

# Grape Management Schedule

A guide to weed, insect and  
disease management in grapes in  
Nova Scotia



**2015**



## **GRAPE INSECT & DISEASE MANAGEMENT SCHEDULE**

### **Nova Scotia Guide to Pest Management in Grape 2015**

[Grape-15]

**Original Author**

**Bill Craig, Horticulturist, Perennia**

**Revised and Edited May, 2015 by**

**Rachael Cheverie, Horticulturist, Perennia**

**Sarah Wood, Perennia**

## **LIABILITY STATEMENT**

Recommendations in this guide are given for general information only and do not give the user the right to use a product in a manner not in accordance with the pesticide label or Pest Control Products Act. Perennia, by funding and printing this publication, does not offer any warranty or guarantee and does not assume any liability for crop loss, animal loss, health, safety or environmental hazard caused by the use of any pesticide or recommendation in this schedule. Pesticides used in this schedule are products labeled for the target and crop. This information was retrieved from the Pest Management Regulatory online Registered Products Database. The list of products presented in this schedule is intended to be complete, but in no way is guaranteed to be complete. Some of the products listed may not be available. Trade names are given as a convenience to producers and are neither an endorsement of the product nor a suggestion that similar products are not available or effective.

All products listed in this guide are registered for use in Canada; however, foreign markets may have specific restrictions on which pesticides can be used on the crop they are buying. It is a good idea to check with the receiving shed or processor you are selling to, for an allowable inputs list.

# CONTENTS

Liability Statement .....	i
Pesticide Emergency Contact Information .....	1
Abbreviations & Conversions .....	1
Toxicity Table.....	2
Emergency and First-Aid Procedures for Pesticide Poisoning.....	2
Table 1: Pesticides Listed in this Schedule.....	3
Table 2: Effectiveness of Fungicides for Grape Disease Control.....	5
Table 3: Relative Disease susceptibility and sensitivity to copper.....	6
Weed Management and Site Preparation for Planting.....	7
Table 6: Weed Management Schedule.....	7
Notes on Insects (Erineum mite and phylloxera).....	11
Label Definitions.....	13
Stages of Grapevine Development .....	14
Integrated Pest Management Tips .....	15
Non-chemical pest management strategies .....	15
Monitoring insects and diseases .....	15
Table 4: Insect Management Schedule .....	16
Table 5: Disease Management Schedule .....	17

## PESTICIDE EMERGENCY CONTACT INFORMATION

<b>Poison Control Centres</b>		
Nova Scotia	1.800.565.8161 or 1.902.470.8161 or 911	Regional Poison Centre, Halifax, NS
New Brunswick	911	Ask for Poison Information
Prince Edward Island	1.800.565.8161 or 1.902.470.8161	Regional Poison Centre, Halifax, NS
Newfoundland	709.722.1110 or 1.866.727.1110	Dr. Charles A. Janeway Child Health Care Centre, St. John's, NF

<b>Environmental Emergencies (Pesticide Spills)</b>	
Transport Canada Regional Operations Centre (24 hours)	
Nova Scotia	1.800.565.1633
New Brunswick	1.800.565.1633
Prince Edward Island	1.800.565.1633
Newfoundland	1.800.563.9089

## ABBREVIATIONS & CONVERSIONS

<b>Formulation, and Measurement Abbreviations</b>			
DF	Dry flowable	g	gram
EC or E	Emulsifiable concentrate	kg	kilogram
L	Liquid	kPa	kiloPascal
WDG	Wettable dry granule	l	litre
WP or W	Wettable powder	ml	millilitre

<b>Label Abbreviations</b>	
PHI	Pre-Harvest Interval
REI	Restricted Entry Interval

<b>Helpful Conversions*</b>	
kPa X 0.14 = pounds per square inch (psi)	millilitres X 0.035 = fluid ounces
hectares X 2.47 = acres	litres X 35 = fluid ounces
kilograms X 2.2 = pounds	litres X 0.22 = imperial gallons
kilograms per hectare X 0.89 = pounds per acre	litres per hectare X 14.17 = fluid ounces per acre
kilograms per hectare X 0.40 = kilograms per acre	litres per hectare X 0.40 = litres per acre

### \* Pesticide Units of Measurement

It is not recommended to convert label rates to imperial units because there is a high likelihood of mathematical errors creeping in to the results. Present day pesticides are formulated to have greater toxic effects in smaller amounts. Therefore, even small conversion errors can lead to the use of incorrect dosages (either too high or too low). Use metric – you will be glad you did!

## Toxicity Table

LD <sub>50</sub> (mg/kg)	Hazard Rating	Relative Toxicity Rating
Above 500	Very Low Hazard	1
101-500	Low Hazard	2
21-100	Moderate Hazard	3
11-20	Very High Hazard	4
10 and less	Extremely Hazardous	5

### Emergency and First-Aid Procedure for Pesticide Poisoning

- Become familiar with the chemicals you are using. Keep a list of common names in case of accidents or emergencies. This information can be found on product labels cross-referenced in this publication.
- If a pesticide has come in contact with the skin or has been spilled on clothing, remove the clothing and wash the skin thoroughly with soap and warm water.
- If a person suspects poisoning from exposure to a pesticide by swallowing, inhalation or contact with skin or eyes, read the label of the pesticide container and carry out first-aid treatment as suggested.
- Immediately after first-aid treatment has been given, wrap the patient in a coat or blanket and rush him/her to the nearest hospital. Take the list of chemical common names with you and identify the one being used.
- If a person is unconscious or lapses into unconsciousness, call **911** immediately.
- Emergency advice on pesticide poisoning is available from the Regional Poison Centre, Halifax, NS. Phone 1-800-565-8161 (NS & PEI).

## Grape Insect & Disease Management Schedule

### TABLE 1: PESTICIDES LISTED IN THIS SCHEDULE

This listing includes all the commercially registered products detailed in the Grape Pest Guide.

