

2021



EXTENSION AND ADVISORY TEAM

GUIDE TO PEST MANAGEMENT IN WINE GRAPES

Nova Scotia Guide to Pest Management in Wine Grapes 2021
[Grapes1-21]



GUIDE TO PEST MANAGEMENT IN WINE GRAPES

Nova Scotia Guide to Pest Management in Wine Grapes 2021
[Grapes1-21]

Revised and Updated January 25, 2021 by
Jill MacDonald, Research Associate, Perennia
Francisco Diez, Viticulture Specialist, Perennia

Original Author
Bill Craig, Horticulturist, 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	1
PESTICIDE EMERGENCY CONTACT INFORMATION	3
ABBREVIATIONS & CONVERSIONS	3
Toxicity table.....	4
Emergency and First-Aid Procedure for Pesticide Poisoning.....	4
Table 1: Pesticides listed in this schedule	5
Table 2 : Effectiveness of fungicides for grape disease control.....	8
Table 3: Relative disease susceptibility and sensitivity to sulphur and copper.....	9
Weed Control in Grape Production	10
Table 4: GRAPE WEED MANAGEMENT SCHEDULE.	10
NOTES ON INSECTS	16
LABEL DEFINITIONS.....	18
STAGES OF GRAPEVINE DEVELOPMENT	19
INTEGRATED PEST MANAGEMENT TIPS	20
Non-chemical pest management strategies	20
Monitoring for insects and diseases	20
Table 5: GRAPE INSECT MANAGEMENT SCHEDULE.....	21
Table 6: GRAPE DISEASE MANAGEMENT SCHEDULE.....	22

PESTICIDE EMERGENCY CONTACT INFORMATION

Poison Control Centres		
Nova Scotia	1.800.565.8164 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

Environmental Emergencies (Pesticide Spills)	
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

Formulation and Measurement Abbreviations			
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

Label Abbreviations	
PHI	Pre-harvest Interval
REI	Restricted Entry Interval

Helpful Conversions*	
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 ₅₀ (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).

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

Table 1: Pesticides listed in this schedule

Chemical Name	Trade name	Group	Re-entry Time (hrs)	Days to harvest (PHI)	Disease/Pest Controlled
Acetamiprid	Assail	4	12	3	Phylloxera
Ametoctradin/ dimethomorph	Zampro	40, 45	12	14	Downy mildew
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55*	44	-	0	Powdery mildew, botrytis bunch rot
<i>Bacillus amyloliquefaciens</i>	Serifel	44	4	0	botrytis gray mold (<i>Botrytis cinerea</i>) and powdery mildew (<i>Erysiphe necator</i>)
<i>Bacillus subtilis</i>	Serenade*	44	-	0	Powdery mildew, botrytis bunch rot
Boscalid	Cantus	7	12	14	Powdery mildew
Boscalid + pyraclostrobin	Pristine	7, 11	21 days ¹	14	Anthracnose, powdery mildew, downy mildew, black rot and botrytis bunch rot
Carfentrazone-ethyl	Aim	14	12	3	Sucker control
Captan	Captan/Maestro	M	72	7	Black rot, downy mildew, phomopsis cane and leaf spot
Clothianidin	Clutch	4A	12	1	Phylloxera
Copper hydroxide	Kocide 2000	M1	48	2	Downy mildew
Copper oxychloride	Copper Spray*	M1		1	Powdery and downy mildew
Tri-basic copper sulphate	Copper 53W* Basicop	M1		1	Black rot, downy mildew, Phomopsis cane and leaf spot
Copper Octanoate	Cueva*	M1	4	1	Powdery and downy mildew
Cypermethrin	Ripcord 400EC	3	-	2	Yellow Jackets or Multicoloured Asian Ladybird Beetles
Cyprodinil	Vanguard	9	48	7	Botrytis bunch rot
Cyprodinil + fludioxanil	Switch	9, 12	12	7	Botrytis bunch rot
Citric, lactic acid	Tivano	-	4	0	Downy mildew

