VI. Pest Management

Managing insect and disease pests is one of the key tasks of any vineyard manager and involves numerous decisions throughout the growing season. Effective management involves monitoring weather conditions, correctly identifying insects and disease pathogens present in a vineyard, taking account of differences in varietal susceptibility to diseases, and choosing appropriate control methods, including pesticides. Collective use of these multiple tactics for making informed decisions forms the basis for Integrated Pest Management (IPM) programs that effectively and economically control pests while minimizing environmental risk.

This section emphasizes correct pest identification, use of scouting and treatment thresholds for insect pests, phenology (vine development)-based disease management, integration of canopy management into disease management, resistance management and improved sprayer technology to protect vines from pests.

Pesticide Application Equipment

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
What type of canopy sprayer is used?	Application equipment is used that increases target deposition (i.e. reduces drift) and allows for a reduction in the amount and/or rate of pesticides used (e.g. a) recycling sprayer, b) tower sprayer, c) directed deposition sprayer).	Application equipment is used that improves deposition and reduces drift (e.g. a) airblast sprayer with low drift nozzles such as air induction nozzles, b) modified airblast sprayer with deflectors, c) nozzle orientation adjusted to improve deposition).		The application equipment does not address drift (e.g. an unmodified airblast sprayer).	

The *NY and PA Pest Management Guidelines for Grapes* provide an overview of spray drift management and nozzle types, including air induction nozzles. Air induction nozzles are well proven with herbicide applications and are recommended. Canopy application trials have been successful but further season-long trials are still needed.

Top and bottom deflectors should be fitted to airblast sprayers to funnel the pesticide-laden air into the canopy. Correct nozzle orientation (to overcome the effects of the uneven airblast resulting from fan rotation) allows the spray plume to target the canopy.

Pesticide Application Equipment

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are the selected nozzles appropriate for use? Are they replaced when worn?	Appropriate size nozzles are chosen. For canopy sprays, 150-200 micron nozzles are recommended. This is known as a "fine" spray classification. AND Nozzles are replaced when worn or damaged.	Appropriate size nozzles are chosen. For canopy sprays, 150-200 micron nozzles are recommended. This is known as a "fine" spray classification. BUT Nozzles are not replaced when worn or damaged.		Nozzle size is not appropriate for canopy sprays. AND Nozzles are not replaced when worn or damaged.	

Dr. Andrew Landers notes that for nozzles <150 microns in size, droplets are likely to drift, and if temperature is high and humidity low, droplets will evaporate. All nozzles can be purchased with different spray classification characteristics from "fine" to "coarse". These classifications appear in nozzle catalogs and will soon appear on pesticide labels. If nozzle output exceeds manufacturer recommendations by >10%, the nozzles need replacing.

Pesticide Application Equipment

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is the canopy sprayer calibrated properly?	Sprayer is serviced and calibrated before the start of each season. AND Sprayer is recalibrated for major growth stages and/or different types of applications when amounts of air or liquid are changed and/or nozzle orientation is adjusted (e.g. spray directed at canopy vs. clusters). AND Calibration is repeated at least once during the growing season.	Sprayer is serviced and calibrated before the start of each season. Sprayer is recalibrated for different types of applications when amounts of air or liquid are changed or nozzle orientation is adjusted (e.g. spray directed at canopy vs. clusters). AND	Sprayer is serviced and calibrated before the start of each season.	Calibration is done infrequently or not at all.	
The annual *NY and PA Pest Management Guidelines for Grapes* (**http:/ipmguidelines.org/grapes**) provides an overview of sprayer calibration. This should be used in concert with recommendations from the manufacturer of your sprayer.					
Are environmental conditions considered before deciding to spray?	No spraying is done if winds are >10 mph unless using a sprayer that is designed/modified to improve deposition and reduce drift.	Most of the time spraying is not done if winds are >10 mph unless using a sprayer that is designed/modified to improve deposition and reduce drift.		Spraying is done in conditions where significant drift will occur.	

Pesticide Application Equipment

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is the canopy sprayer maintained properly?	Sprayer is serviced annually in addition to necessary repair work. Routine maintenance is conducted after the conclusion of each application.	Sprayer is serviced annually in addition to necessary repair work.		Sprayer is not serviced annually. Service occurs only when equipment breaks.	