Chemical Name	Trade name	Fungicide Group	Re-entry Time (hrs)	Days to Harvest	Disease/Pest Controlled
acetamiprid	<b>Assail</b>	4 (insecticide)	12	3	Phylloxera
bacillus subtilis	<b>Serenade</b>	44		0	Powdery mildew, botrytis bunch rot
boscalid	<b>Lance</b>	7	12	14	Powdery mildew
boscalid + pyraclostrobin	<b>Pristine</b>	7+11	21 days <sup>1</sup>	14	Anthrachnose, powdery mildew, downy mildew, black rot and botrytis bunch rot
carfentrazone-ethyl	<b>Aim</b>	14(herbicide)	12	3	Sucker control
captan	<b>Captan/Maestro</b>	M	72	7	Black rot, downy mildew, phomopsis cane and leaf spot
clothianidin	<b>Clutch</b>	4A	12	1	Phylloxera
copper oxychloride	<b>Copper Spray*</b>	M		1	Powdery and downy mildew
tri-basic copper sulphate	<b>Copper 53W* Basicop</b>	M		1	Black rot, downy mildew, Phomopsis cane and leaf spot
cyprodinil	<b>Vanguard</b>	9	48	7	Botrytis bunch rot
cyprodinil + fludioxanil	<b>Switch</b>	9, 12	12, 48, and 168	7	Botrytis bunch rot
Citric, lactic acid	<b>Tivano</b>				Downy mildew
difenoconazole	<b>Inspire</b>	3	12, 240	7	Powdery mildew
dimethomorph	<b>Acrobat</b>	40	12		Downy mildew
fenhexamid	<b>Elevate</b>	17	4	7	Botrytis bunch rot
ferbam	<b>Ferbam</b>	M		7	Black rot
fluopicolide	<b>Presidio</b>	43	12	21	Downy mildew
folpet	<b>Folpan</b>	M	24	1	Black rot, downy mildew, Phomopsis cane and leaf spot
iprodione	<b>Rovral</b>	2	12	Before bunch closure	Botrytis bunch rot
kresoxim-methyl	<b>Sovran</b>	11	48	14	Black rot, powdery and downy mildew
mancozeb + dinocap	<b>Dikar</b>	M	48	30	Powdery and downy mildew
mancozeb + zoxamide	<b>Gavel</b>	22+M	48	66	Downy mildew
mandipropamid	<b>Revus</b>	40	12	14	Downy mildew
metiram	<b>Polyram</b>	M		45	Black rot, downy mildew.
metalaxyl-M + mancozeb	<b>Ridomil Gold MZ</b>	4+M <sup>2</sup>	24	66	Downy mildew
metrafenone	<b>Vivando</b>	U8	12-96	14	Powdery mildew
Mineral oil	<b>Spray Oil 13E</b>				Red mites and powdery mildew
myclobutanil	<b>Nova</b>	3	When dry	14	Powdery mildew, black rot, anthracnose

potassium bicarbonate	<b>Milstop<sup>®</sup></b>	M	4	0	Powdery mildew
pyrimethanil	<b>Scala</b>	9	24	7	Botrytis bunch rot
quinoxifen	<b>Quintec</b>	13	12	14	Powdery mildew
spirotetrament	<b>Movento</b>	23	12	7	Phylloxera
sulphur	<b>Kumulus<sup>®</sup></b> <b>Microscopic Sulphur</b>	M	24	21	Powdery mildew, erineum mite
trifloxystrobin	<b>Flint</b>	11	5 days <sup>2</sup>	14	Powdery mildew, black rot
Tetraconazole	<b>Mettle 125ME</b>	3	12	15	Powdery mildew, black rot

\*Permitted substances for organic production but may have restrictions on their use. Check with your certifying body as to their permissible use.

1 For hand labour, otherwise when dry. 2 For hand labour, otherwise 12 hrs.

**Grape Insect & Disease Management Schedule**

<b>TABLE 2: EFFECTIVENESS OF FUNGICIDES FOR GRAPE DISEASE CONTROL</b>						
	Group	Black rot	Downy Mildew	Powdery Mildew	Botrytis	Phomopsis Cane & Leaf Spot
Copper	M	++	++	++	0	+
Captan	M	++	+++	0	+	+++
Dikar	M	+++	+++	+++	0	+
Elevate	17	0	0	+	+++	0
Ferbam	M	+++	++	0	0	+
Flint	11	+++	+	+++	++	+
Folpan	M	++	+++	0	0	+++
Gavel	M,22	?	+++	0	?	?
Inspire	3	0	0	+++	0	0
Kocide 2000	M	0	+++	0	0	0
Lance	7	0	0	+++	+	0
Luna Tranquility	7,9	0	0	+++	+++	0
Mettle 125ME	3	+++	0	+++	0	0
MilStop	NC	0	0	++	0	0
Polyram	M	+++	+++	0	0	?
Presidio	43	0	+++	0	0	0
Pristine	7,11	+++	+++	+++	++	+
Quintec	13	0	0	+++	0	0
Nova	3	+++	0	+++	0	0
Revus	40	0	+++	0	0	0
Ridomil	4	+	+++	0	0	+
Rovral	2	0	0	0	++	0
Scala	9	0	0	+	+++	?
Serenade	ASO	?	0	+	++	?
Sovran	11	+++	++	+++	++	+
Sulphur	M	0	0	+++	0	0
Switch	9,12	0	0	+	+++	0
Vanguard	9	0	0	+	+++	+
Vivando	U8	0	0	+++	0	0
Zampro	45, 40	0	+++	0	0	0

Although a fungicide may control several diseases only use fungicides for diseases that are listed on the product label.

Ratings based upon information from OMFRA Pub. 360 and NY Pest Management Guide for Grapes.

0 = ineffective

+ = slightly effective/suppression, not recommended for very susceptible cultivars or at critical stages of infection