Chemical Name	Trade name	Group	Re-entry Time (hrs)	Days to harvest (PHI)	Disease/Pest Controlled
Dichlobenil	Casoron G-4	20	12	-	Weed control
Difenoconazole	Inspire	3	12, 24	7	Powdery mildew
Dimethenamid	Frontier Max	15	24	30	Weed control
Dimethomorph	Acrobat	40	12	14	Downy mildew
Diuron	Karmer XP or DF	7	12	-	Weed control
Fenhexamid	Elevate	17	4	7	Botrytis bunch rot
Ferbam	Ferbam	M	-	7	Black rot
Flazasulfuron	Chikara 25WG	2	12	75	Weed control
Fluazifop-P-butyl and S-isomer	Venture L	1	12	30	Weed control
Fludioxonil + pydiflumetofen	Miravis Prime	7, 12	12	14	Botrytis bunch rot
Flumioxozin	Chateau WDG	14	12	60	Weed control
Fluopyram/pyrimethanil	Luna Tranquility	7, 9	24	7	Powdery mildew, botrytis bunch rot
Folpet	Folpan	M	24	1	Black rot, downy mildew, Phomopsis cane and leaf spot
Glyphosate	Glyphosate	9	12	14	Weed control
Glufosinate ammonium	Ignite SN	10	12	40	Weed control
Iprodione	Rovral	2	12	Before bunch closure	Botrytis bunch rot
Kresoxim-methyl	Sovran	11	48	14	Black rot, powdery and downy mildew
Mancozeb + dinocap	Dikar	M, U	48	30	Powdery and downy mildew
Mancozeb + zoxamide	Gavel	M3, 22	48	66	Downy mildew
Mandipropamid	Revus	40	12	14	Downy mildew
Mefentrifluconazole	Cevya	3	12	14	Powdery mildew
Metiram	Polyram	M ²	-	45	Black rot, downy mildew
Metalaxyl-M & S-isomer, mancozeb	Ridomil Gold MZ	4, M	24	66	Downy mildew
Metrafenone	Vivando	50	12, 96	14	Powdery mildew

Mineral oil	Purespray Green Spray Oil 13E	-	-	-	Red mites and powdery mildew
Mono- and dibasic sodium, potassium, and ammonium phosphite	Phostrol	33	12	0	Downy mildew
Myclobutanil	Nova	3	When dry	14	Powdery mildew, black rot, anthracnose
Napropamide	Devrinol 50DF	15	12	-	Weed control
Paraquat	Gramoxone	22	24	-	Weed control
Polyoxin D zinc salt	Diplomat 5SC	19	-	0	Powdery mildew, grey mold
Potassium bicarbonate	Milstop* or Sirocco	-	4	0	Powdery mildew
Pyraclostrobin + Fluxapyroxad	Merivon	7, 11		14	Powdery mildew
Pyrethrins	Pyganic	-	12	-	Aphids, leafhoppers
Pyrimethanil	Scala	9	24	7	Botrytis bunch rot
Quinoxifen	Quintec	13	12	14	Powdery mildew
<i>Reynoutria sachalinensis</i>	Regalia Maxx*	P5	-	-	Powdery mildew, botrytis bunch rot
Rimsulfuron	Prism SG	2	12	21	Weed control
Sethoxydim	Poast Ultra	1	12	30	Weed control
Simazine	Princep Nine-T Simadex Simazine	5	12	-	Weed control
Spirotetrament	Movento	23	12	7	Phylloxera
Sulphur	Kumulus* Microscopic Sulphur	M2	24	21	Powdery mildew, erineum mite
Trifloxystrobin	Flint	11	5 days ²	14	Powdery mildew, black rot
Tea tree oil	Timorex Gold*	46	4	2	Powdery mildew, Downy mildew, botrytis bunch rot
Tetraconazole	Mettle	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.

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

Table 2 : Effectiveness of fungicides for grape disease control.

	Group	Black rot	Downy Mildew	Powdery Mildew	Botrytis	Phomopsis Cane & Leaf Spot
Cantus	7	0	0	+++	+	0
Captan	M	++	+++	0	+	+++
Copper	M	++	++	++	0	+
Dikar	M, U	+++	+++	+++	0	+
Elevate	17	0	0	+	+++	0
Ferbam	M	+++	++	0	0	+
Flint	11	+++	+	+++	++	+
Folpan	M	++	+++	0	0	+++
Gavel	M3,22	?	+++	0	?	?
Inspire	3	0	0	+++	0	0
Kocide 2000	M	0	+++	0	0	0
Luna Tranquility	7,9	0	0	+++	+++	0
Mettle 125ME	3	+++	0	+++	0	0
MilStop	-	0	0	++	0	0
Polyram	M ²	+++	+++	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	44	?	0	+	++	?
Sovran	11	+++	++	+++	++	+
Sulphur	M	0	0	+++	0	0
Switch	9,12	0	0	+	+++	0
Vangard	9	0	0	+	+++	+
Vivando	50	0	0	+++	0	0
Zampro	40, 45	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 OMAFRA 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 gall; **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.

