat and drought stress. Plan to use repeated applications of nonresidual postemergence herbicides on a regular schedule, every 2 to 4 weeks during the growing season to control weeds in trickle irrigated crops. Time the application of residual herbicides to derive the maximum benefit from their use when harvest approaches and preharvest interval (PHI) restrictions will not permit the continued use of the nonresidual postemergence herbicides.

VINEYARD SOD WEED CONTROL

Broadleaf weeds are undesirable in a vineyard sod growing between the rows. Competition with the crop and mowing requirements may be increased. Many weeds are alternate hosts for diseases, insects, and nematode pests. The flowers of dandelion, clover, mustard species and other weeds coincide with bloom and are preferred by pollinating insects. The same weeds, and others, may also bloom before or after the vines bloom and attract bees into the vineyard when insecticides must be sprayed. The seedheads of dandelion clog tractor radiators and delay other vineyard maintenance operations.

Clover is difficult to control, but can be suppressed or controlled in an vineyard sod with good management practices and herbicides. Manage fertilizer applications to favor grass rather than the clover. Nitrogen fertilizer stimulates grass growth, and phosphorus and potassium stimulate clover growth in a mixed grass and legume sod. Do not apply fertilizer containing phosphorous or potassium to sod if clover control is a problem. Rather apply fertilizer for vine growth in the vegetation free strip. Mowing height also influences the composition of a mixed grass and clover sod. Close mowing favors the clover. Taller sod will favor the grass. Mow no closer than 4 inches if clover control is a problem in the sod.

Use Dri-Clean, or other labeled formulations of 2,4-D to suppress or control broadleaf weeds in the sod in the late-fall in vineyards that are more than 3 years old. Apply 16.0 to 25.0 dry oz./A. Warning: Grapes that are not dormant are very sensitive to 2,4-D. Delay application in the fall until the abscission layer has formed at the base of the petioles, and the vines have dropped ALL their leaves and petioles. Do NOT spray vineyards or near vineyards that have not dropped ALL their leaves. Do NOT treat in late-winter (after January 1st), when grapes may have acquired the hours of chilling necessary to break physiological dormancy. Do not allow the spray to contact young trunks that do not have layers of old "dead" bark or trunks that have swollen viable buds. Use waxed carton shields to protect varieties that require frequent trunk replacement due to cold or other injury.

PREEMERGENCE HERBICIDES

(before weeds appear)

Chateau (flumioxazin) – 0.188 - 0.375 lb. ai (active ingredient)/A. Apply in late fall or spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Primarily for annual broadleaf weed control. Chateau will suppress annual grasses, but may not provide full season control. Tank-mix with Prowl, Surflan, Solicam, or Devrinol to improve the control of annual grasses.

WARNINGS:

A maximum Chateau of 0.188 lb. ai/A (6.0 oz./A)/application should be used on any soil that has a sand plus gravel content of over 80% if the vines are less than 3 years old.

Do NOT apply to grapes established less than 2 years unless they are trellised at least 3 feet from the soil surface or are protected by nonporous wraps, grow tubes, or waxed containers.

Do NOT apply after flowering unless hooded or shielded application equipment is used and the applicator can ensure that spray drift will not contact the crop's fruit or foliage.

Do NOT apply to grapes that are not trellised or staked unless they are free standing.

Do NOT make a sequential application within 30 days of the first application.

Do NOT apply within 60 days of harvest.

For newly planted (nonbearing) vineyards.

For established (bearing) vineyards.

Devrinol (napropamide) – 2.0-4.0 lbs. ai (active ingredient)/A. Use 4.0-8.0 lbs./A Devrinol 50DF. Apply in late-fall and/or early-spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Use the high rate for long-term control (4 to 8 months) and the low rate for short-term control (2 to 4 months). Devrinol controls primarily annual grasses. Tank-mix with Princep plus a postemergence herbicide in late fall or with Goal 2XL/Galigan 2E or reduced rates of Princep, Karmex, or Sinbar in the spring when labeled for the crop to control annual broadleaf weeds.

For newly planted (nonbearing) vineyards.

For established (bearing) vineyards.

Gallery 75DF (isoxabin) – 0.75–1.0 lb. ai/A. Use 1.0 to 1.33 lbs./A Gallery 75DF. Apply in late-fall or early-spring to weed-free soil to control many broadleaf weeds. In newly planted vineyards, allow the soil to settle and fill any depressions around the vines before application. Add a postemergence herbicide to improve the control of emerged weeds. Gallery primarily controls annual broadleaf weeds. Tank-mix with Prowl to control annual grasses.

For newly planted (nonbearing) vineyards.

CAUTION: NOT labeled for BEARING VINEYARDS.