The annual *New York and Pennsylvania Pest Management Guidelines for Grapes* (**http:/ipmguidelines.org/grapes**) provide a preseason checklist for sprayers as well as a routine maintenance checklist.

Additional comments from Dr. Andrew Landers: Tractor speed should be fast enough to provide a good output per hour while ensuring canopy penetration; speeds too fast result in poor penetration in a full canopy, and moving too slowly results in poor output per day. Growers should also minimize the volume of air displaced by their sprayer if possible. The airflow should be adequate to displace the air in the canopy with pesticide-laden air from the sprayer. The volume of spray should provide acceptable coverage though the grower should not spray to the point where the leaves are dripping. Grower should apply sufficient spray for the developing canopy as the season progresses. Alternative row spraying (a common early season practice with airblast sprayers) provides inadequate coverage in many instances, and where disease pressure is highest, research has shown that spraying every row is preferable.

Pruning and Dormant Vineyard Practices

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is pruning done in a way to minimize overwintering pathogens and insects?	Wood infected by significant amounts of overwintering fungi is pruned off to minimize sources of inoculum. Old cluster stems may harbor overwintering Botrytis; mummified fruit - black rot and/or Phomopsis; scabby spurs and canes (particularly the basal 2-3 nodes) - Phomopsis. AND Spray program is adjusted to reflect the level of overwintering inoculum.	Wood infected by significant amounts of overwintering Phomopsis cane and leaf spot, black rot, and/ or powdery mildew is sometimes pruned off. AND Spray program is adjusted to reflect the level of overwintering inoculum.	Wood infected by significant amounts of overwintering Phomopsis cane and leaf spot, black rot, and/or powdery mildew is sometimes pruned off. BUT Spray program is not adjusted to reflect the level of overwintering inoculum.	Pruning is done without regard to the presence of overwintering inoculum, and spray program is not adjusted.	

Pruning and Dormant Vineyard Practices

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Can the Vineyard Manager identify Eutypa dieback symptoms?	The Vineyard Manager can identify Eutypa dieback. Where Eutypa is suspected, vines are double pruned and/or cut well below the canker. Vines are flagged during the growing season for future observation. Dead wood and prunings are removed each year and disposed of by burying or burning.	The Vineyard Manager can identify Eutypa dieback. Action against Eutypa and/or other suspicious trunk systems has been done but not in a thorough manner. Dead wood and prunings are sometimes removed from the vineyard and disposed of by burying or burning but not on a yearly basis.		The Vineyard Manager cannot identify Eutypa dieback and/or suspicious cankers and other suspicious symptoms are ignored. Dead wood and prunings are not removed from the vineyard.	

According to Dr. Wayne Wilcox (Dept. of Plant Pathology, NYSAES, Geneva), Eutypa canker has long been known as a cause of declining grapevines. More recently, vine decline has been recognized as a disease complex associated with a number of potential trunk-infecting fungi. Eutypa and some other fungi typically infect through pruning wounds, and then cause cankers that slowly expand down and around the infected arm, cordon or trunk. A cross section through such cankers typically reveals a distinctive wedge-shaped zone of dead wood radiating from the center of the cylinder. Another group of vine-decline fungi do not cause such cankers. Rather, cross sections through trunks of symptomatic vines often display black spotting or gumming whereas longitudinal sections reveal black streaks through the water-conducting vessels of the wood. Current research suggests that decline symptoms from these infections are unlikely to occur unless the vines are subjected to stress. Therefore, viticultural practices designed to minimize vine stress should help to prevent/minimize the occurrence of such forms of vine decline. These practices would include timely irrigation, balanced nutrition, minimized trunk injury from machine implements and so on.