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.

Note: 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.

Table 4: GRAPE WEED MANAGEMENT SCHEDULE.

Weeds/Timing	Active Ingredient	Product	Rate	Notes
Soil Applied Grass Herbicides	Dimethenamid-P	Frontier Max(720g/L)	963 ml/ha	Bearing and non-bearing grapes. Applied as a single pre-emergent (before weeds emerge) application directed to the base of the vines. Do not apply during bud swell, bud break or at time of first flush new growth. Do not harvest within in 2 years of application on 1st year grapes. Do not harvest within one year of application on 2nd year grapes. PRE-Rainfall is required within 10 days of application to achieve sufficient herbicide activation.

				<p>Single application directed under the vines. Do not apply by air. Use a minimum spray volume of 170 L/ha Do not enter within 24 hours of application. Apply to weed-free soil, after planting or hilling. PHI = 30 days.</p>
Soil Applied Grass and Broadleaf Herbicides	Dichlobenil	Casoron G-4 (4G)	110-225Kg/ha	<p>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 10-15°C 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. REI- 12 hours</p>
	Flumioxazin	Chateau WDG (51.1%)	0.28 - 0.42 kg/ha	<p>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. Moisture required to activate Chateau in soil for residual weed control. Do not apply after bud break unless using hooded or shielded equipment. PHI = 60 days. REI- 12 hours</p>
	Diuron	Karmex XP Karmex DF	2.25-6.75 kg/ha	<p>Established plantings only (at least 3 years old). PRE- Apply as a directed spray to a 1m strip under vines before weeds emerge. Apply in at least 300L/ha water. 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</p>

Soil Applied Grass and Broadleaf Herbicides	Diuron (Continued)			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 90 days between first application and retreatment. REI- 12 hours
	Simazine	Princep Nine –T (90wg); Simadex (500g/L); Simazine 480 (480g/L)	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. Maximum one application per year (Princep Nine-T) Use higher rates on perennial weeds. Use only in vineyards established for at least 3 years. May be tank mixed with Ignite and Glyphosate. REI- 12 hours
	Flazasulfuron	Chikara 25WG	150-200 g/ha	Apply to broadleaf weeds and grasses less than 10 cm tall and before tillering of grasses. Use sufficient spray volume to obtain complete and uniform coverage. Use higher water volumes on larger weeds. Adjuvant use recommended. Apply only to 3rd year planted vines and older. Apply only as a directed spray to the soil beneath the vines to prevent injury to the foliage and bark of young vines. Use of a protective sleeve is required for third year vines to minimize injury potential. Do not apply to areas where roots are exposed or suckers are actively growing and have not hardened off. Once the application has been made, the soil surface should not be disturbed. For postemergence application, use an adjuvant (refer to Additive Use Requirements section on the label). Rates listed above are for broadcast application. If making a banded application, see product information section of the label for calculating appropriate use rate. Do not apply to stony soils. Maximum one application per year. REI: 12 hours PHI: 75 days

Post Emergence Grass Herbicides and Broadleaf Herbicides	Rimsulfuron 25.0%	Prism SG	60 g/ha	May be applied twice per year. Make a single application early post-emergence to actively growing weeds, plus a recommended non-ionic surfactant at 2L per 1000 L spray solution. Do not apply more than 60 grams per hectare on a broadcast application basis per year. Use on grapes that have gone through at least one growing season, and are in good health and vigor. Do not apply within 21 days of harvest.
Post Emergence Grass Herbicides	Fluazifop-p-butyl & S-isomer	Venture L (125 g/L)	0.6-2L/ha	New, 2nd 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. Do not use this product on grapes for export to the U.S. REI- 12 hours PHI- 30 days
	Sethoxydim	Poast Ultra (450 g/L) + Merge	0.32 – 1.1(L/ha) +0.5-2.0 L/ha	Bearing plantings, and non-bearing 1st and 2nd 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. PHI = 30 days.
Post Emergence Broadleaf Herbicides	Carfentrazone-ethyl plus non-ionic surfactant	AIM EC (240g/L) plus Agral 90 or Ag-Surf or Merge	36.5-150ml/ha + 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 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. REI- 12 hours, PHI- 3 days