Goal 2XL/Galigan 2E (oxyfluorfen) – 2.0 lbs. ai/A. Use 4.0 qts./A Goal 2XL or Galigan 2E. Apply in early-spring before bloom. Add an appropriate postemergence herbicide to kill existing vegetation. Goal 2XL/Galigan 2E controls annual broadleaf weeds and suppresses annual grasses. Tank-mix with Prowl, Devrinol, or Surflan to improve length of annual grass control. Do NOT incorporate Goal 2XL/Galigan 2E into the soil with a disk or other implement, or reduced weed control may result.

For newly planted (nonbearing) vineyards.

For established (bearing) vineyards.

Karmex (diuron) – 1.0-3.0 lbs. ai/A. Use 1.25-3.75 lbs./A Karmex 80DF. Apply in late fall or spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Primarily for annual broadleaf weed control. Tank-mix with Prowl, Surflan, Solicam, Devrinol, or a reduced rate of Sinbar at one-half the labeled Karmex use rate alone for the soil type to improve crop safety and the range of weeds controlled. Apply to grapes established a minimum of 3 years.

For established (bearing) vineyards.

Matrix FNV (rimsulfuron) – 0.031-0.062 lb. ai/A. Use 4.0 dry oz. of Matrix FNV/A in a single application or split the application and apply 2.0 dry oz. 2 times. Apply in the spring, or split the application and apply Matrix FNV in late fall or the spring and repeat in early-summer. Matrix FNV controls many annual grasses and broadleaf weeds, and will suppress or control yellow nutsedge. Always add nonionic surfactant to be 0.25% of the spray solution, and always maintain the spray solution at a pH between 4.0 and 8.0. Matrix FNV is a group 2 herbicide with a single site of action in susceptible weeds, which makes it a high risk for weed resistance development. Tank-mix or use Matrix FNV in combination with other herbicides with a different mode of action in your annual weed control program.

For established (bearing) vineyards.

Norosac/Casoron (dichlobenil) – 4.0-6.0 lbs. ai/A. Use 100-150 lbs./A Norosac/Casoron 4G or 2.8 gals. of Casoron CS/A. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15th, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50° F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) vineyards.

Princep (simazine) – 2.0-4.0 lbs. ai/A. Use 2.2-4.4 lbs./A Princep 90DF (or other labeled formulations). Apply in late fall OR spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Primarily for annual broadleaf weed control. Tank-mix with Prowl, Surflan, Solicam, or Devrinol at one-half the labeled Princep use rate alone for the soil type to improve crop safety and the range of weeds controlled. Apply to grapes established a minimum of 1 year.

For established (bearing) vineyards.

Prowl (pendimethalin) – 1.9-5.8 lbs. ai/A. Use 2.0-4.0 qts./A Prowl H_2O in nonbearing grapes and 3.0-6.0 qts./A Prowl H_2O in bearing grapes. Apply in late-fall and/or early-spring before bud swell to weed-free soil or add a postemergence herbicide to control emerged weeds. Use the high rate for long-term control (4 to 8 months) and the low rate for short-term control (2 to 4 months). Prowl controls primarily annual grasses. Tank-mix with Princep in late fall or with Goal 2XL/Galigan 2E, Karmex, or Sinbar in the spring to control annual broadleaf weeds.

For newly planted (nonbearing) vineyards.
For established (bearing) vineyards.

Sinbar (terbacil) – 1.0-3.0 lbs. ai/A. Use 1.25-3.75 lbs./A Sinbar 80DF. Apply in the spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Tank-mix with Surflan, Devrinol, or a reduced rate of Karmex at one-half the labeled Sinbar use rate alone for the soil type to improve crop safety and the range of weeds controlled. Apply to vines established a minimum of 3 years.

For established (bearing) vineyards.

Solicam (norflurazon) – 2.0-4.0 lbs. ai/A. Use 2.5-5.0 lbs./A Solicam 80DF. Apply in late-fall or spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Primarily for annual grass control, Solicam may provide partial control of many broadleaf weeds. Tank-mix with Princep plus a postemergence herbicide in late fall, or with Goal 2XL/Galigan 2E, Karmex, or Sinbar in the spring, when labeled for the crop, to improve the control of broadleaf weeds.

For newly planted (nonbearing) vineyards.

For established (bearing) vineyards.

Surflan (oryzalin) – 2.0-4.0 lbs. ai/A. Use 2.0-4.0 qts./A Surflan 4AS (or other labeled formulations). Apply in late-fall and/or early-spring to weed-free soil, or add an appropriate postemergence herbicide to kill existing vegetation. Use the high rate for long-term control (4 to 8 months) and the low rate for short-term control (2 to 4 months). Surflan controls primarily annual grasses. Tank-mix with Princep plus a postemergence herbicide in late fall or with Goal 2XL/Galigan 2E, Karmex, or Sinbar in the spring when labeled for the crop to control annual broadleaf weeds.

For newly planted (nonbearing) vineyards.

For established (bearing) vineyards.

