

# 7 Pesticide Application

## 7.1 Pesticides

This chapter is a brief introduction to pesticides and pesticide safety. For more information take the BC Pesticide Applicator Course for Agricultural Producers. Course books are available from the BC Government Distribution Centre. The toll free phone number is 1-800-282-7955.

The BC Ministry of Agriculture and Lands (BCMAL) web page "*Pesticide Wise*" provides useful information on pesticide use and safety (<http://www.al.gov.bc.ca/pesticides/>).

### Legislation

The purpose of legislation is to prevent unacceptable risk to people and the environment and to ensure a safe food supply for consumers. The laws provide a margin of safety to people on or near farms (farmers, their families, farm workers and neighbours). Consumer safety and confidence is supported by laws that prohibit the sale of fruit with pesticide residues above established safety limits. Other standards promoted by these laws are safe drinking water and the protection of fish and migratory birds. The laws reflect societal values and considerations for the health and safety of you, your community, your customers and your environment.

Breaking laws can result in substantial fines, court action, detention of your crops and administrative penalties.

### Canadian Laws

#### ***Pest Control Products Act and Regulations***

Only pesticides registered by the Pest Management Regulatory Agency (PMRA) of Health Canada can be used or sold in BC. Each label must have a PCP Act number on it. Using pesticides without a PCP Act # (from other countries) is against the law unless you have a pesticide own use import permit. Each label must also list the crops and pests the pesticide can be used on. The label is a legal document. The user is required to use the pesticide in a manner that is consistent with label directions. There are a few minor pesticide uses that may be applied but not be on the label. This guide includes these minor uses.

The PMRA takes random crop samples during the growing season to check for residues of unregistered pesticides.

The PMRA classifies pesticides as Domestic, Commercial (Agricultural, Industrial, Forestry) or Restricted on the labels. Restricted products are more hazardous and have special restrictions on the label.

#### ***The Food and Drugs Act***

All domestic and imported food must be free of harmful pesticide residues. Health Canada sets the maximum pesticide residue levels (MRL) allowed on crops at the time of sale. The Canadian Food Inspection Agency (CFIA) collects random samples of crops to test for pesticide residues at the time of sale. The CFIA can seize any crop with pesticide residues exceeding the MRL for that crop. If you follow the recommended rates in this Guide and wait the required days before harvest, you should not be over the MRLs.

#### ***The Fisheries Act and Migratory Birds Regulations***

You can be charged if you kill or harm fish or migratory birds with pesticides. This applies to creeks, rivers, and lakes on your own property as well as on public land. It is illegal to introduce pesticides into waters either directly or indirectly through spray drift or run-off.

#### ***Transportation of Dangerous Goods Act***

You cannot transport certain dangerous goods unless you use shipping documents, special labels, and vehicle signs. Ask your pesticide dealer if the product you have bought needs special transport procedures. Growers are usually exempt from this when they are transporting less than 500 kg of pesticide.

# 7 Pesticide Application

## British Columbia Laws

### Integrated Pest Management Act and Regulations

The BC Ministry of Environment also has rules about the sale and use of pesticides in British Columbia. Rules that apply to farmers include:

- 1) Pesticides labeled Restricted or Commercial must be kept in locked storage that is vented to the outside and has a warning sign on the door.
- 2) Anyone buying or using pesticides labeled Restricted must have a valid pesticide applicator certificate issued by the Ministry of Environment. Tables in this chapter tell which pesticides (referred to in this guide) can only be purchased and used by certified applicators.
- 3) People applying pesticides to public land must have a Pesticide Use Permit. Contact the regional Ministry of Environment office for details.
- 4) Businesses selling pesticides must be licensed and their sales people must be certified.
- 5) Anyone applying pesticides in exchange for a fee must have a valid applicator certificate and a Pest Control Service License. But, if you spray your neighbor's crops you do not need a license if the work is done as a favor and no money is exchanged.
- 6) Everyone must dispose of containers and left over pesticides safely.

### WorkSafeBC

WorkSafeBC Regulations for Occupational Health and Safety apply to farmers who must be registered with WorkSafeBC. If you are unsure whether the regulations apply to you, call WorkSafeCB at 1-888-621-7233. FARSHA (Farm and Ranch Safety and Health Association) at 1-877-533-1789 can also provide information on WorkSafeBC regulations.

WorkSafeBC regulations cover conditions of workplaces such as general safety procedures, hazardous substances, pesticides, confined spaces such as silos and storage bins, protective clothing and equipment, tools, machinery and equipment.

The regulations on pesticides outline requirements for pesticide applicator certification, emergency medical care, washing facilities, personal protective clothing and equipment, application equipment, pesticide application, posting warning signs, re-entry into treated areas, record keeping, drift prevention, and aerial application. Copies of the regulations are available from any WorkSafeBC office.

Their pesticide regulations state workers must be over 16 years old and must have a valid pesticide applicator certificate from the BC Ministry of Environment if they mix, load or apply moderately or very toxic pesticides or if they clean or maintain application equipment for these pesticides. Tables in this chapter identify which pesticides, referred to in this guide, can only be used by a certified applicator.

Anyone younger than 25 is considered a young employee and must complete a "new or young employee orientations". FARSHA (1-877-533-1789) can help develop or present a program for your farm.

The WorkSafeBC re-entry requirements are explained in the "Re-entry Restrictions" section of this chapter. Re-entry dates for pesticides used must be recorded on the grower spray record.

## Toxicity

Some pesticides are more poisonous or toxic than others. Pesticides are categorized as very, moderately or slightly toxic. The toxicity of pesticides in this guide are listed in tables in this chapter. The ratings indicate short term toxicity and are based on the LD<sub>50</sub> of the active ingredient. The LD<sub>50</sub>s which correspond to the categories are:

Toxicity	Oral LD <sub>50</sub>	Dermal LD <sub>50</sub>
Very Toxic	0 to 50	0 to 200
Moderately Toxic	51 to 500	201 to 1,000
Slightly Toxic	over 500	over 1,000

The values are only a guide to toxicity to humans.

### Re-Entry Intervals (REI)

Poisoning may occur when people work in treated areas too soon after pesticides have been applied. Poisoning may be from breathing

# 7 Pesticide Application

pesticide fumes or handling treated plants e.g. hand weeding, hand thinning.

The REI is the time people must wait after a pesticide has been applied before they can enter the treated area. The REI allows the pesticide residues to breakdown to levels that do not pose a risk to workers. The REI may be hours or days and varies with each pesticide. There may also be different REI's for each work activity. Tell farm workers about recently treated areas and specific REI. Growers that have employees must post a sign at entry points to fields to tell workers when they can safely enter

the field. Contact FARSHA to obtain signs <http://www.farsha.bc.ca/>.