Non-Selective Herbicides and Tank Mix Options	Glyphosate	Glyphosate (360 g/L) (480 g/L) (500 g/L) (540 g/L)	2.25–12L/ha 1.69-9L/ha 1.62-8.64L/ha 1.5-8L/ha	Established plantings only. For actively growing weeds. Do not apply to coarse, gravelly, or sandy soil. Do not use on vines less than 3 years old. Direct spray to avoid leaves and green stems of grapevines. Do not 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 14 days to harvest. <i>*Various formulations of Glyphosate are available. Always consult the product label before using a pesticide.</i>
	Glyphosate + Simazine	Glyphosate (360 g/L) (480 g/L) (500 g/L) (540 g/L) Princep Nine-T (90wg)	2.25–12L/ha 1.69-9L/ha 1.62-8.64L/ha 1.5-8L/ha 2.5-5Kg/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. Do not use within 40 days of harvest.
	Paraquat	Gramoxone (200 g/L)	5.5L/ha	Established plantings ONLY. Apply in 1100 L/ha water. Use on vines established on trellises. Avoid contact with green bark, leaves or fruit REI- 24 hours
	Paraquat + Napropamide	Gramoxone (200g/L) + Devrinol DF-XT (50DF)	5.5L/ha 9Kg/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.

Non-Selective Herbicides and Tank Mix Options	Glufosinate Ammonium	Ignite SN (150g/L)	2.7-5 L/ha	Established plantings of at least 3 years only. Apply as a directed spray before annual weeds are 30 cm 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	Ignite (150g/L) + Princep nine- T (90WG) Or Simadex (500g/L)	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 OMAFRA 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 at 3 kg/ha, Kumulus DF at 3.4 kg/ha and Microthiol Disperss at 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 destructive 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 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.

Grape Vine – Growth Stages
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.

Table 5: 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. Do not use on Concord, Foch, de Chaunac and Van Buren varieties. Table grapes - Do not apply later than 1 day before harvest. Wine grapes - Do not apply later than 21 days before harvest.
		Kumulus DF	3.4 kg/ha		
Grape Phylloxera	Acetamiprid	Assail 70 WP Aceta 70 WP	80 g/ha	Aerial form only	Use only 2 applications per season, minimum of 14 days apart. REI: 5 days. PHI: 3 days (mechanical harvest); 5 days (hand harvest).
	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. PHI: 1 day. <i>*toxic to bees – do not apply during bloom.</i>
	Spirotetramat	Movento 240 SC	365-585 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. PHI: 7 days.
Yellow Jackets or Multicoloured Asian Ladybird Beetles	Cypermethrin	Ripcord 400 EC	150 ml/ha	Apply prior to harvest when treatment thresholds have been reached.	Apply in no less than 400 L water per hectare. Ensure enough water volume is used to provide thorough coverage of foliage. For hand harvest, maximum of 2 applications & PHI: 7 days. For mechanical harvest, maximum of 3 applications & PHI: 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.
Aphids Leafhoppers	Pyrethrins	Pyganic	2.32-4.65 L/ha	-	Do not reapply more often than every 7 days. Toxic to bees.

Aphids Leafhoppers					
	Cypermethrin	UP-Cyde 2.5EC	240 ml/ha	For Grape Leafhopper, apply when insects first appear. For Grape Berry Moth, apply shortly before bloom and repeat immediately after bloom.	Grape Leafhopper and Grape Berry Moth - Additional sprays should be applied as insects or damage appear. PHI: 7 days. Do not apply more than 3 times per season with a minimum of 7 days between applications. Multicolored Asian lady beetle and Yellow Jackets (foliar spray using airblast equipment) – Apply at 245 mL/ha. Apply in no less than 400 L water per hectare. Ensure enough water volume is used to provide thorough coverage of grapevine foliage. Apply prior to harvest when treatment thresholds have been reached, as determined by local monitoring. Consult local spray calendars or extension specialists for timing. Repeat application if required. DO NOT USE ON TABLE GRAPES. Toxic to bees.

Table 6: GRAPE DISEASE MANAGEMENT SCHEDULE.

Disease	Active ingredient	Product	Rate	Notes
Phomopsis Cane and Leaf Spot	Captan	Maestro 80DF	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. Apply when new shoots are 1 to 5 centimetres long and again when 10 to 15 centimetres long. Cannot be used after May 10, 2021.
		Supra Captan 80WDG	1.2 kg/1000 L water	
		Maestro 80 WSP	2.0 kg/ha	
	Folpet	Folpan 80 WDG	1.25 kg/ha in 1000 L/ha	Apply when new shoots are 2.5 to 5.0cm long, and repeat when growth is 10 to 15 cm long. Do not apply within 1 day of harvest.