POSTEMERGENCE HERBICIDES

Selective

Dri-Clean 80.5% Acid equivalent (2,4-D) 0.9-1.25 lbs. ae (acid equivalent)/A. Use 16.0 to 25.0 dry oz./A Dri-Clean Herbicide (or other labeled formulations). Apply in the late fall when grapes in the treated and in adjacent vineyards are dormant and have dropped all their leaves to control winter annual and certain perennial broadleaf weeds. Spray under the trellis to control target weeds in the row, or between the rows to control weeds in sod drive rows. Use a shielded directed low pressure spray to ensure the grape vines are not hit by the spray or drift. Treated grapes must be established at least 3 years.

Warning: Grapes that are not dormant are extremely sensitive to 2,4-D. Delay application in the fall until the abscission layer has formed at the base of the petioles, and the vines have dropped ALL their leaves and petioles. Do NOT spray vineyards or near vineyards that have not dropped ALL their leaves. Do NOT treat in late winter (after January 1st), when grapes may have acquired the hours of chilling necessary to break physiological dormancy. Do not allow the spray to contact young trunks that do not have layers of old "dead" bark or trunks that have swollen viable buds. Use waxed carton shields to protect varieties that require frequent trunk replacement due to cold or other injury.

For dormant established (bearing) vineyards.

Fusilade DX 2EC (fluazifop butyl) – 0.18-0.38 lb. ai/A. Use 12.0-24.0 fl. oz./A Fusilade DX 2EC. Add 2.0 pts. crop oil concentrate or nonionic surfactant to be 0.25% of the spray solution (1.0 qt./100 gals. of spray solution.). Use the lower rate on most annual grasses less than 6 inches tall and to johnsongrass. Use the higher rate to control other perennial grasses, crabgrass, and annual grasses more than 6 inches tall.

WARNINGS:

1. Do NOT tank-mix Fusilade DX 2EC with any other pesticide.
2. Do NOT apply within 1 hour of rainfall.
3. Do NOT apply to grasses suffering from drought, heat, cold, or any other stress condition.

For newly planted (nonbearing) vineyards.

For established (bearing) vineyards.

Kerb (pronamide) – 2.0-4.0 lbs. ai/A. Use 4.0-8.0 lbs./A Kerb 50WP. Apply in November when soil temperatures are between 35° and 55° F (1.67° and 12.8° C). Spring transplanted grapes should be at least 6 months in the field, and fall transplanted grapes should be in the field for 12 months prior to treatment. Primarily controls perennial grasses, including quackgrass, bluegrass, ryegrass sp., fescue sp., and also provides early control of annual grasses the following spring.

Apply Surflan, Prowl, Solicam, or Sinbar the following May or June for full season annual grass control. Tank-mix Kerb with 2,4-D and Princep for postemergence and residual broadleaf weed control.

For established (bearing) vineyards.

Poast (sethoxydim) – 0.2-0.5 lb. ai/A. Apply 1.0-2.5 pts./A Poast 1.53EC. Add 2.0 pts. crop oil concentrate/A. Use the lower rate to control annual grasses less than 6 inches tall. Use the higher rate to control annual grass 6 to 12 inches tall and to control perennial grasses.

WARNINGS:

1. Do NOT tank-mix Poast with any other pesticide.
2. Do NOT apply within 1 hour of rainfall.
3. Do NOT apply to grasses suffering from drought, heat, cold, or any other stress condition.

For newly planted (nonbearing) vineyards.

For established (bearing) vineyards.

Select (clethodim) – 0.125-0.25 lb. ai/A. Apply 8.0 to 16.0 fl. oz. of Select 2EC/A or 16.0 to 32.0 fl. oz. of SelectMax 0.97EC to control most grass weed species, including certain hard to control grass weeds, such as small grain volunteers and cover crops, and perennials such as hard fescue, tall fescue, Bermudagrass, orchardgrass, quackgrass, Johnsongrass, and wirestem muhly. Use the lower rate to control annual grasses and the perennial grasses listed above. Repeat the application if regrowth occurs. Always add oil concentrate to be 1% of the spray solution, or a minimum of 1.0 pt./A to Select 2EC. Always add nonionic surfactant to be 0.25% of the spray solution to SelectMax 0.97EC.

WARNINGS:

1. Do NOT tank-mix with any other pesticide unless labeled.
2. Do NOT apply within 1 hour of rainfall.
3. Do NOT apply to grasses suffering from drought, heat, cold, or any other stress condition.
4. Select is currently LABELED for NONBEARING VINEYARDS only! Do NOT apply within 12 months of harvest.

For newly planted (nonbearing) vineyards.