Most pesticide labels list REI's. Follow the REI on the pesticide label. WorkSafe BC regulations also have REI requirements of 24 hours for slightly toxic pesticides and 48 hours for moderately or very toxic pesticides. If the pesticide label does not have REI, follow WorkSafeBC REI's. If a person needs to enter a treated area before the REI is over, wear the personal protective equipment specified on the pesticide label.

**Table 7.1 INSECTICIDES – Toxicity and Re-entry Intervals**

Trade Name	Common Name	Oral Toxicity	Dermal Toxicity	Re-entry Interval (Label) <sup>2</sup>	Re-entry Interval (WCB)	Applicator Certificate Required by	
						Environment	WCB
Acramite	bifenazate	S	S	12 h - 5 days <sup>3</sup>	24 h – 5 days	no	no
Agri-Mek ☠	abamectin	V	S	dry <sup>1</sup>	48 h	no	yes
Altacor	chlorantraniliprole	S	S	12 h	24 h	no	no
Ambush	permethrin	S	S	dry <sup>1</sup>	24 h	no	no
Assail	acetamiprid	S	S	12 h	24 h	no	no
Clutch	clothianidin	S	S	12 h	24 h	no	no
Delegate	spinetoram	S	S	12 h	24 h	no	no
Diazinon	diazinon	M	S	24 h	48 h	no	yes
Dipel	<i>Bacillus thuringiensis</i>	S	S		24 h	no	no
Entrust	spinosad	S	S	7 days	7 days	no	no
Envidor	spiroticlofen	S	S	12 h – 6 days <sup>4</sup>	24 h – 6 days	no	no
Guthion ☠	azinphos-methyl	V	V	28 days	28 days	yes	yes
Insecticidal Soap	potassium salts of fatty acids	S	S		24 h	no	no
Kelthane	dicolfol	S	S	dry <sup>1</sup>	24 h	no	no
Kumulus	sulphur	S	S	24 h	24 h	no	no
Malathion	malathion	S	S	24 h	24 h	no	no
Movento	spirotetramat	S	S	12 h	24 h	no	no
Nexter	pyridaben	S	S	24 h	24 h	no	no
Pounce	permethrin	S	S	dry <sup>1</sup>	24 h	no	no
Ripcord	cypermethrin	S	S		24 h	no	no
Sevin	carbaryl	M	S	24 h	48 h	no	yes
Success	spinosad	S	S	dry – 15 days <sup>5</sup>	24 h – 15 days	no	no
Surround WP	kaolin	S	S		24 h	no	no
Thionex ☠	endosulfan	V	M	48 h	48 h	no	yes

<sup>1</sup> Workers should not enter treated areas until the residues have dried

<sup>2</sup> A blank square indicates there is no re-entry period indicated on the product label

<sup>3</sup> Do not re-enter treated area for 12 hours. No hand harvesting, tying, pruning, training, leaf pulling, or thinning for 2 days; no cane turning, tying or girdling activities for 5 days.

<sup>4</sup> Do not re-enter treated area for 12 hours. No cane-girdling and turning for 6 days.

<sup>5</sup> No re-entry until residues have dried. No training, tying, hand harvesting, hand pruning and thinning for 7 days; no girdling or cane-turning activities for 15 days.

# 7 Pesticide Application

**Table 7.2 FUNGICIDES – Toxicity and Re-entry Intervals**

Trade Name	Common Name	Oral Toxicity	Dermal Toxicity	Re-entry Interval (Label) <sup>2</sup>	Re-entry Interval (WCB)	Applicator Certificate Required by	
						Environment	WCB
Bordeaux mixture	copper oxychloride	S	S		24 h	no	no
Captan	captan	S	S	48 h	48 h	no	no
Copper Sulphate	copper sulphate	M	S		48 h	no	yes
Dikar	mancozeb + dinocap	S	S	48 h	48 h	no	no
Elevate	fenhexamid	S	S	4 h	24 h	no	no
ferbam	ferbam	S	S		24 h	no	no
fixed copper	copper oxychloride	S	S		24 h	no	no
Flint	trifloxystrobin	S	S	12 h – 12 days <sup>3</sup>	24 h – 12 days	no	no
Kumulus DF	wettable sulphur	S	S	24 h	24 h	no	no
Lance	boscalid	S	S	4 h	24 h	no	no
lime sulphur	lime sulphur	S	S		24 h	no	no
Microthiol Disperss	sulphur	S	S	24 h	24 h	no	no
Milstop	potassium bicarbonate	S	S	4 h	24 h	no	no
Nova	myclobutanil	S	S	dry <sup>1</sup>	24 h	no	no
Quintec	quinoxifen	S	S	12 h	24 h	no	no
Pristine	boscalid + pyraclostrobin	S	S	dry <sup>1</sup> – 21 days <sup>4</sup>	24 h – 21 days	no	no
Rovral	iprodione	S	S	12 h	24 h	no	no
Scala	pyrimethanil	S	S	24 h	24 h	no	no
Serenade	<i>Bacillus subtilis</i>	S	S		24 h	no	no
Sovran	kresoxim-methyl	S	S	48 h	48 h	no	no
Vanguard	cyprodinil	S	S	48 h	48 h	no	no

<sup>1</sup> Workers should not enter treated areas until the residues have dried

<sup>2</sup> A blank square indicates there is no re-entry period indicated on the product label

<sup>3</sup> No re-entry for 12 hours. No pruning, thinning, training, tying and leaf pulling for 5 days. No girdling activities for 12 days.

<sup>4</sup> No re-entry until residues have dried. No hand harvesting, thinning, tying, leaf pulling and hand pruning for 21 days.