Phomopsis Cane and Leaf Spot	Copper	Copper 53W + lime	3.0 kg + 6.0 kg/1000 L	Apply according to local spray calendar recommendations. Add 6 Kg of hydrated lime per 1000 L. Copper 53W wettable powder cannot be used on French hybrid or vinifera varieties.
Black Rot	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.			
	Folpet	Folpan 80 WDG	1.25 kg/ha in 1000 L/ha	Apply just before bloom, just after bloom, and in first cover spray. Do not apply within 1 day of harvest. Do not apply more than 4 applications per season.
	Metiram	Polyram DF	2.0 kg/ha in 1000 L	Apply in Pre-Bloom, Post-Bloom and First Cover Sprays. Do not make more than three applications per season. Do not apply later than 45 days before harvest. Cannot be used after June 21, 2021.
	Ferbam	Ferbam 76 WDG	2.0kg in 1000 L	Apply just before bloom, just after bloom, 14 days after bloom and in supplemental applications as recommended by local authorities. Do not apply within 7 days of harvest. Cannot be used after December 14, 2021.
	Myclobutanil	Nova 40 WSP	200 g/ha	Begin application at prebloom and continue application on a 14 day schedule during infection periods. PHI: 14 days.
	Tryfloxystrobin	Flint 50WG	105-140 g/ha	Do not apply to Concord grapes. Begin applications when shoots are 3-9 cm (1-3 in.) in length and continue as needed on a 7-14 day interval. Maximum 4 applications/season. PHI: 14 days.
	Kresoxim-methyl	Sovran 50WG	240 g/ha	Apply at 14-day interval. Maximum 4 applications/season. PHI: 14 days.
	Boscalid + pyraclostrobin	Pristine WG	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. REI: 21 days for hand labour tasks. PHI: 14 days.
	Tetraconazole	Mettle 125ME	292-365 ml/ha	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 applications. Max 2 applications/season. PHI: 15 days.
		Mettle 210ME	174-217 ml/ha	
Difenoconazole + Cyprodinil	Inspire Super	1475 ml/ha	Begin applications prior to disease onset when conditions are conducive for disease. Apply on a 15 to 21 day schedule. If disease pressure is high, use the shortest interval.	

Black Rot	Copper	Copper 53W + lime	3.0 kg + 6.0 kg/1000 L	Apply according to local spray calendar recommendations. Add 6 Kg of hydrated lime per 1000 L. Copper 53W wettable powder cannot be used on French hybrid or vinifera varieties.
Powdery Mildew	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.			
	Folpet	Folpan 80 WDG	1.25 kg/ha in 1000 L/ha	Apply 2 to 3 weeks after bloom and repeat at 2 weeks intervals as needed. Do not apply within 1 day of harvest.
	Pyraclostrobin + Fluxapyroxad	Merivon	0.3 L/ha	Begin applications prior to onset of disease development. Use on a spray interval of 7-14 days, with a maximum of 6 applications per year. Do not tank mix with any other products. Do not use on table grapes.
	Myclobutanil	Nova 40 WSP	200 g/ha	Begin application at prebloom and continue application on a 21 day schedule. PHI: 14 days.
	Tryfloxystrobin	Flint 50WG	105-140 g/ha	Do not apply to Concord grapes. Begin applications preventively and continue as needed on a 14-21 day interval. Maximum 4 applications/season. PHI: 14 days.
	Kresoxim-methyl	Sovran 50WG	240-300 g/ha	Can be applied to grapes through pre- and post-bloom for control of powdery and downy mildew. Apply at 240 g/ha under low to moderate disease pressure and at 300 g/ha under heavy disease pressure. Use a 14-day interval under moderate to heavy disease pressure and a 21-day interval under low disease pressure. Maximum 4 applications/season. PHI: 14 days.
	Boscalid + pyraclostrobin	Pristine WG	420-735 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. REI: 21 days for hand labour tasks. PHI: 14 days.
	Tetraconazole	Mettle 125ME Mettle 210ME	219-365 ml/ha 130-217 ml/ha	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. PHI: 15 days.
Boscalid	Cantus WDG	315 g/ha	For powdery mildew control, sprays may begin as of budbreak, repeat on a 10-14 day schedule. Use the shorter interval when disease pressure is high. PHI: 14 days.	