Nonselective

Gramoxone SL2.0 (paraquat) – 0.6-1.0 lb. ai/A. Use 2.4-4.0 pts./A Gramoxone SL2.0 or other labeled formulations. Contact killer only; with no translocation or residual activity. Best results occur when weeds are 6 inches tall or less. Regrowth may occur from the root systems of established weeds. Use a surfactant to be 0.25% of the spray solution (1.0 qt./100 gals. of spray solution). Combine with recommended preemergence herbicide(s) for residual weed control. Do not allow spray or drift to contact green bark, leaves, or fruit. Crop damage may result. The use of shields, such as grow tubes or paper milk cartons greatly reduces the risk of injury in young vineyards. **DANGER: Do not breathe spray mist. Read safety precautions on the label.**

For newly planted (nonbearing) vineyards.

For established (bearing) vineyards.

Glyphosate products (Roundup products, Touchdown products, Glyphomax Plus and OLF) will control many serious annual and perennial weeds in vineyards. It is a translocated, slow-acting herbicide with no soil or residual activity. Results will become evident 1 to 3 weeks after application. Optimum rate and time of application depend on weed species and growth stage. Weeds should be growing vigorously when treated. Do not treat weeds that are under stress from drought, extreme heat, cold, or other adverse growing conditions.

Broadcast: 0.56-3.0 lb. ae (acid equivalent)/A. See your product's label for the rate per acre. Apply lower rates to control seedlings and annual weeds and to suppress established perennial weeds. Use shields and do not allow glyphosate to contact the foliage or green vines. See warnings below.

Spot Treatment: See your product's label for rate. Wet weed foliage thoroughly. See warnings below.

Ropewick Applicator: See your product's label for rate (water to product mixing ratio). Fill pipe only one-half full to prevent excessive dripping. One gallon of glyphosate will wipe 10 to 100 acres, depending on weed density. Repeated wiping may be needed to provide control equal to broadcast or spot applications. The Ropewick applicator offers significant herbicide cost savings. See factsheet FS017 on Ropewick applicator construction and use warnings below.

"Cut Stump" Treatment: See your product's label for rate. Apply to the cambium (inner bark area) of the stump of woody plants IMMEDIATELY after cutting. Cut and treat stumps only when the target is actively growing and not under stress. Best results are often obtained in late-summer and early-fall, but before fall color is observed in the foliage. Warning: Injury due to root grafting may occur in adjacent plants. Do not treat cut stumps if there is a possibility of root grafting to desirable vegetation.

WARNINGS:

1. Do NOT allow Glyphosate to contact the leaves, young green bark, fresh trunk wounds, or root suckers, or severe crop injury may occur.
2. Do NOT allow Glyphosate to contact ANY IMMATURE PART of grape vine.
3. Do NOT use GALVANIZED containers. Glyphosate may react with the container to produce explosive hydrogen gas.

For newly planted (nonbearing) vineyards.

For established (bearing) vineyards.

Rely 200 (glufosinate) – 1.0-1.5 lbs. ai/A. Use 5.0 to 7.0 pts./A as a banded or broadcast spray, or 2.4 fl. oz./gal. as a spot treatment when spraying "to wet". Glufosinate is a contact killer; with limited translocation and no residual activity. Best results occur when weeds are 6 inches tall or less. Regrowth from the root systems of established perennial weeds may be initially suppressed, but may eventually occur. Combine with recommended preemergence herbicide(s) for residual weed control. Do not allow spray or drift to contact green bark, leaves, or fruit. Crop damage may result. The use of shields, such as grow tubes or paper milk cartons greatly reduces the risk of injury in young vineyards. Do Not apply Rely 200 within 1 year of transplanting.

For established (bearing) vineyards.

PROBLEM WEEDS

Annual. A weed that lives less than 1 full year.

Biennial. A weed that lives longer than 1 year, but less than 2 full years. The plant often grows vegetatively during the first year, then flowers and dies during the second year.

Perennial. A weed that lives longer than 2 full years, often reproducing vegetatively by horizontal shoots, roots, or rhizomes, as well as by seed.

Complete weed control (eradication) of any weed is difficult or impossible. Established perennial weeds are among the most difficult to kill. One application of an herbicide recommended below may not provide complete control, but regrowth should be limited and competitive ability reduced. Follow-up spot treatments will improve the long-term result of the initial herbicide application.

Bindweed species (hedge and field)
These perennial weeds have deep vertical roots for food storage, and horizontal roots that spread the weed vegetatively. Shoots emerge from this extensive root system in the spring. Flowers appear in late spring and throughout the summer. They are distinctively trumpet shaped, white, or lightly tinted with lavender. Hedge bindweed flowers are 0.75 to 1.0 inches across the trumpet, while field bindweed flowers are only about 0.5 inches across the trumpet. Bindweed species are often confused with annual morningglories, which have larger bright blue flowers, simple shallower roots, and are easier to control. The leaves of bindweed species are triangular, or arrow-head shaped. The shoots grow as a vine across the ground or twining up the shoots of other plants for support. Control can be difficult due the deep and extensive root system bindweed develops.