Pruning and Dormant Vineyard Practices

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Can the Vineyard Manager identify symptoms of crown gall infection?	The Vineyard Manager can identify crown gall. Vines, or portions of vines, rendered unproductive by crown gall are either removed or a new trunk is trained up. AND Preparations designed to rid the vine of crown gall are NOT used as efficacy has been poor in both research and grower trials.	The Vineyard Manager can identify crown gall using fact sheets. Vines rendered unproductive by crown gall are either removed or a new trunk is trained up. AND Preparations designed to rid the vine of crown gall are NOT used as efficacy has been poor in both research and grower trials.		The Vineyard Manager either cannot identify the presence of crown gall, has not addressed crown gall problems in the vineyard or has addressed the problems with topical preparations that have been proven to have poor efficacy in both research and grower trials.	

According to Dr. Tom Burr (Dept. of Plant Pathology, NYSAES, Geneva) scion and rootstocks differ in their susceptibility to crown gall. In addition, the younger the vine is at infection, the greater the impact on the vine. Crown gall compromises the wound healing process by preventing normal differentiation of cells that are generated in the cambial zone following wounding.

Pruning and Dormant Vineyard Practices

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are dormant fungicide sprays applied? *[Note – dormant and post-harvest are two distinct time periods. Dormant refers to the absence of green tissue and leaves.]*	Due to data indicating marginal benefits and high costs, dormant sprays are NOT routinely applied to the vineyard.		A single dormant spray is applied.	Two or more dormant sprays are applied to vines with the general goal of reducing overwintering inoculum of powdery mildew or Phomopsis.	

According to Dr. Wayne Wilcox, a single dormant spray MAY be appropriate if extreme levels of powdery mildew or Phomopsis are present on canes, but only if spray coverage is maximized with an efficient sprayer. Any benefits derived from such a spray are highly unlikely if a low efficiency sprayer, such as an unmodified airblast sprayer, is used.

Experiments conducted in upstate NY in the 1980s showed that dormant applications of lime sulfur reduced the viability of overwintering inoculum of the powdery mildew and Phomopsis fungi, and sometimes improved the efficacy of the standard spray program that followed. However, these trials were conducted using a rate of over 30 gal/acre of lime sulfur in 300 gal/acre of water. (Note that lime sulfur is not a mix of lime + sulfur but rather calcium polysulfide, a completely different material.) This rate is extremely expensive and impractical. Lower rates (e.g. 10-12 gal lime sulfur in 100 gal water per acre) have been advocated in California, but data on their efficacy is very limited. In a recent NY trial, they provided only modest benefits at a relatively high cost. Most conventional fungicides should have little or no activity if applied during the dormant season, nor are they labeled for use at that time of year.

Disease Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are proper canopy management practices followed to minimize fungal disease pressure?	The canopy is managed following recommendations in this guide to facilitate light, air and spray penetration. See the Vineyard Management section.	The canopy management recommendations in this guide are sometimes followed.		Canopy management recommendations in this guide are mostly ignored. The canopy is dense with poor light penetration and poor drying.	
When planning a fungal disease management program, is block history taken into account?	Historical susceptibility to disease is taken into account when planning a fungal disease management program.			Historical susceptibility to disease is not taken into account when planning a fungal disease management program.	

Disease Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
What actions are taken to minimize disease pressure in Labrusca varieties?	Disease management consists of two sprays, one at the immediate pre-bloom period and another post-bloom with spray intervals not exceeding 10 to 14 days. AND Spraying focused on periods of peak cluster susceptibility. AND Disease management concentrates on limiting infection by primary inoculums of black rot, powdery mildew, downy mildew, and Phomopsis cane and leaf spot.	Disease management consists of two sprays, one at the immediate pre-bloom period and another post-bloom with spray intervals not exceeding 10 to 14 days. AND Spraying focused on periods of peak cluster susceptibility.	Disease management consists of two sprays around the bloom period but the interval between sprays exceeds 14 days.	Disease management does not begin until after bloom, requiring use of an eradicant material in an attempt to manage established infections.	

Over-wintering inoculum of black rot and Phomopsis should be minimized by pruning and disposing of infected canes and bunches during the dormant season. Fungicide sprays should include a minimum of an immediate pre-bloom application and a post-bloom application 10 to 14 days later with materials providing protection against all four diseases. For varieties (e.g. Niagara) and locations subject to severe Phomopsis infections, an effective material is often required soon after cluster emergence as well. The need for additional applications (either pre- or post-bloom) are determined each year depending on weather conditions, over-wintered inoculum potential, and the presence of current-season infections as determined by scouting.