Powdery Mildew	Metrafenone	Vivando SC	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. PHI: 14 days.
	quinoxyfen	Quintec SC	300 ml/ha	Use before symptoms appear, will not control established infections. Do not apply more than 5 times per season. REI: 12 hours. PHI: 14 days. Cannot be used after June 30, 2021.
	Mancozeb+dinocap	Dikar 80WP	5.5 kg/ha	Apply in the prebloom, postbloom and cover sprays. Repeat applications for additional powdery mildew control in accordance with local recommendations. Do not use Dikar in combination with Zolone on Foch and Chelois as injury may result. When applying Dikar to Foch use at least 600 L of water per hectare as more concentrated sprays may cause injury. Do not apply Dikar under slow drying conditions or temperatures above 27°C as some injury may result. PHI: 30 days.
	Copper	Copper Spray + lime Or Guardsman Copper Oxychloride	3.0 kg + 6.0 kg/1000 L	Apply at pre-bloom at 1500 L per ha and at postbloom and in cover sprays at 2000 L per ha until mid-August. Do not apply on Seibel varieties. Apply a maximum of 7 applications per year and leave a minimum of 3 days between applications.
	Copper Octanoate	Cueva	Use a 0.5% to 2% solution, applied at 470-940 L per hectare	Do not mix with lime. Certain <i>Vitis vinifera</i> and French hybrid varieties may be sensitive to copper sprays resulting in marginal leaf burn. Make test sprays before spraying these varieties.
	Sulphur	Kumulus DF	12.6 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.
		Microscopic sulphur	4.5 kg/1000 L of water	

Powdery Mildew	Potassium bicarbonate	Milstop 85WP or Sirocco	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.
	<i>Bacillus subtilis</i>	Serenade Opti	1.7-3.3 kg/ha	Begin application when new shoots are 1-3 cm high. Make a repeat application when shoots are 6-10 cm high, and when shoots are 18-20 cm high, then at 7-10 day intervals thereafter.
	Difenoconazole	Inspire	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. REI: 2 days. PHI: 7 days.
	Difenoconazole + Cyprodinil	Inspire Super	836 ml/ha	Begin at bud break and apply on a 15 to 21 day interval.
	Mineral oil	Purespray green spray oil 13E	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>Bacillus amyloliquefaciens</i>	Double Nickel 55	Foliar application: 1-2 kg/ha Low disease pressure: 0.5 kg/ha-1 kg/ha	Start applications when new shoots are 1-3 cm long. Repeat at 6-10 cm, 18-20 cm, and then at 7-10 day intervals as long as disease conditions persist. Under moderate to high disease pressure, or when environmental conditions and plant stage are conducive to rapid disease development, use higher label rates (1 to 2 kg/ha), apply more frequently (every 3 to 7 days) or rotate Double Nickel 55 with other fungicides for improved performance. Lower rates

Powdery Mildew		Double Nickel 55 (Continued)		(0.5 to 1 kg/ha) may be applied under low disease pressure or to smaller (e.g. newly-emerged) plants.
	<i>Bacillus amyloliquefaciens</i> strain MBI 600	Serifel	0.25-0.5 kg/ha	Begin foliar applications at bud break or prior to onset of disease. Repeat applications if needed on 5 –10 day intervals. Under low-level disease conditions, the minimum application rates can be used while maximum application rates and the shorter spray intervals are recommended for severe or threatening disease conditions. Apply in sufficient water to ensure thorough coverage of foliage, bloom, and fruit. DO NOT apply during periods of dead calm.
	<i>Reynoutria sachalinensis</i>	Regalia Maxx	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	Luna Tranquility	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 per hectare per season. 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. PHI: 7 days.

Powdery Mildew	Mefentrifluconazole	Cevya	190 – 250 ml/ha	Begin applications of Cevya prior to disease development. Apply an additional application at an interval of 14 days if disease persists or weather conditions are favourable for disease development. Under high disease pressure and during rapid growth, use the higher rate. DO NOT apply more than 1.125 L/ha per year. DO NOT enter or allow worker entry into treated areas during the restricted entry interval (REI) of 35 days to perform cane turning and girdling in table grapes.
	Tea tree oil	Timorex Gold	1.5 – 2.0 L/ha	Do not tank-mix or alternate with Supra Captan, Maestro or sulphur products. See label for precautions on compatibility.
	Polyoxin D Zinc Salt	Diplomat 5SC	259 – 926 ml/ha	Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). For Powdery mildew, begin as a preventative application when conditions favour disease development and continue on a 7-14-day interval as needed to maintain control. Do not apply more than 150g a.i./ha/season. PHI: 0 day.
Downy Mildew	Fungicides may control more than one disease; select one that best fits the control program. Refer to table for options.			
	Captan	Maestro 80DF	2 – 3.5 kg/ha	Apply just before bloom, just after bloom and in first cover. For downy mildew, an additional application 2 to 3 weeks later may be needed. Do not apply within 7 days of harvest. Cannot be used after May 10, 2021.
		Supra Captan 80WDG	1.2 – 1.5 kg/1000 L water	
		Maestro 80 WSP	2.0 kg/ha	
	Folpet	Folpan 80 WDG	1.25 kg/ha in 1000 L/ha	Apply just before bloom, just after bloom, and in first cover spray. Do not apply within 1 day of harvest. Do not apply more than 4 applications per season.
Metiram	Polyram DF	2.0 kg/ha in 1000 L	Apply in Pre-Bloom, Post-Bloom and First Cover Sprays. Do not make more than three applications per season. Do not apply later than 45 days before harvest. Cannot be used after June 21, 2021.	