++ = moderately effective

+++ = very effective



**TABLE 3: RELATIVE DISEASE SUSCEPTIBILITY AND SENSITIVITY TO SULPHUR AND COPPER**

Cultivar	Susceptibility							Sensitivity	
	BR	DM	PM	Bot	Phom	Eu	CG	S	Cu
Baco noir	+++	+	++	++	+	++	+++	No	?
Cabernet Franc	+++	+++	+++	+	?	?	+++	No	?
Cabernet Sauvignon	+++	++	+++	+	+++	+++	+++	No	?
Canadice	+++	+	+	++	?	?	++	?	?
Chancellor	+	++	++	+	+++	+	+++	Yes	+++
Chardonnay	++	+++	+++	+++	+++	++	+++	No	+
Concord	+++	++	++	+	+++	+++	+	Yes	+
De Chaunac	+	+++	++	+	+++	+++	++	Yes	+
Einset Seedless	+++	+	+++	+	?	?	+	?	?
Frontenac	++	+++	++	++	+	?	?	No	?
Gewürztraminer	+++	+	+++	+++	?	?	+++	No	+
Himrod	++	+++	++	+	?	?	?	No	?
L'Acadie	+	+	+	+	+	+	?	?	?
Léon Millot	+	+++	+++	+	+	+	?	Yes	?
Lucie Kuhlmann	++	+	++	++	++	++	?	?	?
Marechal Foch	++	+	++	+	++	++	?	Yes	?
NewYork Muscat	+	+	++	+	+	+	?	?	?
Pinot gris	+++	+++	+++	++	?	+++	+++	No	?
Pinot noir	+++	+++	+++	+++	?	?	+++	No	+
Reliance	+++	+++	++	+	++	?	?	No	+
Riesling	+++	+++	++	+	++	?	?	No	+
Sauvignon blanc	+++	++	+++	+++	?	?	+++	No	+
Seyval	++	+	+++	+++	++	+	++	No	+
Vidal	+	++	+++	+	+	+	++	No	?

Key **BR**= black rot; **DM** = downy mildew; **PM** = powdery mildew; **Bot** = Botrytis; **Phom** = Phomopsis; **Eu** = Eutypa; **CG** = crown gull; **S** = sulphur; **C** = copper

Key to ratings: = = slightly susceptible or sensitive; ++ = moderately susceptible or sensitive; +++ = highly susceptible or sensitive; No = not sensitive; Yes = sensitive; ? = relative susceptibility or sensitivity not established

Slight to moderate sulphur injury may occur even on tolerant cultivars when applied at temperatures of 29°C or higher, immediately prior to or after application.

Copper applied under cool, slow-drying conditions is likely to cause injury

**Grape Insect & Disease Management Schedule**

**Weed Control in Grape Production**

Site preparation before planting is very important when establishing perennial fruit crops like grapes. Grapes are very sensitive to competition in the first couple of years of establishment so every effort should be made to keep the area within the row, under the vines, weed free.

Before planting, it's important to do a weed survey and determine if the weed species are annual or perennial. Perennial weeds reproduce through vegetative means and most effectively treated the summer/fall before planting with a broad spectrum herbicide like glyphosate. Annual weeds reproduce through seeds and there may be a significant weed seed bank in your soil that will necessitate you having to control weeds on a regular basis while your vines are getting established.

The use of cultivation, mulches or cover crops between the rows will aid in water penetration as well as weed control. It's a good idea when planting to use milk/juice cartons or grow tubes around each vine to protect the young vines from any herbicide damage especially in the planting year.

**TABLE 6: WEED MANAGEMENT SCHEDULE**

**Herbicide rates per hectare/acre refer to the area actually treated with herbicide. Unless specified, apply all treatments in 150-300L/ha water.**

**Caution: Simazine, Karmex, and Devrinol residues, high enough to harm many crops, may persist for several years after removal of the vineyard.**

Weeds/Timing	Active Ingredient	Product	Rate	Notes
Soil Applied Grass Herbicides	Dimethenamid	<b>FRONTIER (900g/l)</b>	1.4L/Ha	Non-bearing grapevines only Do not harvest within in 2 years of application on 1 <sup>st</sup> year grapes Do not harvest within one year of application on 2 <sup>nd</sup> year grapes PRE-Rainfall is required within 10 days of application to achieve sufficient herbicide activation Do not apply by air Apply to weed-free soil, after planting or hilling
	Dimethenamid	<b>FRONTIER MAX (720g/L)</b>	.96L/ha	Bearing and non-bearing grapes Do not harvest within in 2 years of application on 1 <sup>st</sup> year grapes Do not harvest within one year of application on 2 <sup>nd</sup> year grapes PRE-Rainfall is required within 10 days of application to achieve sufficient herbicide activation Single application directed under the vines Do not apply by air Apply to weed-free soil, after planting or hilling

Soil Applied Grass and Broadleaf Herbicides	Dichlobenil	<b>CASORAN G-4 (4G)</b>	110- 225Kg/ha	Established plantings only PRE – apply to cool moist but unfrozen soil in late fall or spring before weeds emerge Do not apply if air temperatures are above 10-15oC to avoid injury from volatilization Apply to dormant healthy vines only Do not apply to vines until they have been established for at least two full years For annual weeds, use 110-175Kg/ha For quackgrass and broadleaf perennial weeds, use 175-225kg/ha
	Flumioxazin	<b>Chateau WDG (51.1%)</b>	0.28 - 0.42 kg/ha	Established plantings only Do not apply to grapes established for less than 2 years. Maximum 2 applications per growing season at least 30 days apart Do not apply within 100m of non-dormant pears Apply using ground application only Do not apply after bud break unless using hooded or shielded equipment
	Diuron	<b>Karmex</b>	2.25-6.7 kg/ha	Established plantings only PRE- Apply as a directed spray to a 1m strip under vines before weeds emerge Apply in at least 300L/ha water Use only in vineyards established for at least 3 years On soils low in clay or organic matter (1-2%), use 2.25-3.25Kg/ha (of area actually sprayed); on soil high in clay or organic matter use 3.25 – 6.75 Kg/ha Apply just prior to germination and growth of annual weeds, usually in the spring It may be desirable to make a fall treatment or divide applications equally between fall and spring treatment. Do not exceed the above rates per year as injury may result. When a second application is performed, observe a minimum interval of 90days between first application and retreatment. May be tank mixed with GRAMOXONE
	Simazine	<b>Princep Nine –T (90wg); Simadex (500g/L); Simazine 480 (480g/L)</b>	4-5Kg/ha  7.2-9 L/ha  7.5-9.4 L/ha	Established Plantings only Pre – Apply after hills are removed but before weeds emerge Apply in at least 300L/ha water Use higher rates on perennial weeds Use only in vineyards established for at least 3 years May be tank mixed with Ignite and Glyphosate
Post Emergence Grass Herbicides	Fluazifop-p-butyl	<b>VENTURE L (125g/L)</b>	0.6-2L/ha	New, 2 <sup>nd</sup> year non-bearing grapevines and established plantings Apply POST to actively growing grasses before tillering Apply as banded application to the base of the grapevine Apply at 0.6L/ha at 2-5 leaf stage of volunteer corn Apply at 0.8L/ha at 2-5 leaf stage of volunteer wheat or barley Apply at 1L/ha at 2-5 leaf stage of annual grasses (2-4 leaf for foxtails) Apply at 2L/ha at 3-5 leaf stage of quackgrass and wirestem muhly Apply only once per year Grasses emerging after the treatment will not be controlled