# 7 Pesticide Application

**Table 7.3 HERBICIDES and RODENTICIDES/REPELLENTS**

Trade Name	Common Name	Oral Toxicity	Dermal Toxicity	Re-entry Interval (Label) <sup>2</sup>	Re-entry Interval (WCB)	Applicator Certificate Required by	
						Environment	WCB
<b>Herbicides</b>							
Aim	carfentrazone	S	S		24 h	no	no
Casoron	dichlobenil	S	S	24 h	24 h	no	no
Chateau	flumioxazin	S	S	12 h	24 h	no	no
Devrinol	napropamide	S	S	12 h	24 h	no	no
Frontier	dimethenamid	S	S		24 h	no	no
Gramoxone ☠	paraquat	M	M	24 h	48 h	no	yes
Ignite	glufosinate	S	S		24 h	no	no
Karmex	diuron	S	S	12 h	24 h	no	no
Laredo	glyphosate	S	S		24 h	no	no
Round-up	glyphosate	S	S	12 h	24 h	no	no
Touchdown	glyphosate	S	S	12 h	24 h	no	no
Venture L	fluazifop-p-butyl	S	S		24 h	no	no
Wrangler	glyphosate	S	S		24 h	no	no
<b>Rodenticides and Deer Repellents</b>							
Deer-Away	putrescent egg solids	S	S		24 h	no	no
Gopher Getter ☠	strychnine	V			48 h	yes	yes
Ground Force ☠	chlorophacinone	V			48 h	no	yes
Ramik Brown ☠	diphacinone	V	V		48 h	no	yes
ZP ☠	zinc phosphide	V	S		48 h	no	yes
Rodent Bait ☠	zinc phosphide	V	S		48 h	no	yes
Rodent Pellets ☠	zinc phosphide	V	S		48 h	no	yes
Rozol ☠	chlorophacinone	V			48 h	no	yes

<sup>1</sup> Workers should not enter treated areas until the residues have dried

# 7 Pesticide Application

## Pesticide Resistance Management and Chemical Families

Pests can develop pesticide resistance and no longer be effective if similar pesticides are used over and over. Minimize the development of resistance by alternating different types of pesticides. Pesticides are categorized into resistance management groups. The following table lists the pesticide products recommended for use on grape in British Columbia according to their Group Number or Letter. Both Trade Names and Chemical Names (active ingredients) are listed.

All pesticide products have a Group number/letter and the type of pesticide (fungicide, herbicide, insecticide) displayed on the label.

GROUP	<b>4</b>	INSECTICIDE
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Use these Chemical Group numbers to select pesticides as part of a pesticide resistance management program. Do not repeat the use of pesticides with the same Group Number as this will select for resistant individuals or strains within a population. Pest resistance to one product within a class or group number with a single site of action will lead to resistance to all products within that class or group.

Group Number ( <i>chemical group</i> )	Product Trade Name	Chemical Name	Notes
<b>Insecticides/ Mitrice</b>			
<b>1A</b> (Carbamates)	Sevin	carbaryl	
<b>1B</b> (Organophosphates)	Diazinon Guthion ☠ Malathion Sniper ☠	diazinon azinphos-methyl malathion azinphos-methyl	
<b>2</b> (Chlorinated cyclodienes)	Thionex ☠	endosulfan	
<b>3</b> (Pyrethroids)	Ripcord Ambush, Pounce	cypermethrin permethrin	
<b>4</b> (Neonicotinoids)	Assail Clutch	<i>acetamiprid</i> <i>clothianidin</i>	
<b>5</b> (Spinosyns)	Success	<i>spinosad</i>	
<b>6</b> (Avermectins)	Agri-Mek	abamectin	
<b>11</b> (BT microbials)	Dipel	<b>Bacillus thuringiensis</b>	
<b>21</b> (METI acaricides)	Nexter	pyridaben	
<b>23</b> (Tetronic acids)	Envidor Movento	<i>spirodiclofen</i> spirotriamat	
<b>28</b> (Diamides)	Altacor	chlorantraniliprole	
<b>UN</b> (Unknown)	Acramite Kelthane	bifenazate dicofol	R
(Unclassified)	Insecticidal Soap Surround	fatty acids kaolin clay	low risk of resistance development

# 7 Pesticide Application

Group Number (chemical group)	Product Trade Name	Chemical Name	Notes
<b>Fungicides</b>			
<b>2</b>	(Dicarboximides) Rovral	iprodione	Medium to high risk of resistance
<b>3</b>	(DMI-fungicides - triazoles, piperazines) Nova	myclobutanil	High risk of resistance – powdery mildew
<b>7</b>	(Pyridine carboxamides) Lance Pristine*	boscalid boscalid + pyraclostrobin	Medium risk of resistance
<b>9</b>	(Anilinopyrimidines) Scala Vanguard	pyrimethanil cyprodinil	Medium risk of resistance
<b>11</b>	(QoI-fungicides) Flint Pristine* Sovran	trifloxystrobin pyraclostrobin + boscalid kresoxim-methyl	High risk of resistance
<b>13</b>	(Quinolines) Quintec	quinoxifen	Medium risk of resistance
<b>17</b>	(Hydroxyanilides) Elevate	fenhexamid	Low to medium risk of resistance.
<b>M1</b>	(Inorganic) Copper oxychloride (fixed copper) Copper sulphate	copper oxychloride copper sulphate	Low risk of resistance (fungi).
<b>M2</b>	(Inorganic) Kumulus Lime-sulphur Wettable sulphur	sulphur	Low risk of resistance
<b>M4</b>	(Phthalimides) Captan Maestro	captan captan	Low risk of resistance
<b>NC</b>	(Not classified) Milstop Serenade	potassium bicarbonate <i>Bacillus subtilis</i>	Low risk of resistance.
<b>Herbicides</b>			
<b>1</b>	(Cyclohexanones, Oxy-phenoxy-acid ester) Venture	fluazifop-p-butyl	
<b>7</b>	(Ureas) Karmex	diuron	
<b>9</b>	(Phosphanoglycines) Laredo Roundup Touchdown Wrangler	glyphosate glyphosate glyphosate glyphosate	
<b>10</b>	(Phosphorylated amino acids) Ignite	glufosinate	
<b>14</b>	(N-Phenylphthalimides, Triazolinones) Aim Chateau	carfentrazone flumioxazin	
<b>15</b>	(Acetanilides, Chloroacetamides) Devrinol Frontier	napropamide dimethenamid	
<b>20</b>	(Nitriles) Casoron	dichlobenil	
<b>22</b>	(Bipyridyllums) Gramoxone ☠	paraquat	

\* Contains more than one active ingredient

# 7 Pesticide Application

## Hazard Shapes and Symbols

Shapes and symbols on pesticide labels indicate how harmful a pesticide can be. The shapes indicate how hazardous the product is. The symbols inside the shapes show the type of hazard. If symbols are not on labels, the pesticide has very low hazard.

### Exposure










Pesticides can enter your body through the skin (dermal), the mouth (oral), the nose (inhalation),

or the eyes. The skin is the most common route of poisoning for pesticide applicators. Skin contact may occur from a splash, spill or drift. Your skin is most likely to get contaminated when mixing and loading pesticides.

### Hazard

The hazard of using a pesticide depends on both its toxicity and the amount of exposure. Reduce hazards by selecting pesticides with low toxicity and by reducing exposure. Wear personal protective equipment and follow label safety information.