Disease Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Can the Vineyard Manager identify fungal and viral disease symptoms on shoots, leaves and fruit?	The Vineyard Manager can identify on leaves, shoots and fruit all of the following diseases: •Fungal - black rot, Phomopsis, powdery and downy mildews and Botrytis •Viral - leaf roll, fanleaf •Any unknown disease is ID'd with outside input. AND Vineyard Manager has knowledge of life cycles and crop susceptibility at different times in the growing season.	The Vineyard Manager can identify most of the aforementioned fungal and viral disease symptoms and life cycles with the aid of publications and fact sheets.	The Vineyard Manager cannot identify more than half of the fungal and viral disease symptoms and does not use publications or fact sheets to ensure proper identification.	The Vineyard Manager cannot ID any symptoms of fungal and viral diseases.	

Photos can be found at **http://www.nysipm.cornell.edu/factsheets**. These publications also have good photos: *Grape Pest Management, Compendium of Grape Diseases,* and *Grape IPM in the Northeast.* See the references at the end of the workbook for details.

Disease Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
How are virus-infected vines dealt with?	Vines diagnosed with viral infection are immediately removed if the vines are not producing sufficient quality or quantity of fruit. If vineyard removal is necessary, the site is replanted with a resistant rootstock or left fallow for a minimum of 3 years. When vines are removed, as much of the root system as possible is removed.	Vines diagnosed with viral infection are immediately removed if the vines are not producing sufficient quality or quantity of fruit. If vineyard removal is necessary, the site is left fallow for less than three years.	Even if vines are not producing sufficient quality and quantity of fruit, there is no systematic removal of virus-infected material and/or there is no attempt to renovate sites where virus-infected vines grow.	Nothing is known of viruses and therefore no action plans are in place.	

Disease Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is scouting done for fungal and viral diseases?	Scouting is done every other week or at key phenological times preferably by the same person. Scouting results are recorded and entered into a historical database. Vines are scouted May through September.	Scouting is done occasionally, often targeting hot spots. Records of scouting results are kept and entered into a historical database.	Scouting is done informally (e.g. tractor scouting) or on an irregular basis. No records are kept.	Scouting is not done.	

Monitoring of fungal and viral diseases requires vigilance. Particularly with fungal diseases, it is important to address any problems as soon as possible. Remedial steps tend to be much more effective in the early stages of infection vs. during a raging epidemic. Ideally, in a given vineyard block, 5% of the vines or a minimum of 10 vines are examined weekly for signs of disease. These vines can be chosen using historical records to ensure that hotspots are the first to be scouted. Other options are randomly chosen vines or vines that are permanently tagged. Permanent tags offer the additional advantage of charting a range of measurements (e.g. vine pruning weight, disease status, etc.) from year to year. Both foliage and fruit should be examined for signs of disease.

Disease Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Does the Vineyard Manager provide or arrange for training of field staff in disease and insect identification?	The Vineyard Manager annually provides training to field staff on identification of grape diseases and insects.	Training has been provided once or twice but not on a regular basis.		Training is not done.	
Are fungicides with low leaching potential selected for use?	Materials with high leaching potential are avoided.	Materials with high leaching potential are avoided except where no alternatives exist.		Leaching potential is not taken into account when selecting fungicides.	

Disease Management					
	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Where possible, are reduced risk fungicides, biopesticides, minimum risk fungicides and/or organic fungicides used?	Where practical, these materials are used for control of fungal diseases and total >50% of the spray materials used.	These materials are used for control of fungal diseases and total at least 20% of the spray materials used.	These materials are used once or twice.	These materials are never used.	

See **www.vinebalance.com** for a description of reduced risk, minimum risk, organic and biopesticides.

- For a complete list of minimum risk materials, go to **http://www.epa.gov/oppbppd1/biopesticides/regtools/25b_list.htm.**
- For a complete list of biopesticide materials, go to **http://www.epa.gov/oppbppd1/biopesticides/index.htm.**
- The Cornell Pest Management Education Program provides a database detailing both current and historical products registered in NYS – **http://pmep.cce.cornell.edu/pims/**.
- The NYS DEC website **www.dec.state.ny.us/website/dshm/pesticid/pestprod.pdf** can also be checked to make sure a particular material is registered in the state of NY.