	Sethoxydim	<b>POAST ULTRA (450g/l) + Merge</b>	0.32 – 1.1(l/ha) + 1%V/V	Bearing plantings, and non-bearing 1 <sup>st</sup> and 2 <sup>nd</sup> year plantings Single Post emergent application Apply as a banded application directed to the base of the grape vine Rates will vary dependent on grass species targeted, see label for details Targeted grass leaf stages vary by species, see label for details Do not exceed 1.1L/ha Pre-harvest Interval is 30 days
Post Emergence Broadleaf Herbicides	Carfentrazone- ethyl plus non- ionic surfactant	<b>AIM EC (240g/l) plus Agral 90 or Ag-Surf Or Merge</b>	36.5- 117ml/ha + 2.5L/1000L Or 2.5L/1000L Or 1L/1000L	New and established plantings Apply POST with a hooded sprayer between the rows Apply to actively growing weeds up to 10cm tall Apply in a minimum of 100L/ha Do not apply closer than 3 days to harvest Apply only once per growing season AIM EC may cause crop injury if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
Non-Selective Herbicides and Tank Mix Options	Glyphosate	<b>Glyphosate (360 g/L) (480 g/L) (500 g/L) 540 g/L)</b>	2.25–12L/ha 1.69-9L/ha 1.62-8.64L/ha 1.5-8L/ha	Established plantings only For actively growing weeds Apply in 200-300L/ha water as a directed spray Do not use on vines less than 3 years old Direct spray to avoid leaves and green stems of grapevines Do no mow or till weeds for at least 5-7 days after application – longer if cool Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later Repeat application to regrowth may be necessary for complete control Do not apply closer than 14days to harvest
	Glyphosate	<b>Glyphosate (360 g/L) (480 g/L) (500 g/L) 540 g/L)</b>	1L/2L water 0.75L/2L water 0.72L/2L water 0.67L/2L water	Established plantings only Apply with a rope wick or similar wiping device when weeds are at the optimum stage Direct spray to avoid leaves and green stems of grapevines Do not apply when weeds are wet Do not use on vines less than 3 years old Do not apply closer than 14 days to harvest
	Glyphosate	<b>Glyphosate (360 g/L) (480 g/L) (500 g/L) 540 g/L)</b>	1-2L/100L water 0.75-1.5L/100L 0.72-1.44L/100L 0.36-0.72L/100L	Established plantings only Use hand held sprayers as a spot treatment if wiper equipment is not available Direct spray to avoid leaves and green stems of grapevines Do not use on vines less than 3 years old Do not apply closer than 14 days before harvest
	Glyphosate + Simazine	<b>Glyphosate (360 g/L) (480 g/L) (500 g/L) 540 g/L)</b>	2.25–12L/ha 1.69-9L/ha 1.62-8.64L/ha 1.5-8L/ha	Established plantings of at least 3 years ONLY Use as a directed spray avoiding leaves, suckers and green bark on vines Use higher rates for perennial weeds and heavy weed infestations To control emerged weeds with residual control of germinating annual weeds See precautions for glyphosate and simazine

		<b>Princep Nine-T (90wg)</b>	2.5-5Kg/ha	Do not use within 40 days of harvest
	Paraquat	<b>Gramoxone (200g/L)</b>	5.5L/ha	Established plantings ONLY Apply in 1100L/ha water For spot spraying, apply 55ml in 10L of water sprayed to wet weed foliage Use on vines established on trellises Avoid contact with green bark, leaves or fruit May be tank-mixed with Karmex
	Paraquat + Napropamide	<b>Gramoxone (200g/L) + Devrinol DF (50DF)</b>	5.5L/ha 1.1Kg/ha	Established plantings only Add devrinol to tank first, then agitate and add gramoxone Apply in 1100 L/ha water Avoid contact with foliage, fruit, and green vine bark
	Glufosinate Ammonium	<b>Ignite (150g/L)</b>	2.7-5 L/ha	Established plantings of at least 3 years only Apply as a directed spray before annual weeds are 30cm high Avoid suckers and green bark Use 110-330L/ha water Where weed growth is heavy, use the higher rate and larger water volume Do not apply closer than 40 days to harvest Do not apply more than twice a year Do not apply more than 6.7L/ha product per year
	Glufosinate ammonium + Simazine	<b>Ignite (150g/L) + Princep nine-T (90WG) Or Simadex (500g/L)</b>	2.7-5 L/ha + 4-5Kg/ha or 7.2-9L/ha	Established plantings of at least 3 years of age only Use as a directed spray avoiding leaves, suckers, and green bark on vines To control emerged weeds with residual control of germinating annual weeds See precautions for Ignite and Simazine Do not harvest until 40 days after application

## **Notes on Insects**

Nova Scotia grape growers are very fortunate in that very few insect pests have reached population levels requiring control measures. The most commonly observed pests to date have been the grape erineum mite and phylloxera. The occurrences of these pests are still sporadic within Nova Scotia vineyards. Insecticide should only be applied once a pest has been identified and reached a population level that will have an impact on the crop and quality of grape produced.

### **Erineum Mite**

In many North American grape growing regions the grape erineum mite is considered to be a minor pest causing little economic damage. The fact that Nova Scotia grape growers do not apply insecticides to control other pests may allow for the buildup of this pest. Severe infestations can reduce photosynthesis and cause early leaf drop. At first glance an infestation may be confused with phylloxera as both produce bumpy blistering and gall-like formations on the upper surface of the leaf. Once the leaf is turned over the two are easily distinguished by white hairy erineum resulting from the feeding of the erineum mite.



Photos from OMFRA Factsheet

The only pesticide registered in Canada for erineum mite is sulphur. The timing of treatments is based upon when erineum mites are first observed which can occur in the prebloom period. Repeated applications may be required to control this mite. Microscopic Sulphur WP @ 3 kg/ha, Kumulus DF @ 3.4 kg/ha and Microthiol Disperss @ 3.4 kg/ha have registrations for erineum mite. The rate of sulphur to control erineum mite is only one quarter of the rate used to control powdery mildew. Certain cultivars exhibit phototoxicity symptoms to sulphur which further complicates control of the pest. These three labels instruct not to apply to Concord, Foch, De Chaunac and van Buren varieties. It is important when applying sulphur to control erineum mite that it is applied with sufficient water volume to obtain good coverage on the underside of the leaf.