## Pesticide Warning Symbols

<b>Most Poisonous</b>  <b>Danger Poison</b> <ul style="list-style-type: none"><li>Very poisonous</li><li>(oral LD<sub>50</sub> less than 500)</li><li>Always wear a respirator</li><li>Always wear eye protection</li></ul>	→	 <b>Warning Poison</b> <ul style="list-style-type: none"><li>Moderately poisonous</li><li>(oral LD<sub>50</sub> 500 to 1000)</li><li>Wear a respirator in confined space</li><li>Always wear eye protection</li></ul>	<b>Less Poisonous</b>  <b>Caution Poison</b> <ul style="list-style-type: none"><li>Slightly poisonous</li><li>(oral LD<sub>50</sub> over 1000)</li><li>Wear a respirator in confined space</li><li>Could be an eye irritant, eye protection advisable</li></ul>
<b>Most Flammable</b>  <b>Danger Extremely Flammable</b>	→	 <b>Warning Flammable</b>	<b>Less Flammable</b>  <b>Caution Flammable</b>
<b>Most Corrosive</b>  <b>Danger Extremely Corrosive</b>	→	 <b>Warning Corrosive</b>	<b>Less Corrosive</b>  <b>Caution Corrosive</b>



## Poisoning and First Aid

### Symptoms of Pesticide Poisoning

Know the poisoning symptoms of the pesticides you use. Read pesticide labels for symptoms. Effects from pesticide poisoning vary from person to person and are often hard to recognize. Some poisoning symptoms are headache, tiredness, nausea, dizziness, irritation of the skin or nose or throat, blurred vision, tiny pupils, trembling, perspiration, difficult breathing, vomiting, and unconsciousness. Call your doctor or Poison Control Centre immediately if you suspect poisoning. Follow their instructions.

### Poison Control Centre

The Drug and Poison Information Centre is open 24 hours a day. They provide information on first aid and treatments for poisoning. Their phone number is 1-800-567-8911. Post this number by the phone.

Their phone number is also in the front of the phone book under Emergencies.

### First Aid

Make sure you, and other people on the farm, know what to do in case of an emergency. Consider taking a first aid course and CPR course.

If someone has been poisoned:

1. Protect yourself.
2. Move the victim away from the area of contamination.
3. Check if the victim is breathing. If breathing has stopped or is very weak, clear the airway and begin artificial respiration. Continue until the victim is breathing normally or until medical help arrives. When doing mouth-to-mouth resuscitation, use a plastic mask to protect yourself from poison.
4. Call the Poison Control Centre 1-800-567-8911. If the person is unconscious, convulsing or having problems breathing call 911 and obtain medical help as soon as possible. Be ready to tell them the pesticide name, active ingredient and PCP Act registration number.

5. Unless the Poison Control Centre tells you otherwise, follow the procedures listed below, then,
6. Keep the patient at rest, warm and comfortable. Continue first aid treatment. Do not leave the patient alone. Get someone else to arrange transport to the Emergency Department of the nearest hospital

### Eyes

If a pesticide contacts the eyes put on waterproof gloves and hold the eyelids open and rinse with clean water for 15 minutes or more. Do not use an eye cup. Do not use chemicals or drugs in the wash water.

### Skin

If pesticide contacts the skin put on waterproof gloves, remove the contaminated clothing, and drench the affected skin with water, then wash the contaminated area thoroughly with soap and water. Dry the victim and wrap in a blanket. Place contaminated clothing in a plastic bag. Label the bag "pesticides".

### Chemical Burns

Put on waterproof gloves. Remove contaminated clothing. Wash burned areas with large amounts of water. Cover the burned area with a loosely applied, clean cloth. Do not apply any drugs or medications to the burned area. Do not use ointments, greases, creams, lotions or other drugs. If the victim is in shock, keep the person lying down and warm until medical help arrives.

### Inhaled

Protect yourself. If pesticide is inhaled, take the victim to fresh air as quickly as possible; loosen tight clothing and watch for signs of unconsciousness or convulsions. Keep the airway open and begin resuscitation if breathing has stopped or is difficult. Use a plastic face mask to protect yourself. To prevent chilling, wrap the patient in blankets but do not overheat. Keep patient as quiet as possible.

# 7 Pesticide Application

## Swallowed

- Call the Poison Control Centre at 1-800-567-8911 for further advice.
- Do not induce vomiting unless advised to do so by Poison Control
- If the patient is retching or vomiting, place the patient face down with their head lower than their body in the recovery position. This prevents vomit from entering the lungs and causing more damage. Do not let the patient lie on their back. Clean the vomit from the patient and collect some in case the doctor needs it for chemical tests
- When medical advice cannot be obtained, check and follow the pesticide label directions.
- The doctor may recommend activated charcoal be administered to adsorb any remaining pesticide in the stomach. Follow the doctor's instructions. Activated charcoal should be administered only with the advice of a medical attendant or doctor.

## Protective Clothing and Equipment

Wear protective clothing and equipment to minimize exposure to pesticides. Remember to wear safety equipment during mixing and loading, application, and clean-up. Always wear coveralls, waterproof boots, waterproof gloves, and proper hat. You may also need to wear eye or face protection, respirator, waterproof apron, waterproof pants and jacket. The equipment you wear depends on the pesticide and type of application. Therefore, **follow the safety information on the pesticide label.**

### Coveralls

Wear long sleeved coveralls over full length pants and long-sleeved shirts. Make sure the coveralls are closed at the neckline and wrists. Remove your coveralls as soon as you have finished your pesticide activities. Remove them immediately if they become wet through with pesticide. Wear waterproof clothing if you might get wet during pesticide application.

Some disposable coveralls are suitable for pesticide use. Check with your supplier to see which ones can be used for pesticide application. When removing disposable coveralls, take care not to

contaminate the inside if you will wear them again. Between wearing, hang them in a well ventilated area away from other clothing. Do not launder disposable coveralls but do wash clothing worn under disposable coveralls as you would other clothing worn during pesticide use. Replace with a new coverall when severe pilling (balls on the surface), rips or holes appear. To discard, place in a plastic garbage bag and take to a landfill site. Do not burn.

### Gloves

Always wear gloves when handling pesticides. Many glove materials are available. Use unlined waterproof gloves unless the pesticide label recommends a specific material. Do not use gloves made of leather, cloth, or natural rubber or gloves with cloth linings. Make sure the gloves do not have holes or leaks. Keep your coverall sleeves over the gloves and fold down the tops of the gloves to make cuffs. Wash your gloves before removing them and after each use.