The OMRI list of certified organic materials can be accessed via the web at **www.omri.org**.

When choosing a spray material, consider both the potential efficacy against the target pest as well as other aspects of the compound. Copper compounds, for example, are effective downy mildew (and to a lesser extent, Phomopsis and black rot) materials that are allowed in organic programs. Unfortunately, in other grape growing regions worldwide, copper use has been banned (outright bans as well as bans in organic production exist) due to concerns about the accumulation of this heavy metal in soils. Thus in this particular circumstance, copper would be considered an organic option (the OMRI approved labels) but should be used sparingly and only when necessary.

Disease Management

Additional comments from Dr. Wayne Wilcox: Reducing the application rates of fungicides can save money and reduce the potential for short-term environmental pollution. However, this is not a long-term sustainable practice for certain fungicides. Specifically, reducing rates of the DMI fungicides (also called SIs or sterol inhibitors - Elite, Nova, Procure, and Rubigan) and the strobilurins (Abound, Flint, Sovran) is known to promote the development of resistance to these materials. In contrast, reducing the rates of traditional protectant materials (Dithane, Manex, Penncozeb, coppers, sulfurs, etc.) has no impact on resistance development but can shorten the duration of their active period. Also, note that pesticide rates are typically expressed on a per-acre basis for both legal purposes and convenience, although target organisms actually respond to a rate per unit area of canopy volume. Thus, a rate of 3 oz/acre applied to a thin canopy early in the season may provide the same level of activity as 6 oz/acre applied to a thick canopy in mid-summer. In short, efforts to reduce pesticide rates should be governed not only by the particular materials in use but also by the canopy volume.

Disease Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is a Botrytis control program in place for susceptible varieties?	A Botrytis management plan follows these points: • Conscientious canopy management is done; esp. leaf pull to improve light, air and spray penetration into the cluster zone. • Cluster thinning is done in such a way that clumps of overlapping clusters are loosened/thinned. • Only susceptible varieties are treated, unless extreme weather conditions warrant otherwise. • Particularly during bloom, a treatment is applied only if weather conditions warrant. • Sprays are directed at the cluster zone; GPA of water and the need for a surfactant follow pesticide label recommendations. • N fertilizers applied so that vine growth is balanced.	Four or five of the six considerations are followed for Botrytis control.	Three or fewer of the six considerations are followed for Botrytis control.	Botrytis Management relies on fungicides alone.	

Insect and Mite Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Can the Vineyard Manager identify insect and mite pests and the damage they cause?	The Vineyard Manager can identify all of the following insect/mite pests and the damage they cause: • Major insects • Minor insects • Mites • Any unknown pest is ID'd with outside help • VM has knowledge of crop susceptibility and insect life cycles.	Using fact sheets and websites, the Vineyard Manager can identify a majority of the insect and mite pests and the damage they cause and has knowledge of crop susceptibility and insect life cycles.	The Vineyard Manager has difficulty identifying more than three insect and mite pests and the damage they cause.	The Vineyard Manager cannot ID any insect pests or the damage they cause.	

Insects are found in regions noted – if no region is cited, insects are found in all regions:

Major Insects: Grape Leafhopper (FL), Potato Leafhopper (LI), Japanese Beetles, Grape Berry Moth, and Rose Chafer.
Minor Insects: cutworms, flea beetles, thrips, aphids, girdlers, gallmakers, scale insects, Grape Plume Moth, Grape Cane Borer, Banded Grape Bug (FL & LE), Grape Rootworm (FL).
Mites: European Red Mite, Two Spotted Spider Mites.

Photos can be found at the following web address: **http://www.nysipm.cornell.edu/factsheets.** The following publications (see the reference section for details) also have good photos: *Grape Pest Management, Compendium of Grape Diseases,* and *Grape IPM in the Northeast.*

Insect and Mite Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are dormant miticide sprays applied?	Due to data indicating marginal benefits, dormant sprays are NOT applied to the vineyard for mite control.		A single dormant spray of a labeled horticultural oil is applied with the goal of reducing the viability of European Red Mite eggs. A minimum of 100 GPA water is used or amount of water as per label directions.	More than one dormant oil or other insecticide spray is applied to vines, all in accordance with pesticide labels.	