## Grape Phylloxera

There are two forms of this tiny aphid-like insect, a root form which can be very destructive, and a less destruction form which creates galls. Many cultivars can withstand extensive galling. The leaf form is more commonly observed in Nova Scotia. The insect overwinters as an egg under the bark of the vine. The egg hatches in the spring with the nymph crawling onto the upper surface of a new leaf where it develops a gall. Once mature the female begins to lay eggs within the gall. Nymphs which hatch from these eggs will crawl out of the gall and move onto the upper surface of new leaves near the tip of the vine. The nymphs form new galls and start the process all over again. Several generations can occur during the growing season.



<http://www.ento.okstate.edu/ddd/insects/grapephylloxera.htm>

### Control

There are several pesticides registered for the control of phylloxera in Canada with Movento 240 and Clutch being recommended as being the better options for control. Movento 240 SC is systemic, moving to the roots and growing tips of the vines. It has one drawback, being slow acting, and therefore growers should be apply it as soon as nymphs are observed and not wait until a high number of galls are observed. Based upon past history and early observation it can be applied at the 20-25 cm shoot stage and later. The recommended rate is 88-140 mL/ha with the higher rate used for high pest pressure. The minimal interval between applications is 30 days with a maximum allowable annual application of 920 mL/ha. The pre-harvest interval is seven days. Clutch 50 WDG was recently registered for phylloxera control on grapes. Apply at a rate of 140-210 g/ha prior to population reaching damaging levels. If pest pressure continues apply a second application 14 days later. Do not apply more than two applications per growing season and do not exceed 420 g/ha per season. The pre-harvest interval is one day. The product is toxic to bees and should not be applied when bees are present or during bloom.

### Additional information

<http://www.omafra.gov.on.ca/english/crops/facts/88-125.htm>

## LABEL DEFINITIONS

**DAYS TO HARVEST** - Is the minimum number of days from the last application of the product to first harvest. This interval has been set to ensure that any residue of the pesticide left on the fruit at harvest is within an acceptable tolerance. Read the label and do not spray nearer to harvest than recommended.

**TOXICITY TO BEES** - If a pesticide must be applied during the bloom period, choose products with the least toxicity to bees. Spray in late evening or early morning when bees are not present. Spray deposit should be dry before bees begin foraging. If you have rented bees, notify the beekeeper that you intend to spray. Give enough advance notice so that the bees can be moved. Do not allow pesticide spray to drift onto hives. The presence of large numbers of dead bees at the hive entrance may indicate pesticide poisoning.

**TOXICITY TO APPLICATOR** - Poisoning as a result of pesticide exposure can result from inhalation, ingestion (Oral), or absorption through the skin (Dermal). It is essential that protective clothing, respirator and eye protection are worn when handling products listed as having a high or moderate toxicity. However, since pesticides may also have adverse effects after long term sublethal exposures it is recommended that protective equipment be worn when using all pesticides. Some of the wettable powder (WP) formulations recommended in this guide are now available in low exposure packaging (Instapak, Solupak) or low dust formulations such as dry flowable (DF). Use of these products reduces inhalation exposure during handling.

**RESISTANCE MANAGEMENT** - The use of some products leads to selection of some pests which are more tolerant. Current disease concerns are for the development of resistance in the Botrytis blight fungus to Elevate, Senator and Lance (they are from different chemical families). To slow the development of resistance, use the products at full rates and rotate with other fungicides from different chemical families or groups. Avoid application of more than two consecutive sprays of the same fungicide or fungicides from the same group. If additional protection or control is required, choose a product from another chemical family. Refer to the labels for more detailed information on resistance management.

**PESTICIDE POISONING** - If you suspect poisoning from exposure to a pesticide, consult the label for immediate first-aid instructions. Transport the person to the nearest hospital or call 911. Take the label information or the sealed pesticide container with you since it supplies treatment information. ***The Pest Control Products Act Number (P.C.P. No.) on the label will enable the attending physician to obtain specific treatment guidelines from the Regional Poison Centre.***



# STAGES OF GRAPEVINE DEVELOPMENT

To help growers accurately time pest management strategies, a classification system of growth stages has been developed.

<b>Grape Vine – Growth Stages</b>
Bud Swell
First Leaf ~1.25-5 cm shoot length
3-5 leaves unfolded ~10-15 cm shoot length
Shoot Length ~20-25 cm shoot length
Trace Bloom
Post Bloom
Berries ~ pea sized
Berry Touch to Cluster Closure
Veraison (ripening)

# INTEGRATED PEST MANAGEMENT TIPS

## Non-chemical pest management strategies

Pesticides should be utilized as a tool of last resort in any cropping system and the grapevine management system is no different. There are many management decisions that can minimize or reduce pest pressures, so that pesticide applications can be reduced. This not only reduces environmental risk, but can lower input costs to the grower.

Some studies have shown that creating buffer zones of diverse plant communities (eco-zones) around fields can also help minimize pest pressures. Certain pest species of insects overwinter, or live, in the tree line surrounding a field, and a physical barrier may limit accessibility for these insects. With the tree line pushed back at least 10 meters, the zone can be promoted to grow vegetation that is good habitat or feeding grounds for beneficial insects (e.g. wild flowers for pollinators, parasites, and predators).

## Monitoring for insects and diseases

Monitoring requires visiting vineyards at least once a week throughout the growing season. With a minimum of equipment, and some experience, you can learn to prevent pests from becoming unmanageable. Using pesticides only when and where needed is the responsible thing to do and is cost effective.

Monitoring for insects and diseases is normally done visually (occasionally with a hand lens to magnify images) by walking throughout the vineyard and randomly selecting vines or leaves to examine. Try to walk through all areas of the vineyard or divide your scouting in blocks. Generally you will find diseases first in areas that tend to be shaded or take longer to dry in the mornings after a heavy dew or rainfall. If you suspect a disease and would like it identified, you can call one of our Perennia horticulturalists to help you.

Excellent record keeping is a must for a successful integrated pest management system. All samples should be labeled with information on location, sample number and date. It is important that records of pest problems in fields are kept over the years as this can help to understand what is happening in the field both within the season and among years.