### Boots

Wear waterproof, unlined knee-high boots of rubber or neoprene when you load, mix or apply pesticides. Wear your pant legs outside of your boots. Do not wear boots made of leather or fabric. Wash the outside of your boots after each use.

### Goggles and Face Shields

Wear goggles if there is a chance of getting pesticide spray or dust in your eyes. Do not use goggles with cloth or foam headbands. Do not wear contact lenses when handling pesticides. Face shields provide extra protection when mixing and loading toxic pesticides. Wash goggles and face shields after use.

### Hats

Wear a waterproof hat when pesticides may be splashed or when you could be exposed to drift. Wear a wide brimmed waterproof hat when you will get wet with spray. Do not wear baseball caps, fabric hats, or hats with leather or cloth inner bands.

### Aprons

Wear a waterproof apron when you pour and mix concentrated pesticides.

# 7 Pesticide Application

## **Respirators**

Wear a respirator when the label says to wear one; or when the label says to avoid inhalation of dust, vapor, or spray mist; or if there is a danger poison symbol on the label; or if you are applying pesticides in an enclosed space. Make sure your respirator fits. Men should shave before using a respirator as facial hair prevents a proper fit.

Full face respirators give more protection and may be more comfortable than a half face mask and goggles.

**Do not use** dust masks when applying pesticides. They do not protect you from the fumes.

Specially designed, enclosed tractor cabs fitted with air-purifying devices can protect you from pesticide vapors. A regular enclosed cab is not adequate protection if a respirator is required.

Wear special respirators when using a highly toxic fumigant such as methyl bromide. Check the label for details.

Respirators must be approved by NIOSH or an agency sanctioned by the WorkSafe BC (previously Workers' Compensation Board). The cartridges remove toxic fumes from the air. You require cartridges labeled for organic vapors or pesticides for most pesticides. Filters remove dust and mist. Replace both filters and regularly for the respirator to work.

When using respirators:

- Check the intake and exhaust valves.
- Test to make sure there are no air leaks around the face mask. Do an inhalation or exhalation test.
- Change the dust filter after 4 hours of use or more often if breathing becomes difficult.

Change the cartridges after 8 hours of use or sooner if you can smell the pesticide. Replace cartridges at least once a year, and more often if you use them frequently.

## **Cleaning Protective Clothing & Equipment**

Wash your gloves, boots, goggles, face shield and apron soon after application. Remove the cartridges from your respirator then wash the face piece with soap and warm water, rinse it with clean

water and dry it with a clean cloth. Keep the cleaned respirator in a sealed plastic bag in a clean, dry place. Store the respirator and protective clothing away from pesticides and spray equipment.

Discard any clothing that has become soaked with a pesticide.

Launder all your clothing after each day of applying pesticides. Wash protective clothing separately from the rest of the laundry. Do not touch contaminated clothing with bare hands. Use rubber gloves. Pre-rinse clothing using the pre-soak cycle. Use a high water level and the hottest water setting on your machine. Use a heavy-duty detergent.

If clothes are heavily contaminated, run two complete wash cycles. Hang clothes outside to dry in the sunlight if possible. Clean the washing machine by running through a full cycle with detergent and no clothes to remove any pesticide residue.

## **Personal and Environmental Safety Guidelines**

### **Buying Pesticides**

- Take sure the pesticide is registered for your specific use (crop and pest).
- Buy only what you can use up in a year.

### **Transporting Pesticides**

- Never transport pesticides with food, feed, fertilizer, clothing, or household goods.
- Lock up the pesticides if you leave your vehicle.
- Never transport pesticides in the passenger section of any vehicle.
- Ask the supplier if you need shipping papers and vehicle warning signs.

### **Storing Pesticides/Shelf Life**

Pesticides vary in their stability and response to storage conditions. Try to purchase only quantities of pesticides that you will use up in one growing season. However, under proper storage conditions, you can use most pesticides after at least one year of storage. Follow these guidelines for storage:

# 7 Pesticide Application

- The law says “Commercial” and “Restricted” pesticides must be kept in locked storage that is vented to the outside and that has a warning sign on the door.
- Store pesticides in their original container with the original label. If the label is illegible or missing, label it with the trade name, active ingredient and PCP number. Then obtain a replacement label from your dealer or the PMRA website: <http://www.hc-sc.gc.ca/cps-spc/pest/registrant-titulaire/tools-outils/label-etiq-eng.php>
- Never keep pesticides near livestock, food, feed, seed, wells, water supplies, or in your home.
- Pesticide storage should be 30.5 metres from any well.
- Keep herbicides separate from other pesticides.
- Return pesticides to storage when not in use.
- Keep a list of the pesticides in storage.
- Protect the pesticides from extreme temperatures. Some liquid pesticides are destroyed by freezing.
- Close containers when not in use.
- Dispose of unwanted, unmarked and damaged containers.
- Keep containers above floor level to protect from dampness and flooding.
- Post emergency numbers near-by.
- Keep a fire extinguisher, broom and shovel, absorptive material, and protective clothing near-by in case of emergencies.
- Hold the container below eye level when measuring or adding pesticide into the spray equipment.
- Only use mixing equipment for pesticides and return it to locked storage when not in use.
- Triple rinse or pressure rinse pesticide containers as soon as they are empty. Rinse measuring and mixing equipment. Put rinse water into the sprayer.
- Use clean water. The pH of the water should be from 5.0 to 7.0.
- Prevent overflow. Don't leave the tank unattended.
- Prevent contaminating the water supply by leaving at least a 15 cm air gap between the end of the filler hose and the water in the spray tank. You can also use a backflow preventer valve or nurse tank.
- Partially fill the sprayer tank with water before adding chemicals.
- If combining spray materials, follow label information. Add wettable powders before emulsifiable concentrates or crop oils. Keep the agitator running to keep the spray properly mixed. Without agitation, wettable powders may settle out.
- Premix wettable powders before adding to the spray tank. Make a slurry of wettable powder and water and then pour it into the spray tank.

## **Mixing/Loading Pesticides**

- Wear protective clothing and equipment.
- Read and follow label directions.
- Choose a mixing and loading site away from people, livestock, pets, wells, and water bodies.
- Measure accurately.
- Do not rip open paper pesticide bags. Slit them open with a sharp knife.
- Mix pesticides in still or low wind conditions. Stand up-wind of the pesticide.
- Read and follow label directions.
- Use calibrated application equipment.
- Use the label or current production guide rate.
- Wash before eating, drinking, smoking, or using the toilet.
- Have fresh water and emergency supplies on hand.
- Make sure the area to be treated is clear of people and animals.
- Don't work alone when handling very toxic pesticides.
- Post warning signs if necessary to keep people out of treated areas.