Norosac/Casoron (dichlobenil) – 4.0-6.0 lbs. ai/A. Use 100-150 lbs./A Norosac/Casoron 4G or 2.8 gals. of Casoron CS/A. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15th, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50° F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) vineyards.

Glyphosate products. Apply in late June when Canada thistle has flower buds or flowers, or in the fall after the shoots are 6 to 8 inches tall, but before frost. Roundup translocates into the vertical roots of the plant well, but in less quantity into the horizontal roots. Follow-up spot treatments may be needed to control regrowth from pieces of horizontal roots that were not killed by the initial application. (See warning in the "Herbicide Recommendations" section of this bulletin.)

Broadcast: 2.25 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet the weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50% of the weed foliage for effective control.

Ropewick Applicator: Wipe twice; travel in opposite directions for each wipe.

Canada Thistle
This perennial weed has deep vertical roots for food storage, and horizontal roots that spread the weed vegetatively. Shoots emerge from this extensive root system in the spring. Flowers appear in late-June, and seed is dispersed in July. The shoots die after the seed is dispersed. New shoots appear in late summer and grow vegetatively until frost. These fall shoots make food for the roots and do not flower.

Norosac/Casoron (dichlobenil) – 4.0-6.0 lbs. ai/A. Use 100-150 lbs./A Norosac/Casoron 4G or 2.8 gals. of Casoron CS/A. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15th, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50° F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) vineyards.

Glyphosate products. Apply in late-June when Canada thistle has flower buds or flowers, or in the fall after the shoots are 6 to 8 inches tall, but before frost. Roundup translocates into the vertical roots of the plant well, but in less quantity into the horizontal roots. Follow-up spot treatments may be needed to control regrowth from pieces of horizontal roots that were not killed by the initial application. (See warning in the "Herbicide Recommendations" section of this bulletin.)

Broadcast: 2.25 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet the weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50% of the weed foliage for effective control.

Ropewick Applicator: Wipe twice; travel in opposite directions for each wipe.

Camphorweed

This is a biennial in the southern states. Seeds germinate in the late summer or fall, and the plant overwinters as a rosette. Flowers are produced the following summer, and the plant dies. Whether camphorweed seedlings overwinter in New Jersey, or originate from seed that germinates in the spring, is unknown.

Norosac/Casoron (dichlobenil) – 4.0-6.0 lbs. ai/A. Use 100-150 lbs./A Norosac/Casoron 4G or 2.8 gals. of Casoron CS/A. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15th, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50° F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) vineyards.

Dri-Clean 80.5% Acid equivalent (2,4-D) 0.9-1.25 lbs. ae (acid equivalent)/A. Use 16.0 to 25.0 dry oz./A Dri-Clean Herbicide (or other labeled formulations). Apply in the late fall when grapes in the treated and in adjacent vineyards are dormant and have dropped all their leaves to control winter annual and certain perennial broadleaf weeds. Spray under the trellis to control target weeds in the row, or between the rows to control weeds in sod drive rows. Use a shielded directed low pressure spray to ensure the grape vines are not hit by the spray or drift. Treated grapes must be established at least 3 years.

Warning: Grapes that are not dormant are extremely sensitive to 2,4-D. Delay application in the fall until the abscission layer has formed at the base of the petioles, and the vines have dropped ALL their leaves and petioles. Do NOT spray vineyards or near vineyards that have not dropped ALL their leaves. Do NOT treat in late winter (after January 1st), when grapes may have acquired the hours of chilling necessary to break physiological dormancy. Do not allow the spray to contact young trunks that do not have layers of old "dead" bark or trunks that have swollen viable buds. Use waxed carton shields to protect varieties that require frequent trunk replacement due to cold or other injury.

For dormant established (bearing) vineyards.

Glyphosate products. Apply as a banded directed spray in early-spring before the grapes break dormancy or as a spot treatment later in the season. (See warnings in the "Herbicide Recommendations" section of this bulletin.)

Broadcast: 0.75-1.5 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet the weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50% of the weed foliage for effective control.

Ropewick Applicator: Wipe after the plant bolts and is tall enough to contact wicks in late-June or July.

Dandelion

This perennial plant grows actively during the spring and fall. This weed is known to be an alternate host for the stem-pitting virus of peaches and other stone fruits, and union necrosis in apples.

Norosac/Casoron (dichlobenil) – 4.0-6.0 lba. ai/A. Use 100-150 lbs./A Norosac/Casoron 4G or 2.8 gals. of Casoron CS/A. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15th, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50° F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) vineyards.