**Grape Insect & Disease Management Schedule**

**TABLE 4: GRAPE INSECT MANAGEMENT SCHEDULE**

Insect	Active Ingredient	Product	Rate	Timing	Notes
Erineum Mites	Sulphur	Microscopic Sulphur WP	3 kg/ha	Pre-bloom or as soon as mites are noticed	Some varieties are sensitive to sulphur application – please see Table 3. Apply sulphur with sufficient water volume to obtain good coverage on the underside of the leaf
		Kumulus DF	3.4 kg/ha		
Grape Phylloxera	Acetamiprid	Assail 70 WP	80 g/ha	When nymphs are first noticed	Use only 2 applications per season, minimum of 14 days apart. 3 Day PHI – 5 Day REI
	Clothianidin	Clutch 50 WDG	140-210 g/ha	Before population reaches damaging levels	If pest populations persist apply again 14 days later – do not apply more than two applications per season and do not exceed 420 g/ha per season. 1 Day PHI – toxic to bees – do not apply during bloom.
	Spirotetramat	Movento 240 SC	88-140 ml/ha	When nymphs are first noticed	Use higher rate for higher pest pressure. Minimal interval between applications is 30 days and a maximum allowable rate of 920 ml per season. 7 Day PHI
Yellow Jackets or Multicoloured Asian Ladybird Beetles	Cypermethrin	Ripcord	150 ml/ha	Apply prior to harvest when treatment thresholds have been reached, as determined by local monitoring.	Apply in no less than 400 L water per hectare. Ensure enough water volume is used to provide thorough coverage of grapevine foliage. For hand harvest, a maximum of 2 applications are permitted with a pre-harvest interval of 7 days. For mechanical harvest, a maximum of 3 applications are permitted with a pre-harvest interval of 2 days. Not all grape varieties have been tested. A small area should be treated before widespread sprays are applied. Leave a 15-metre buffer zone between sprayed area and any body of water.

## TABLE 5: GRAPE DISEASE MANAGEMENT SCHEDULE

Fungicide rates are based on a dilute water volume of 1700 l/ha

Fungicides may control more than one disease; select one that best fits your disease control program.

Disease	Active Ingredient	Product	Rate	Notes
<b>Phomopsis Cane and Leaf Spot</b>	Use one of the following listed fungicides.			
	Captan	<b>Maestro 80DF</b>	2 kg/ha	Fungus is active from bud break through pea-size berries, but the majority of infection takes place between bud break and bloom. Apply to susceptible cultivars early if history of phomopsis and it's a wet spring. Use sufficient water volume of water to provide complete coverage. Rachises are quite susceptible when cluster first becomes visible.
		<b>Supra Captan 80WDG</b>	2kg/ha	
	Folpet	<b>Folpan 50 WP</b>	1.25 kg/ha	
<b>Black Rot</b>	If black rot was a serious problem last year begin treatments at the 3-5 leaf stage, otherwise start at shoot length 20-25 cm.			
	Metiram	<b>Polyram DF</b>	3.5 kg/ha	If black rot was a serious problem last year begin treatments at the 3-5 leaf stage, otherwise start at shoot length 20-25 cm.
	Ferbam	<b>Ferbam 76 WDG</b>	3.5 kg/ha	
	Folpet	<b>Folpan 50 WP</b>	1.25 kg/ha	Apply in sufficient water to provide good coverage (1000 l/ha). Apply just before bloom, just after bloom, and in first cover spray. For downy mildew, an additional application 2 to 3 weeks later may be needed. Do not apply within 1 day of harvest. Do not apply more than 4 applications per season.
	Myclobutanil	<b>Nova 40W</b>	200 g/ha	For resistance management do not apply more than 2 consecutive applications of Nova and use a maximum of 5 applications per season.
	Tryfloxystrobin	<b>Flint 50WG</b>	140 g/ha	Do not apply to Concord grapes. For resistance management do not apply more than 2 consecutive applications of fungicides from the same class (group 11) in a season, and then alternate with 2 applications of a fungicide with a different mode of action. Do not apply more than 4 times per season.
	Kresoxim-methyl	<b>Sovran 50WG</b>	240 g/ha	For resistance management do not apply more than 2 consecutive applications of fungicides from the same class (group 11) in a season, and then alternate with two applications of a fungicide with a different mode of action. Do not apply more than 4 times per season.
	Boscalid + pyraclostrobin	<b>Pristine WG</b>	735 g/ha	Do not apply more than 6 applications per growing season. Do not apply to Concord Fredonia and like cultivars due to possible injury. 21 day REI for hand labour tasks.
	Tetraconazole	<b>Mettle 125ME</b>	292-365	Begin first application at 2.5 to 7.6 cm of new shoot growth and continue at 14-day intervals. Use higher rate under heavy disease pressure. When heavy disease pressure requires a shorter application interval, use alternate chemistries in between Mettle 125 ME Fungicide applications. Maximum of 2 applications per season.