# 7 Pesticide Application

- Use separate equipment for applying herbicides.
- Cover or remove animal food and water containers near the treatment area.
- Wear gloves to replace or clean plugged nozzles. Do not blow out a plugged nozzle or screen with your mouth. Use a soft brush or toothpick.
- Shut off the spray nozzles when you turn and stop the flow of spray droplets at the end of rows.
- Pesticides must be registered for chemigation before they can be applied through irrigation systems. Therefore, only apply pesticides through the irrigation system when the label has instructions for chemigation. If chemigation is used, follow *Chemigation Guidelines for BC*. This publication is available from the Kelowna BCMAL office
- Use and maintain the tractor speed chosen during calibration.
- Prevent pesticides from contaminating non-target areas. Leave an unsprayed buffer around lakes, streams, ditches, and wells. Check the pesticide label for the widths of buffer zones. Spray down wind from sensitive areas.
- Minimize drift by:
  - ♦ Not spray in strong winds or dead calm. There is usually less wind in the early morning and late evening.
  - ♦ Not spray when temperatures are greater than 30° C.
  - ♦ Using boom sprayers with as low pressure as possible, the correct nozzles, large volumes of water, and setting the boom as near to the ground as possible to still get uniform coverage.
  - ♦ Use a drift control agent.
  - ♦ Using drift guard or other specialty nozzles that reduce drift.

## **After Applying Pesticides**

- Clean application equipment away from water supplies.
- Remove and clean protective clothing and equipment.
- Shower.
- Keep records of every application.

## **Disposal of Unwanted Pesticides**

- Calculate the amount needed so none is left over.
- Do not re-spray an area to get rid of leftover spray.
- Apply left over material according to label directions on another site or crop listed on the label. Do not put unwanted pesticides into sewers, down drains, or on the land.
- More information on pesticide disposal and the pesticide return program is at <http://www.al.gov.bc.ca/pesticides/>.

## **Disposal of Containers**

- Drain the container into the spray tank for at least 30 seconds or shake out the bag.
- Triple or pressure rinse drums, glass bottles, plastic and metal containers. Single rinse plastic and paper bags.
- Put the rinse water into the spray tank.
- Crush, puncture or damage empty containers so they cannot be re-used.
- Return the containers to your pesticide storage until you can recycle them or take them to an approved landfill.
- Pesticide containers can only be buried if the burial location is:
  - on land owned or leased by the person owning the container
  - on flat ground, not a swale and at least 200 metres from surface water of a well, The ground does not consists of gravel, sand or other similarly porous material

Do not burn pesticide containers.

## **Re-Entry Intervals (REI)**

Details on REI are earlier in this chapter after the “Toxicity” section.

## **Grazing Restrictions**

If animals are to graze a treated area, check the pesticide label for grazing restrictions. Wait the required time before grazing.

## **Harvesting Restrictions**

The pre harvest interval (PHI) or days before harvest (DBH) is the time between the last application of a pesticide and the crop harvest. Follow the

# 7 Pesticide Application

pre-harvest interval (days-to-harvest) before harvesting to prevent unsafe and illegal residues of pesticides on food crops. Pre-harvest intervals are on pesticide labels.

## Special Environmental Precautions

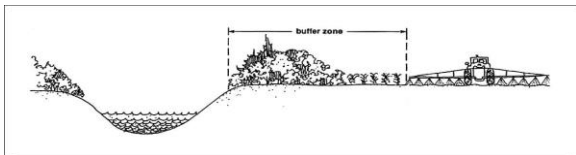
### **Buffer Zones**

Many pesticide labels have buffer zone requirements. Buffer zones are strips of land next to sensitive areas that cannot be treated with a pesticide (see figure below). The purpose of the buffer zone is to protect sensitive areas from pesticide drift.

A buffer zone is measured between the point of direct application and the closest downwind edge of sensitive habitat, thus they depend on wind direction. The pesticide label may specify:

- Whether the buffer zone is to protect aquatic (waterbodies) and/or terrestrial (planted) habitat
- What is considered to be aquatic or terrestrial habitat
- The type of pesticide application equipment that requires a buffer zone and any types of application equipment that do not need a buffer zone
- The buffer zone size (often in a table)
- If and how buffer zones can be reduced; the use of drift reducing spray shields, special nozzles, or other application modifications may allow the applicator to reduce the buffer zone.

### Measuring Aquatic Buffer Zones



### **Protecting Fish and Other Wildlife**

All insecticides, as well as some fungicides and herbicides, are very toxic to fish. Insecticides are toxic to birds and wildlife. Exposure to trace amounts of these pesticides may kill fish or birds. Destroying the vegetation along fish-

bearing water harms fish by removing food and shelter.

Protect fish and wildlife from pesticide poisoning by following label precautions, safety guidelines in the guide, and the guidelines below.

- Use pesticides only when necessary.
- Select the least toxic and least persistent pesticides.
- Leave a buffer zone along all bodies of water to keep pesticides out of the water.
- Do not destroy vegetation along fish bearing waters and do not spray with pesticides.
- Incorporate granular insecticides.
- Use precautions to prevent drift, leaching and run-off to areas outside the treated area.
- Store treated seed where it cannot be eaten by animals.
- Place baits in covered bait stations.

### **Protecting Bees and Beneficial Insects**

Bees and other pollinating insects are essential for the production of many crops. Some other insects help control pests. Many pesticides, particularly insecticides, are very toxic to honeybees, wild bees, and beneficial insects. Poisoning of these occurs when foraging insects contact contaminated blossoms. They may also be killed when collecting water from contaminated sources or when flying through pesticide mists during applications. Protect these insects from pesticide poisoning by:

- Telling nearby beekeepers about your spray program.
- Not applying pesticides near hives.
- Not applying pesticides toxic to bees when plants are in bloom.
- Selecting formulations least harmful to bees. Microencapsulated formulations are very hazardous; dusts are more hazardous than sprays; wettable powders are more hazardous than EC and liquid formulations; granular formulations are least hazardous to bees.
- Minimize drift

# 7 Pesticide Application

- Timing applications carefully. Evening sprays are less hazardous than morning sprays. Both are safer than midday.

## Protecting Groundwater

Groundwater is the source of water for wells and springs. It is very difficult to clean contaminated groundwater. The best solution to groundwater contamination is prevention.

Groundwater contamination is most likely to occur where soils are gravelly or sandy, the water table is close to the soil surface, there is high rainfall or extensive irrigation, or the pesticide is injected or incorporated into the soil. Pesticides that are persistent in the soil, are weakly absorbed and leach quickly, or are highly soluble may contaminate groundwater.