Dormant oils, when applied properly, can provide some control of overwintering European Red Mites (ERM) in tree fruit, particularly apples. High water gallonage (200-300 gal/acre) and rates based on time of year/stage of growth are used. In apples, mites become progressively more susceptible to control with dormant oil as spring arrives.

Horticultural oil research has been conducted statewide. Sprays were applied at multiple timings with a backpack sprayer. Treatments were unsuccessful in controlling subsequent mite populations. Grower experience with airblast sprayers has been similarly disappointing. The location of mites in cracks and crevices and under bark makes control more difficult than in tree fruit. For areas with potentially high overwintering ERM populations, an efficient sprayer that achieves excellent coverage would be the best choice for dormant oil application. Coverage must be sufficient to penetrate areas where overwintering mites reside. Be sure to use an oil product labeled for dormant use in vineyards.

Insect and Mite Management					
	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Does scouting for insect and mite pests take place?	Scouting takes place on a regular basis (every other week and/or at the first signs of the pest) for major insect pests such as European Red Mite, Potato Leafhopper, Japanese Beetles, Grape Berry Moth, Grape Leafhopper and Rose Chafer.	Informal scouting or scouting less frequent than every other week takes place.		Scouting is not done for insect and mite pests.	
See **www.vinebalance.com** for a general description of scouting goals and techniques.					
Are insect/mite thresholds considered when making a treatment decision?	Where thresholds exist, scouting results are used to help determine the need for a treatment. Currently, informal thresholds exist for Grape Berry Moth, European Red Mite, Potato Leafhopper, Grape Leafhopper, Climbing Cutworm and flea beetles.	Thresholds are sometimes used to help determine the need for a treatment.	Thresholds are disregarded when deciding the need for a treatment.	An insecticide is applied routinely with most spray applications.	
Suggestions for thresholds can be found in the article describing scouting techniques. One additional threshold – 2% infested buds for Grape Flea Beetle.					

Insect and Mite Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is spot treatment used for insect/mite infestations?	If infestations are localized, only the vineyard areas with economically damaging levels of a pest are treated. For example, only the block by the wooded edge is treated for berry moth; blocks A&B but not C are treated for ERM.	Spot treatment is sometimes done.		Spot treatment is never done. If an insect or mite outbreak occurs, the entire vineyard is treated.	
Where practical, are reduced risk, minimum risk and/or organic insecticides and miticides or biopesticides used?	These materials are always used for insect/mite control.	Where effective and economically feasible, these materials are used for insect and mite control.		These materials have not been used during the growing season for insect/mite control.	

See **www.vinebalance.com** for more information on reduced risk, minimum risk, organic and biopesticides. For a complete list of minimum risk materials, go to **http://www.epa.gov/PR_Notices/pr2000-6.pdf**. For a complete list of biopesticide materials, go to **http://www.epa.gov/pesticides/biopesticides/ingredients/index.htm**. The NYS DEC website **www.dec.state.ny.us/website/dshm/pesticid/pestprod.pdf** or the Cornell PMEP website **http://pmep.cce.cornell.edu/pims** should be checked to make sure a particular material is registered in the state of NY.

The OMRI list of certified organic materials can be accessed via the web at **www.omri.org**.

When choosing a spray material, consider both the potential efficacy against the target pest as well as other aspects of the compound. Rotenone, for example, is an organically approved insecticide. It is also moderately toxic to ERM predators and highly toxic to fish, and in fact, it is used to remove unwanted fish populations. The economic sustainability of a low risk material must also be considered. It is not sustainable if it is a prohibitively expensive treatment, particularly one with marginal benefits in terms of pest control.

Insect and Mite Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is the impact of a material on European Red Mite (ERM) predators considered when making a treatment decision?	The spray materials are adjusted so that only pesticides (fungicides, insecticides and miticides) with a low to moderate negative impact on ERM predators are used.	Only a few pesticides in the spray schedule are known to be detrimental to mite predators.		More than half of the spray materials used is rated as harmful to mite predators.	