<b>Powdery Mildew</b>	If mildew was a problem the previous season start applications as the 3-5 leaf stage, otherwise start at 20-25 cm shoot length. Fungicides may control more than one disease – select one that best fits your control program.		
Myclobutanil	<b>Nova 40W</b>	200 g/ha	If mildew was a problem in the previous year start applications at the 3-5 leaf stage. For resistance management do not apply more than 2 consecutive applications of Nova and use a maximum of 5 applications per season.
Tryfloxystrobin	<b>Flint 50WG</b>	140 g/ha	Do not apply to Concord grapes. For resistance management do not apply more than 2 consecutive applications of fungicides from the same class (group 11) in a season, and then alternate with two applications of a fungicide with a different mode of action. Do not apply more than 4 times per season.
Kresoxim-methyl	<b>Sovran 50WG</b>	240-300 g/ha	Use the 240 g rate for low to moderate pressure and 300 g rate for high to extreme pressure. For resistance management do not apply more than 2 consecutive applications of fungicides from the same class (group 11) in a season, and then alternate with two applications of a fungicide with a different mode of action. Do not apply more than 4 times per season.
Boscalid	<b>Lance WDG</b>	315 g/ha	For resistance management do not apply more than 2 consecutive applications of fungicides from the same class (group 7) in a season, and then alternate with two applications of a fungicide with a different mode of action. Do not apply more than 5 times per season.
Boscalid + pyraclostrobin	<b>Pristine WG</b>	420-735 g/ha	Use the high rate for spray intervals of up to 21 days. Do not apply more than 6 applications per growing season. Do not apply to Concord Fredonia and like cultivars due to possible injury. 21 day REI for hand labour tasks
Metrafenone	<b>Vivando SC</b>	750 ml/ha	Begin applications at bud break prior to onset of powdery mildew. Use a 14-21 day spray interval during periods of rapid growth; if conditions are conducive to high disease pressure use a 14-day interval. For resistance management do not apply more than 2 consecutive applications of fungicides from the same class (group U8) in a season, and then alternate with at least one application of a fungicide with a different mode of action. Maximum of 6 applications/season.
quinoxifen	<b>Quintec SC</b>	300 ml/ha	Use before symptoms appear, will not control established infections. Do not apply more than 5 times per season.
Mancozeb+dinocap	<b>Dikar 80WP</b>	5.5 kg/ha	When applying to Foch use at least 600L of water per ha as more concentrated sprays may cause injury. Do not apply under slow drying conditions or temperatures above 27°C.
Sulphur	<b>Kumulus DF</b>	7.1 kg/ha	Can be phytotoxic to certain grape cultivars. Do not use on Concord, Foch, De Chaunac, Van Buren or other sulphur sensitive cultivars. Sulphur sprays will suppress and may fully control erineum mite.
	<b>Microscopic sulphur 92G</b>	7.5 kg/ha	
Potassium bicarbonate	<b>Milstop 85WP</b>	2.8-5.6 kg/ha	Use the high rate and short spray intervals when conditions favour disease development. Complete coverage is required, use a minimum water volume of 500 l/ha. Do not mix with products that are not compatible with a mildly alkaline solution.
Bacillus subtilis	<b>Serenade Max</b>	3-6 kg/ha	Use the high rate and short spray intervals when conditions favour disease development. Complete coverage is required use a minimum water volume of 500 l/ha.

	Difenoconazole	<b>Inspire</b>	292 ml/ha	Begin at budbreak and apply on an 11-21 day interval making no more than 2 sequential applications before alternating to a fungicide with a different mode of action. Use the shorter interval when conditions are more conducive to disease, and do not use more than 6 applications per season. Minimum spray volume of 150 l/ha is recommended. 2 day REI and 7 day PHI.
	Mineral Oil	<b>Spray Oil 13E</b>	10 l/ha	Do not apply in less than 1000 l water/ha (1% solution) as phytotoxicity may result. Make the first application pre-bloom and continue every 10-21 days depending on the level of disease pressure. Use shorter spray intervals when disease conditions are severe. PHI is 14 days for table grapes. Oil will remove the bloom on grapes. Do not tank mix oil and copper more than once per season and never when fruit is present. Do not use oil within 14 days before or after Captan fungicide. Since not all grape varieties have been tested, it's recommended to spray a small area of each variety to confirm tolerance prior to adoption as a general field practice.
	<i>Reynoutria sachalinensis</i>	<b>Regalia Maxx</b>	0.125 – 0.25% v/v	Apply preventatively or when disease symptoms first appear in 500-1500 litres water per hectare after shoot emergence and new shoots are approximately 1-3 cm in length. Repeat applications at 7- 14 day intervals depending upon crop growth and disease pressure. When environmental conditions and plant stage are conducive to rapid disease development, use in a rotational program with other registered fungicides.
	fluopyram/ pyrimethanil	<b>Luna Tranquility</b>	600 ml/ha	Begin applications preventatively and continue as needed on a 7-14 day interval. Do not apply more than 3 applications to control powdery mildew if fewer than 12 fungicide applications are made in a season. Where 12 or more fungicide applications are made in total, a maximum of 4 applications of Group 9 containing fungicides can be applied per season. Do not exceed 4 L of LUNA TRANQUILITY per hectare per season. Do not apply LUNA TRANQUILITY within 7 days of harvest. To limit the potential for development of disease resistance to these fungicide classes do not make more than 2 sequential applications of LUNA TRANQUILITY or any Group 7 or Group 9 containing fungicide before rotating with a fungicide from a different Group.
	Tetraconazole	<b>Mettle 125ME</b>	219-365	Begin application at prebloom (30.5 - 45.7 cm shoots) and continue applications using spray intervals up to 21 days in low to moderate disease pressure. Use a 14-day spray interval when disease pressure is severe or conditions are favorable for powdery mildew. Maximum of 2 applications per season.
<b>Downy Mildew</b>	Fungicides may control more than one disease; select one that best fits the control program. Refer to table for options.			
	Captan	<b>Maestro 80DF/Supra Captan 80 WDG</b>	2.00 kg	
	Mancozeb+dinocap	<b>Dikar 80WP</b>	5.5 kg/ha	When applying to Foch use at least 600 l of water per ha as more concentrated sprays may cause injury. Do not apply under slow drying conditions or temperatures above 27°C.