Remember to avoid spills, drift, and irrigation run off and to properly dispose of unwanted pesticides and empty containers. Never store pesticides near wells or pump houses and guard against leaking containers.

## Pesticide Application Equipment

Using pesticides requires accuracy and caution. To accomplish this, use proper equipment, maintained in good condition and calibrated regularly.

### Tree Row Volume Spraying

Tree Row Volume (TRV) is a measurement of the volume of trunk, limbs and leaves in a hectare or acre of vines. Research in the Okanagan and elsewhere has shown conclusively that adjusting the volume of spray mixture applied for vine size prevents over application. For example, excessive pesticide or nutrient sprays may result in residues that exceed allowable levels, leaf and fruit burning, and unnecessary loss of beneficial insects and mites. To use TRV, an adjustment in sprayer calibration (i.e. change nozzles, pressure, or travel speed) will be required to apply the calculated volume of spray mixture.

Calculate TRV as follows:

$$\text{TRV} = \frac{\text{area of hectare (or acre)} \times \text{vine height} \times \text{vine width}}{\text{row width}}$$

$$= \frac{10,000 \text{sq m}}{1.8\text{m}} \times 1.5\text{m} \times 0.6\text{m} = \frac{43,560 \text{sq ft}}{6\text{ft}} \times 5\text{ft} \times 2\text{ft}$$

$$= 5,000 \text{ cubic metres} \qquad = 72,600 \text{ cubic feet}$$

Blow-through is another problem in high density plantings with our existing PTO driven sprayers. There are actual pesticide losses because the spray mix droplets and air are going so fast that they go around leaves instead of hitting a leaf. Therefore as much as it is practical, reduce air speed so more spray hits the vines and leaves. To achieve this, various options are available for sprayers: smaller fans, two speed sprayer gear boxes and fans that allow adjustment of blade tilt to reduce or increase air speed. In addition, reduce air speed by reducing tractor engine speed. Slow speed in a given gear, or use a higher gear and lower engine speed to achieve the same ground speed and reduce fan speed.

### Closing Nozzles

Prevent overspray and drift by reducing the number of nozzles to fit the spray pattern with the vine size. Just closing the top nozzles to reduce spray volume will not necessarily give the proper spray volume or pattern required for proper coverage. It is important to calculate TRV for the vineyard planting and use that water volume in the calculation for the sprayer calibration.

**It is important not to reduce the concentration of the chemical** because this will reduce the effectiveness of the chemical.

For immature vines, use the same method of calculating Tree Row Volume. To reduce spray volume, use fewer and smaller nozzles, increase tractor ground speed and reduce pressure. For most sprayers, do not go below 100 psi as spray droplet size changes too dramatically.

Because vine canopies change through the growing season due to growth and increased foliage density, it may be necessary to increase the Tree Row Volume initially calculated for the beginning of the season as the growth increases throughout the season.

# 7 Pesticide Application

## ***Alternate Row Spraying***

Some growers are spraying alternate rows when they cannot reduce blow-through adequately or early in the growing season (less canopy). This can work well for rows less than 3.6 m if the spray penetrates and swirls through the row. The next time a spray is applied, start in the panel next to where spraying began the first time to obtain good control and coverage in most vineyards. Do not use this technique once blow-through is insufficient to give proper canopy coverage in the adjacent rows.

## **Sprayer Calibration**

**It is important to properly calibrate sprayers in order to deliver and apply spray material accurately and uniformly.** Not only does proper calibration ensure reliable pest control, but also minimizes the risks of crop injury, excessive chemical residues and environmental contamination. Tractor speed, row width, nozzles and pump pressure combined with tree row volume calculation, will determine the volume of spray mixture applied per hectare or acre. Using properly calibrated sprayers and Tree Row Volume can result in substantial savings in chemical costs.

**Each grower should complete the following sprayer calibration check list** before each spray season to ensure the sprayer(s) is in good working order and properly calibrated. Have your owner's manual handy to check manufacturer's specifications where required. Whoever checks the sprayer should initial parts/functions operating correctly. Replace any defective parts immediately and note the date of repair on the check list for future reference. Seek advice where difficulties arise in completing the check list or checking the calibration.

For additional information on maintaining sprayers, see the publication *Suggestions for Field Sprayer Operation and Maintenance* on the BCMAL web site at <http://www.al.gov.bc.ca/resmgmt/publist/200series/234005-1.pdf>.



# 7 Pesticide Application

## Sprayer Calibration Checklist

**Be careful when working around equipment while the tractor is running.**

Engage the hand brake when off the tractor and ensure transmissions are in “neutral”.

Sprayer part / Function	What to check for	OK	Date repaired
1. Hoses	• Splits and cracks, especially where hoses pass through or around objects		
	• Leaks at connections		
2. Filters	• Leaks, damaged seals and filter elements, blocked filter		
3. Tank	• Leaks due to cracks, punctures or other damage		
	• Ensure venting system is clear		
	• The tank sits firmly in its mount		
	• The securing straps are correctly adjusted		
	• Intake lines are properly secured and in good		
	• Shape (no leaks, cracks, creases)		
4. Agitation System	• Mixing basket is intact (no cracks, holes) and clean		
	• Agitation system is working properly		
	• If mechanical agitation system make sure that: ✓ Maximum adjustment is available on the packing gland		
	✓ The other end of agitation shaft is supported properly ✓ The bearings are not worn ✓ The paddles are turning and in the correct positions		
5. Tires / Wheels	• Tires have no cuts and have correct tire pressure		
	• Wheel nuts are all present and tight		
	• Wheel bearings for tightness		
6. Controls	• Control circuitry (electronics, hydraulic or air) for correct operation		
	• Pressure control valves operate smoothly and properly		
	• Shut-off valves operate properly (tank shut-off valves, nozzle, controls)		
7. Pressure Gauge	• That gauge reads “ZERO” when sprayer is not operating		
	• Gauge contains proper level of fluid		
	• Needle does not jump around when sprayer is running		
8. Nozzles	• Nozzles are not worn, corroded or plugged. <i>(A gauge is available to check the output of nozzles)</i>		
9. Hitch	• Hitch and safety chain are correctly positioned and intact		
10. Calibration	• Calibration of your sprayer(s) following the instructions below		

# 7 Pesticide Application

## Mixing Chemicals

Mark off the distance to cover one acre or one hectare in a level area of your vineyard.