Dri-Clean 80.5% Acid equivalent (2,4-D) 0.9-1.25 lbs. ae (acid equivalent)/A. Use 16.0 to 25.0 dry oz./A Dri-Clean Herbicide (or other labeled formulations). Apply in the late fall when grapes in the treated and in adjacent vineyards are dormant and have dropped all their leaves to control winter annual and certain perennial broadleaf weeds. Spray under the trellis to control target weeds in the row, or between the rows to control weeds in sod drive rows. Use a shielded directed low pressure spray to ensure the grape vines are not hit by the spray or drift. Treated grapes must be established at least 3 years.

Warning: Grapes that are not dormant are extremely sensitive to 2,4-D. Delay application in the fall until the abscission layer has formed at the base of the petioles, and the vines have dropped ALL their leaves and petioles. Do NOT spray vineyards or near vineyards that have not dropped ALL their leaves. Do NOT treat in late winter (after January 1st), when grapes may have acquired the hours of chilling necessary to break physiological dormancy. Do not allow the spray to contact young trunks that do not have layers of old "dead" bark or trunks that have swollen viable buds. Use waxed carton shields to protect varieties that require frequent trunk replacement due to cold or other injury.

For dormant established (bearing) vineyards.

Glyphosate products. Apply when the weed is growing actively and has flower buds. Spring or fall applications are more effective than applications made in mid-summer. (See warnings in the "Herbicide Recommendations" section of this bulletin.)

Broadcast: 3.0-3.75 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50% of the weed foliage for effective control.

Ropewick Applicator: Not recommended.

Goldenrod Species

These closely related weeds are perennials that begin growth in April from rosettes or rootstocks. Typically, yellow blooms appear in late summer and the stems die in the fall. Some regrowth, as short stems or rosettes, often occurs before winter. Strong root systems overwinter and resume growth in the spring. The weeds spread using underground horizontal roots. Once established, control of this weed is difficult, since it is tolerant to most herbicides and the roots can be spread by cultivation or other tillage practices.

Norosac/Casoron (dichlobenil) – 4.0-6.0 lbs. ai/A. Use 100-150 lbs./A Norosac/Casoron 4G or 2.8 gals. of Casoron CS/A. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15th, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50° F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) vineyards.

Glyphosate products. Apply in late spring after spring growth is 8 to 10 inches tall, but before the shoots become too tall for good coverage with the spray solution. Generally, banded or broadcast sprays must be applied earlier in the spring, while spot treatments and ropewick applications can be applied later in the spring. (See warnings in the "Herbicide Recommendations" section.)

Broadcast: 1.5-3.0 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50% of the weed foliage for effective control.

Ropewick Applicator: Wipe twice; travel in opposite direction for each wipe.

Horseweed (Marestail)

Horseweed is a biennial plant with seed that germinates in late-summer or early-fall. The seedling grows as a rosette during the fall and early-spring. The plant bolts during the summer, flowers, sets seed, and dies during its second late summer and fall season. The common name "marestail" is a misnomer. Herbicide labels that claim "marestail control" may be referring to another weed.

NOTE: GLYPHOSATE RESISTANT horseweed, also called marestail or stickweed locally, have been identified in the Mid-Atlantic Region, including New Jersey. Horseweed can behave like a biennial or summer annual weed, but usually behaves like a winter annual. The weed produces a large number of wind distributed seed in late-summer and early-fall. Due to the wind borne distribution of the seed, it is likely that glyphosate resistant biotypes will spread to your farm despite good integrated weed management by individual growers. Therefore, all horseweed populations should be considered potentially glyphosate resistant. Glyphosate, formulated as Roundup Ultra Max, Touchdown, Glyphomax Plus, and other generic formulations were recommended for horseweed control prior to 2003, but have been removed from the recommendations for horseweed control due to the resistance development.

Norosac/Casoron (dichlobenil) – 4.0-6.0 lbs. ai/A. Use 100-150 lbs./A Norosac/Casoron 4G or 2.8 gals. of Casoron CS/A. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15th, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50° F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) vineyards.

Dri-Clean 80.5% Acid equivalent (2,4-D) 0.9-1.25 lbs. ae (acid equivalent)/A. Use 16.0 to 25.0 dry oz./A Dri-Clean Herbicide (or other labeled formulations). Apply in the late fall when grapes in the treated and in adjacent vineyards are dormant and have dropped all their leaves to control winter annual and certain perennial broadleaf weeds. Spray under the trellis to control target weeds in the row, or between the rows to control weeds in sod drive rows. Use a shielded directed low pressure spray to ensure the grape vines are not hit by the spray or drift. Treated grapes must be established at least 3 years.

Warning: Grapes that are not dormant are extremely sensitive to 2,4-D. Delay application in the fall until the abscission layer has formed at the base of the petioles, and the vines have dropped ALL their leaves and petioles. Do NOT spray vineyards or near vineyards that have not dropped ALL their leaves. Do NOT treat in late winter (after January 1st), when grapes may have acquired the hours of chilling necessary to break physiological dormancy. Do not allow the spray to contact young trunks that do not have layers of old "dead" bark or trunks that have swollen viable buds. Use waxed carton shields to protect varieties that require frequent trunk replacement due to cold or other injury.