The selection of spray materials that are less harmful to *Typhlodromus pyri,* the main predator of European Red Mites (ERM) in New York vineyards, may help to maintain their populations and provide biological control of ERM populations. The impact of various pesticides on the survival of *T. pyri* is seen in the following chart.

Toxicity of Vineyard Pesticides to *Typhlodromus pyri*, Predator of European Red Mite *Panonychus ulmi*

Fungicides

Material	Active ingredient	Class of material	Effect on *T. pyri*
Abound	azoxystrobin	strobilurin	L?
Captan 50 WP, 80 WP Captec 4L	captan	carboximide	L
Carbamate WDG	ferbam	DMDC- Dimethyldithiocarbamate	M-H?
Champ, Kocide	copper hydroxide	fixed copper	L?
Dithane, Manex, Penncozeb (many labels)	mancozeb, maneb	EBDC - ethylenebisdithiocarbamate	M-H
Elevate 50 WDG	fenhexamid	hydroxyanilide	L?
Elite 45 DF	tebuconazole	sterol inhibitor	L?
Flint 50 WG	trifloxystrobin	strobilurin	L

Fungicides (continued)			
Material	**Active ingredient**	**Class of material**	**Effect on *T. pyri***
JMS Stylet Oil	paraffinic oil	horticultural oil	L
Kaligreen	potassium bicarbonate	potassium salt	L?
Nova 40W	myclobutanil	sterol inhibitor	L
Nutrol	monopotassium phosphate	potassium salt	L?
Procure	triflumizole	sterol inhibitor	L?
Ridomil Gold MZ Ridomil Gold/Copper	mefanoxam + mancozeb or copper	phenylamide + EBDC or fixed copper	M-H – MZ L-M - Gold
Rubigan	fenarimol	sterol inhibitor	L
Rovral 50WP	iprodione	dicarboximide	L
Serenade	Bacillus subtilis	biological	L?
Sovran	kresoxim-methyl	strobilurin	L
Sulfur - WP, DF, F formulations	sulfur	elemental	L-M?

Fungicides (continued)			
Vangard 75WG	cyprodinil	anilinopyrimidine	L?
Ziram 76DF	ziram	DMDC	M-H?

Insecticides and Miticides				
Material	**Active ingredient**	**Class of material**	**Effect on *T. pyri***	**Comments**
Acramite	bifenazate	carbazate	L-M	miticide
Agri-Mek	abamectin	macrocyclic lactone	M	miticide
Biobit, DiPel	Bacillus thuringiensis	biological	L	GBM specific
Danitol	fenpropathrin	pyrethroid	H	broad spectrum
Imidan	phosmet	carbamate	L-M	broad spectrum
Kelthane	dicofol	chlorinated hydrocarbon	M	miticide
Lannate	methomyl	carbamate	H	broad spectrum

Insecticides and Miticides (continued)

Material	Active ingredient	Class of material	Effect on *T. pyri*	Comments
Nextar	pyridaben	pyridazinone	M	miticide
Provado	imidacloprid	chloronicotinyl	L	Potato Leafhopper and mealybug
M-Pede	potassium salts of fatty acids	insecticidal soaps	L	leafhopper, beetles, mites
Various products.5	rotenone	plant derived	M	broad spectrum
Sevin	carbaryl	carbamate	L-M?	broad spectrum
Thiodan/Thionex	endosulfan	chlorinated hydrocarbon	L	broad spectrum
Vendex	fenbutatin-oxide	organotin	L	miticide

? – indicates the rating is a best guess based on field observations and knowledge of the product.
Toxicity ratings: Low (<30% mortality after 48 hrs)
Medium (30-70% mortality after 48 hrs)
High (>70% mortality after 48 hrs)

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Insect and Mite Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are mancozeb products used in a way that minimizes their impact on ERM predators?	Products with the active ingredient mancozeb are known to be particularly harmful to predators of ERM. These are only used in sprays applied prior to bloom.	Regardless of the application of mancozeb in the prebloom period, only one mancozeb spray is applied in the period during or after bloom.		Two or more mancozeb sprays are applied in the period during or after bloom.	

See **www.vinebalance.com** for a discussion of the biological control of European Red Mites.