Downy Mildew	Kresoxim-methyl	Sovran 50WG	240-300 g/ha	Can be applied to grapes through pre- and post-bloom for control of powdery and downy mildew. Apply at 240 g/ha under low to moderate disease pressure and at 300 g/ha under heavy disease pressure. Use a 14-day interval under moderate to heavy disease pressure and a 21-day interval under low disease pressure. Max. 4 applications/season. PHI: 14 days.
	Boscalid + pyraclostrobin	Pristine WG	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. REI: 21 days for hand labour tasks. PHI: 14 days.
	Mancozeb+dinocap	Dikar 80WP	5.5 kg/ha	Apply in the prebloom, postbloom and cover sprays. Do not use Dikar in combination with Zolone on Foch and Chelois as injury may result. When applying Dikar to Foch use at least 600 L of water per hectare as more concentrated sprays may cause injury. Do not apply Dikar under slow drying conditions or temperatures above 27°C as some injury may result. PHI: 30 days.
	Mancozeb + zoxamide	Gavel 75DF	2.25 kg/ha	Application should start when new shoots are 1 to 4 cm long, repeat at 8 to 12 cm and at 20 to 25 cm. Continue applications on a 7-10-day interval when conditions are favourable to disease development. Max. 6 applications per season. PHI: 66 days.
	Metalaxyl-m and mancozeb	Ridomil Gold MZ 68WP	2.5 kg/ha	Make only one application per year as a pre-bloom spray. PHI: 66 days.
	Mandipropamid	Revus SC	500 ml/ha	The use of a non-ionic adjuvant (0.25% v/v) is recommended. Apply prior to disease development. Max. 4 applications per season.
	Copper	Copper Spray + lime Or Copper 53W or Guardsman Copper Oxychloride	3.0 kg + 6.0 kg/1000 L	Apply at pre-bloom at 1500 L per ha and at postbloom and in cover sprays at 2000 L per ha until mid-August. Do not apply on Seibel varieties. Apply a maximum of 7 applications per year and leave a minimum of 3 days between applications.

Downy Mildew	Copper hydroxide	Kocide 2000	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. 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. PHI: 1 day.
	Copper Octanoate	Cueva	Use a 0.5% to 2% solution, applied at 470-940 L per hectare	Do not mix with lime. Certain <i>Vitis vinifera</i> and French hybrid varieties may be sensitive to copper sprays resulting in marginal leaf burn. Make test sprays before spraying these varieties.
	Citric/Lactic Acid	Tivano	12-16 L/ha	<i>Partial suppression.</i> 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	Acrobat 50WP	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. PHI: 14 days. REI: 12 days for hand labour tasks.
	Ametoctradin / Dimethomorph	Zampro	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

		Zampro (Continued)		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	Phostrol	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.
	Tea tree oil	Timorex Gold	3 – 4 L/ha	Suppression only. Do not tank-mix or alternate with Supra Captan, Maestro or sulphur products. See label for precautions on compatibility.
	Mono- and dipotassium salts of phosphorous acid	Rampart	2.5-5 L/ha	For suppression of downy mildew (<i>Plasmopara viticola</i>): Apply at 1-3-week intervals, using the higher rate and shorter interval when disease pressure is severe. The suggested water volume is 500 L/ha when the plants are first starting to grow and 1000 L/ha when leaves, vines and fruit increase the surface area of the plant. DO NOT make more than five applications per season on a given area. DO NOT apply to plants that are DORMANT or HEAT STRESSED. To avoid undesirable copper phytotoxicity, DO NOT apply as foliar to plants treated with copper based compounds at less than 20 day intervals. Allow foliage to completely dry after application. DO NOT apply when conditions favour wet tissue for prolonged periods (> 4 hours). PHI: 1 day
Botrytis Bunch Rot	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).			