For dormant established (bearing) vineyards.

Rely 200 (glufosinate) – 1.0-1.5 lbs. ai/A. Use 5.0 to 7.0 pts./A as a banded or broadcast spray, or 2.4 fl. oz./gal. as a spot treatment when spraying "to wet". Glufosinate is a contact killer, with limited translocation and no residual activity. Best results occur when weeds are 6 inches tall or less. Regrowth from the root systems of established weeds may be initially suppressed, but may eventually occur. (See warnings in "Herbicide Recommendations" section of this bulletin.)

Poison Ivy

This woody perennial vine or shrub is capable of climbing a trellis. Contact with any part of the plant may result in an itching, blistering skin rash. Nonselective postemergence herbicides must be used to control this weed. Take control measure before vine grows up the grape trunk or trellis.

Glyphosate products. Apply in mid- to late-summer, after the weed flowers in late-June or early-July, or in early-fall before fall colors appear. Results of the fall application may not become evident until the following spring. Best results have been obtained in late summer after the fruit has formed. (See warnings in the "Herbicide Recommendations" section of this bulletin.)

Broadcast: 3.0-3.75 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50% of the weed foliage for effective control.

Ropewick Applicator: not recommended.

"Cut Stump" Treatment: See your product's label for rate. Apply to the cambium (inner bark area) of the stump of woody plants IMMEDIATELY after cutting. Cut and treat stumps only when the target is actively growing and not under stress. Best results are often obtained in late-summer and early-fall, but before fall color is observed in the foliage. Warning: Injury due to root grafting may occur in adjacent plants. Do not treat cut stumps if there is a possibility of root grafting to desirable vegetation.

Quackgrass

This perennial plant grows actively in the late-spring and early-fall when daily high temperatures range between 65° and 80° F (18.3° and 26.7° C). High mid-summer temperatures, above 85° F (29.4° C), and/or low soil moisture cause the weed to become dormant or semi-dormant until moisture and cooler weather return. The weed reproduces by seed and vegetatively by rhizomes, horizontal underground stems that eventually curve upward and make new shoots. The seedhead, which appears in June, resembles ryegrass, except each floret is rotated one quarter turn compared to ryegrass. The rhizomes are about 0.125 inch in diameter and may grow horizontally for up to several feet in length before curving upward and making a new shoot. Ryegrass does not have rhizomes.

Glyphosate products. Apply in late spring, May or June, or in the fall, October or November, when the weed has vigorous healthy foliage, a minimum of 4 to 6 leaves, and has begun to tiller. Do NOT till the field or otherwise disrupt the root and rhizome system of the weeds in the soil for a minimum of 8 months before treatment.

Broadcast: 1.5 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet weed foliage as thoroughly as possible.

Ropewick Applicator: Wipe in late May or June after the weed is at least 1 foot tall. Not recommended in the fall due to the more prostrate growth habit of the weed.

Kerb (pronamide) – 2.0-4.0 lbs. ai/A. Use 4.0-8.0 lbs./A Kerb 50WP. Apply in November when soil temperatures are between 35° and 55° F (1.67° and 12.8° C). Primarily controls perennial grasses, including quackgrass, bluegrass, ryegrass sp., fescue sp., and also provides early control of annual grasses the following spring. Apply Surflan, Prowl, Solicam, or Sinbar the following May or June for full season annual grass control. Tank-mix Kerb with Gramoxone SL2.0 or a glyphosate product and with Princep for postemergence and residual broadleaf weed control.

Virginia Creeper

Virginia Creeper is a woody perennial vine capable of climbing a trellis and smothering a grape vine. Nonselective postemergence herbicides must be used to suppress or control this weed. Remove the vine from the trellis during winter pruning and lay it on the ground or plan a "cut stump" treatment during the growing season. Do NOT "prune out" the vine during the dormant season. Good growth and maximum leaf area is needed at the time of herbicide application during the summer.

Glyphosate products. Apply in mid- to late-summer after vine flowers in early-July, but before fall color appears in the foliage. Applications in spring or early-summer, before flowering, have been less effective. Repeat applications may be needed. One application may merely suppress Virginia Creeper. (See warnings in the "Herbicide Recommendations" section of this bulletin.)

Broadcast: 3.0-3.75 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50% of the weed foliage for effective control.

Ropewick Applicator: Not recommended; the creeping nature of plant is difficult to wipe.

"Cut Stump" Treatment: See your product's label for rate. Apply to the cambium (inner bark area) of the stump of woody plants IMMEDIATELY after cutting. Cut and treat stumps only when the target is actively growing and not under stress. Best results are often obtained in late-summer and early-fall, but before fall color is observed in the foliage. Warning: Injury due to root grafting may occur in adjacent plants. Do not treat cut stumps if there is a possibility of root grafting to desirable vegetation.