	Metiram	<b>Polyram DF</b>	3.5 kg/ha	
	Folpet	<b>Folpan 50 WP</b>	1.25 kg/ha	
	Mancozeb + zoxamide	<b>Gavel 75DF</b>	2.25kg/ha	Treated area must be posted prior to and post treatment. Signs must remain in place for at least 20 days after the application, see the label.
	Metalaxyl-m and mancozeb	<b>Ridomil Gold MZ 68WP</b>	2.5 kg/ha	Make only one application per year as a pre-bloom spray.
	Kresoxim-methyl	<b>Sovran 50WG</b>	240-300 g/ha	Use the 240g rate for low to moderate pressure and 300g rate for high to extreme pressure. For resistance management do not apply more than 2 consecutive applications of fungicides from the same class (group 11) in a season, and then alternate with two applications of a fungicide with a different mode of action. Do not apply more than 4 times per season.
	Boscalid + pyraclostrobin	<b>Pristine WG</b>	675-735 g/ha	Do not apply more than 6 applications per growing season. Do not apply to Concord Fredonia and like cultivars due to possible injury. 21 day REI for hand labour tasks.
	Mandipropamid	<b>Revus SC</b>	500 ml/ha	The use of a non-ionic adjuvant (0.125 v/v) is recommended. Apply prior to disease development. Do not apply more than 4 times per growing season.
	Copper	<b>Copper spray + lime</b>	3.0 kg + 6.0 kg/1000 l	Do not apply on Seibel cultivars (De Chaunac).
	Fluopicolide	<b>Presidio</b>	220-292 ml/ha	For resistance management Presidio must be tankmixed with a labeled rate of another registered fungicide for the target pathogen, but with a different mode of action. Apply Presidio fungicide in a tank mix with Captan. Follow the most restrictive use directions for either label. Make foliar applications on a 7-14 day schedule beginning with initial flowering or when disease conditions are favourable, but prior to disease development. Use the lower rate and longer intervals as preventative applications and higher rate and shorter intervals if disease is present. 21 day PHI.
	Citric/Lactic Acid	<b>Tivano</b>	8-12% dilution in water	Under conditions of moderate to high disease pressure, use the higher rate and shorter application intervals. For maximum effectiveness, apply prior to, or at the early stages of disease development. Apply in sufficient volume (200 l/ha) to ensure full coverage for effective control. Addition of a surfactant can increase coverage and ultimately effectiveness.
	Dimethomorph	<b>Acrobat 50WP</b>	450 g/ha	Acrobat MUST be tankmixed with another fungicide registered for downy mildew in grapes. Begin applications prior to disease infection and repeat at 7-10 day intervals – shorter interval if disease pressure is high. For resistance management do not apply more than 2 consecutive applications of fungicides from the same class (group 40) in a season, and then alternate with at least one application of a fungicide with a different mode of action. Do not use more than 4 applications per season. 14 day PHI. 12 day REI for hand labour tasks.
	Ametoctradin / Dimethomorph	<b>Zampro</b>	0.8-1.0 l/ha	Begin applications prior to disease development and continue on a 7-10 day interval. Use the higher rate and shorter interval when disease pressure is high. The addition of a spreading/ penetrating adjuvant is recommended to improve

				disease control performance. Do not make more than two sequential applications of ZAMPRO before alternating to another effective fungicide with a different mode of action for at least one application. Do not enter treated areas for cane turning within 20 days after application; or for training, thinning or hand pruning within 12 days after application. For all other activities in grapes, do not enter treated areas within 12 hours after application. DO NOT use less than 200 litres of water per hectare.
	Mono- and dibasic sodium, potassium, and ammonium phosphites	<b>Phostrol</b>	2.9-5.8 l/ha	Due to varietal sensitivity, determine crop sensitivity prior to use. For preventative control of downy mildew, begin foliar applications when conditions favouring disease development exist and continue on a 7-day interval, when required. Apply in a minimum of 500 L water/ha ensuring thorough coverage of the foliage. May be applied up to the day of harvest. Use the higher rate when disease pressure is moderate to high. Maximum of 4 applications/season.
	Copper hydroxide	<b>Kocide 2000</b>	1.6 kg/ha	Apply product in 500-1400 l/ha of water. Make one application every 7-14 days starting at bud break with subsequent applications throughout the season depending on disease severity, up to a maximum of 7 applications per year. Do not apply within 1 day of harvest. Note: foliage injury may occur on copper sensitive varieties such as Concord, Delaware, Niagara and Rosette. Always test for sensitivity. The addition of 454-1360 g hydrated lime per 454 g of Kocide 2000 may reduce phytotoxicity
<b>Botrytis Bunch Rot</b>	Direct spray to the fruiting zone of the grape canopy. Use at least 1000 l of water to provide good coverage. Susceptible cultivars, vinifera and hybrids may require more than 1 application during the bunch closing period. If late summer, early fall weather conditions are wet and humid, additional fungicide applications may be required to control botrytis during this period (especially important for late harvest for ice wine)			
	Fenhexamid	<b>Elevate 50WDG</b>	1.12 kg/ha	Use Agral 90 at 200 ml/1000 l of water (.02%v/v) with Elevate in the tank. Do not apply if rain is expected within 6 hours after application.
	Iprodione	<b>Rovral 50WP</b>	1.5 kg/ha	Do not apply more than 2 times per year. Alternate with other fungicides.
	Cyprodinil	<b>Vanguard 75WDG</b>	750 g/ha	Do not apply with 30 m of lakes, streams, and ponds.
	Boscalid + pyraclostrobin	<b>Pristine WG</b>	420-735 g/ha	Use high rate when disease pressure is high. Do not apply more than 6 applications per growing season. Do not apply to Concord Fredonia and like cultivars due to possible injury. 21 day REI for hand labour tasks.
	Pyrimethanil	<b>Scala SC</b>	2 l/ha	Maximum of 3 applications per year. Alternate with other fungicides.
	Bacillus subtilis	<b>Serenade Max</b>	3-6 kg/ha	Use the high rate and short spray intervals when conditions favour disease development. Complete coverage is required. Use a minimum water volume of 500 l/ha.
	Cyprodinil + Fludioxanil	<b>Switch 62.5G</b>	775-975 g/ha	Begin applications at early bloom, one additional application may be made at berry touch, veraison, or preharvest. Application interval is 21 days. For resistance management do not apply more than 2 consecutive applications of fungicides from the same class (group 9, 12) in a season, and then alternate with two applications of a fungicide with a different mode of action. 7 day PHI. 2 day REI for hand labour tasks.



	<i>Reynoutria sachalinensis</i>	<b>Regalia Maxx</b>	0.25% v/v	Apply preventatively in 500-1500 litres water per hectare beginning at bloom. Repeat applications at bunch closure, veraison and preharvest. When environmental conditions and plant stage are conducive to rapid disease development use in a rotational program with other registered fungicides.
	Fluopyram/ Pyrimethanil	<b>Luna Tranquility</b>	1200 ml/ha	Begin applications at early bloom if needed then follow with applications from berry touch to bunch closure. An application can also be made from fruit ripening through to harvest during frequent wet conditions (conducive to infection) or when symptoms of infection are evident. Thorough coverage of bunches is essential. Apply maximum of 2 applications per season for <i>Botrytis</i> . Always alternate applications of LUNA TRANQUILITY or other Group 9 fungicides with fungicides having a different mode of action (different Group). In situations where 3 to 6 <i>Botrytis</i> treatments are made per crop and season, a maximum of 2 applications of LUNA TRANQUILITY or any other Group 9 fungicide are recommended. In situations where 7 or more <i>Botrytis</i> treatments are made per crop and season, a maximum of 3 applications of LUNA TRANQUILITY or any other Group 9 fungicide are recommended.