Botrytis Bunch Rot	Boscalid + pyraclostrobin	Pristine WG	420-735 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. REI: 21 days for hand labour tasks. PHI: 14 days.
	Difenoconazole + Cyprodinil	Inspire Super	1033-1475 ml/ha	Begin applications prior to disease onset when conditions are conducive for disease. Apply on a 15 to 21 day schedule. If disease pressure is high, use the highest rate and shortest interval.
	<i>Reynoutria sachalinensis</i>	Regalia Maxx	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	Luna Tranquility	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 Botrytis. 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 Botrytis 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 Botrytis treatments are made per crop and season, a maximum of 3 applications of Luna Tranquility or any other Group 9 fungicide are recommended.
	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	Foliar application: 1.25-5 kg/ha Low disease pressure: 0.6 kg/ha-1.25 kg/ha	Apply at bloom, before bunch closure, at veraison, and before harvest. Repeat application every 3 to 10 days for as long as conditions favor disease development. Under moderate to high disease pressure, or when environmental conditions and plant stage are conducive to rapid disease development, use higher label rates (1.25 to 5 kg/ha), apply more frequently (every 3 to 7 days), or rotate Double Nickel 55 with other fungicides for

Botrytis Bunch Rot		Double Nickel 55 (Con't)		improved performance. Lower rates (0.6 to 1.25 kg/ha) may be applied under low disease pressure or to smaller (e.g. newly emerged) plants.
	<i>Bacillus amyloliquefaciens</i> strain MBI 600	Serifel	0.25-0.5 kg/ha	Begin applications prior to disease development when conditions favor the development of botrytis such as during early bloom, bunch pre-closure and veraison. Repeat applications if needed on 5 –10-day intervals. Under low-level disease conditions, the minimum application rates can be used while maximum application rates and the shorter spray intervals are recommended for severe or threatening disease conditions. Apply in sufficient water to ensure thorough coverage of foliage, bloom, and fruit. DO NOT apply during periods of dead calm.
	Fenhexamid	Elevate 50WDG	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. Apply prior to disease establishment when conditions favour disease development at early bloom, bunch pre-closure, veraison (beginning of fruit ripening) to two weeks after veraison. PHI: 7 days.
	Iprodione	Rovral 50WP	1.5 kg/ha	Sprays may be applied beginning at mid to late bloom. Two sprays should be applied before complete bunch closure; these should be timed to achieve maximum protection of the fruit, i.e. just before anticipated periods of wet weather. Do not apply more than 2 times per year. Alternate with other fungicides. Cannot be used after June 21, 2021.
	Cyprodinil	Vangard 75WDG	750 g/ha	Begin application of Vangard at early bloom only if weather is wet. The most important application is at berry touch to bunch closure. An application can also be made at the early ripening (veraison) to pre-harvest period when symptoms of Botrytis Bunch Rot are showing or wet conditions conducive to infection are frequent. Thorough coverage of the bunches is essential. PHI: 7 days. Do not apply within 30 m of lakes, streams, and ponds.

Botrytis Bunch Rot	Pyrimethanil	Scala SC	2 L/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. Applications must be made a minimum of 7 days apart. Max. of 3 applications per growing season. PHI: 7 days.
	<i>Bacillus subtilis</i>	Serenade Opti	1.7-3.3 kg/ha	Make the first application at bloom, then repeat at bunch closure, at veraison and preharvest.
	Cyprodinil + Fludioxonil	Switch 62.5 WG	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. PHI: 7 days. REI: 2 days for hand labour tasks.
	Fludioxonil + pydiflumetofen	Miravis Prime	0.8 – 1 L/ha	For control of botrytis grey mould, begin applications at early bloom. One additional application may be no sooner than 21 days at berry touch, veraison or pre-harvest. Thorough coverage of bunches is essential. Maximum 2 applications, then switch to a non-Group 7 and 12 fungicide.
	Tea tree oil	Timorex Gold	1.5 – 2 L/ha	Do not tank-mix or alternate with Supra Captan, Maestro or sulphur products. See label for precautions on compatibility.
	Polyoxin D Zinc Salt	Diplomat SSC	463 – 926 ml/ha	Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). For Bunch rot and Grey mold, apply pre- bloom, at bunch pre-closure, veraison, and pre-harvest. Apply as a preventative application when conditions favour disease development and continue as needed to maintain suppression. PHI: 0 day.