White Heath Aster

Weeds are perennials that begin growth in April from rosettes or rootstocks. Typically, blooms are about 0.5 inch in diameter. The flowers have white or slightly tinted purple petals with yellow centers. They appear in late summer, set seed, and the stems die in the fall. Some regrowth, as short stems or rosettes, often occurs before winter. The weed spreads using underground horizontal roots. Once established, control of this weed is difficult since it is tolerant to most herbicides and the roots can be spread by cultivation or other tillage practices.

Norosac/Casoron (dichlobenil) – 4.0-6.0 lbs. ai/A. Use 100-150 lbs./A Norosac/Casoron 4G or 2.8 gals. of Casoron CS/A. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15th, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50° F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) vineyards.

Glyphosate products. Apply in May or June after spring growth is 8 to 10 inches tall, but before the shoots become too tall for good coverage with the spray solution. Generally, broadcast sprays must be applied in May, while spot treatments and ropewick applications can be delayed until June. (See warnings in the "Herbicide Recommendations" section.)

Broadcast: 1.5-3.0 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50% of the weed foliage for effective control.

Ropewick Applicator: Wipe twice; travel in opposite direction for each wipe.

Wild Grape
Wild grape is a woody perennial vine closely related to the desirable varieties grown in the vineyard. The wild grape is capable of climbing a trellis and smothering the desirable grape vine. Nonselective postemergence herbicides must be used to suppress or control this weed. Remove the vine from the trellis during winter pruning and lay it on the ground or plan a "cut stump" treatment during the growing season. Do NOT "prune out" the vine during the dormant season. Good growth and maximum leaf area is needed at the time of herbicide application during the summer.

Glyphosate products. Apply in mid- to late-summer after fruit set, from early-July till fall, but before fall color appears in the foliage. Applications in spring have been less effective. Repeat applications may be needed. One application may merely suppress wild grape. (See warnings in the "Herbicide Recommendations" section of this bulletin.)

Broadcast: 3.0-3.75 lbs. ae (acid equivalent)/A.

Spot Treatment: See your product's label for rate. Wet weed foliage as thoroughly as possible. Use the highest labeled percent solution rate when only partial wetting of the weed foliage is possible. Wet a minimum of 50% of the weed foliage for effective control.

Ropewick Applicator: Not recommended; the creeping nature of plant is difficult to wipe.

"Cut Stump" Treatment: See your product's label for rate. Apply to the cambium (inner bark area) of the stump of woody plants IMMEDIATELY after cutting. Cut and treat stumps only when the target is actively growing and not under stress. Best results are often obtained in late-summer and early-fall, but before fall color is observed in the foliage. **Warning: Injury due to root grafting may occur in adjacent plants. Do not treat cut stumps if there is a possibility of root grafting to desirable plants.**

Yellow Nutsedge
This perennial sprouts from over wintering nutlets from mid- to late-spring through early-summer. In late-spring and early-summer the weed grows vegetatively and spreads by underground rhizomes that curve up and establish new plants. In late-summer, after about August 1st, rhizomes stop curving up to make new plants. A new flush of rhizomes grow down, the tips swell, and form new nutlets. In early- to mid-fall the plant dies, separating the nutlets from each other. The nutlets survive the winter and may sprout the following spring, or may remain dormant for several years before sprouting.

Matrix FNV (rimsulfuron) – 0.031-0.062 lb. ai/A. Use 4.0 dry oz. of Matrix FNV/A in a single application or split the application and apply 2.0 dry oz. 2 times. Apply in the spring, or split the application and apply Matrix FNV in late-fall or spring and repeat in early-summer. Matrix FNV controls many annual grasses and broadleaf weeds, and will suppress or control yellow nutsedge. Always add nonionic surfactant to be 0.25% of the spray solution, and always maintain the spray solution at a pH between 4.0 and 8.0. Matrix FNV is a group 2 herbicide with a single site of action in susceptible weeds, which makes it a high risk for weed resistance development. Tank-mix or use Matrix FNV in combination with other herbicides with a different mode of action in your annual weed control program.

For established (bearing) vineyards.

Norosac/Casoron (dichlobenil) – 4.0-6.0 lbs. ai/A. Use 100-150 lbs./A Norosac/Casoron 4G or 2.8 gals. of Casoron CS/A. Apply between November 15 and March 15 to control labeled annual, biennial, and perennial weeds. Late fall treatments, after November 15th, but before the soil freezes, have controlled susceptible perennial weeds more consistently than late winter applications. Treat before weed growth begins and when daily high temperatures do not exceed 50° F. Norosac/Casoron is volatile in warm temperatures and must be irrigated or incorporated after application if applied in warm weather to prevent significant loss of the herbicide.

For established (bearing) vineyards.

NOTES

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