You can calculate this distance as follows:

### One Acre:

- A) Multiply row width \_\_\_\_\_ft X row length \_\_\_\_\_ ft = \_\_\_\_\_sq ft
- B) Divide 43,560 by values (A) = \_\_\_\_\_, the number of rows you must travel to cover 1 acre.
- C) Multiply value (B) by row length to get the distance (feet) you must travel to cover 1 acre.

For example – a vineyard is planted with row width = 9 feet and row length = 600 feet.

- A) 9 ft X 600 ft = 5,400 sq ft
- B)  $43,560 \div 5,400 = 8$  (the number of rows you must travel to cover an acre)
- C)  $8 \times 600 \text{ ft} = 4,800 \text{ ft}$  (the distance to travel to cover an acre)

### One Hectare:

- A) Multiply row width \_\_\_\_\_ft X row length \_\_\_\_\_ m = \_\_\_\_\_sq m
- B) Divide 10,000 by values (A) = \_\_\_\_\_, the number of rows you must travel to cover 1 hectare.
- C) Multiply value (B) by row length to get the distance (meters) you must travel to cover 1 hectare.

For example – a vineyard is planted with row width = 2.7 m and row length = 183 m.

- A) 2.7 m X 183 m = 494 sq m
- B)  $10,000 \div 494 = 20.25$  (the number of rows you must travel to cover an hectare)
- C)  $20.25 \times 183 \text{ m} = 3,704 \text{ m}$  (the distance to travel to cover an hectare)

Once inspection of the sprayer is complete and necessary repairs made:

1. Fill the sprayer tank and spray the test acre or hectare at the speed, RPMs etc. at which the sprayer was previously calibrated.
2. Compare the volume of spray actually delivered to the volume for which the sprayer is calibrated.
3. Adjust the sprayer controls and re-test until the calibrated and test spray volume outputs are within 5% of each other (i.e. +/- 5 L/100 L.)

## Maintenance and Operation of Air-Blast Sprayers

Good control of vineyard pests and diseases requires proper maintenance and operation spray equipment. If you are not familiar with air-blast sprayers, you should study the bulletin *Air-Blast Orchard Sprayers - An Operation and Maintenance Manual*, published by the Research Station, Summerland. Or obtain a copy of the BCMAL fact sheet *Suggestions for Field Sprayer Operation and Maintenance*.

Make sure you know the capabilities and shortcomings of your sprayer so you can use it to the best advantage.

Attention to the following points will help to do a good spray job:

1. **Do not spray in the wind or in dead calm.**
2. **Travel between 1.5 and 3 km per hour (25-50 m per minute).** The speed of travel is governed by density of foliage, vine size and spacing, and by sprayer efficiency. The speed must be slow enough to permit the spray-laden air-stream to penetrate through the foliage.
3. **Keep the fan blades clean.** Dirty blades cannot pump air efficiently.
4. **Operate the fan at the correct speed.** A drop in fan speed means a drop in air velocity and volume.
5. **Use an accurate pressure gauge and read it frequently.** The gauge should be mounted where it can be easily seen from the tractor seat. Regularly compare the gauge with an accurate (new) gauge.
6. **Select suitable nozzles for the job.** For low-volume air-blast spraying 550-850 L/ha (220-345L/acre), the nozzle disk orifices should be between 1.2 mm and 2.4 mm in diameter and the swirl plates should have two openings not greater than 1.6 mm in diameter. For high-volume spraying, the nozzle dimensions are not as critical. To avoid excessive deposits in the lower portion of the vines, use smaller disks in the lower part of the nozzle boom than in the upper part. When spraying small vines, you can reduce waste of spray

material by putting blanks in some of the upper nozzles.

7. **Calibrate the sprayer.** Calibrating sprayers makes sure they are applying the right amount of pesticide uniformly to the crop. Calibrate using water only. Check nozzle output and tractor speed accurately so you know exactly what area you can cover with a tank of spray mixture. If the tank covers 0.64 ha, put enough chemical in the tank to treat 0.64 ha.
8. **Keep your sprayer clean.** Flush out the tank, pump, strainers and nozzles thoroughly before calibrating and after each day's spraying.
9. **Air shear nozzles** – To obtain adequate spray droplet break-up with air-shear nozzles, the air velocity must be at least 250 km/hr.

## Sprayers Classified According to Volume of Spray Mixture per Acre

### Ultra Low Volume

The term “ultra low volume” is used when the total volume of spray applied per hectare is 5.5 L or less (2.2 L/acre) and the material is undiluted.

### Low Volume

In low-volume spraying the pesticide is diluted, but the mixture is applied at a rate that will give no run-off from leaves and fruit. It is often referred to as “concentrate” spraying. The usual range is 550 - 850 L of spray mixture per hectare (220-345 L/acre), but may be as low as 110 - 175 L/ha (45-70 L/acre).

### Medium Volume

In medium volume spraying there is considerable running together of the spray droplets but little actual run-off of spray mixture from leaves and fruit. It is often referred to as “semi-concentrate” spraying. The usual range is from 1100-2200 L spray mixture per hectare.

### High Volume

High-volume spraying is characterized by a running together of the spray droplets to thoroughly wet all parts of the vines. It always results in considerable run-off of the spray mixture. (2270 L/acre) are common.

## Vineyard Weed Sprayers

Vineyard weed sprayers have special features that distinguish them from other sprayers.

1. Low pressure. To minimize spray drift, the pump pressure of herbicide sprayers should not exceed 280 kilopascals (kPa) or 40 lbs pressure per square inch (psi).
2. Boom features. To spray under branches in the row, weed sprayers use a single boom with 2 - 4 nozzles. The end nozzle should have a special off-centre nozzle tip, or be a swivel nozzle directed at an angle to provide coverage of vegetation in the tree row. The boom should be hinged at the tractor end to prevent breakage when the boom strikes vine trunks, posts, or wires, and the boom height should be easily adjustable to accommodate spraying of vegetation of different heights.

Other features of weed sprayers are common to any chemical spraying equipment.

A detailed description of available similar herbicide applicators, how they function, and precautions to be taken are included in the publication *Orchard Floor Vegetation Management Options - Orchard Weedspraying* (1986) available at the Kelowna BCMAL office.

### **Weed Sprayer Calibration**

There are at least three good reasons why herbicide spraying equipment calibration is of utmost importance: (1) excessive rates can result in damage to vines; and (2) low rates can result in lack of control; (3) non uniform applications can cause both damage and poor control. This wastes expensive time and pesticides. Calibration of weed sprayers is described in the BCME *Pesticide Applicator Course for Agricultural Producers*.

### **Sprayer Cleaning**

Immediately after use, flush out the sprayer with soapy water or a sprayer cleaning compound and rinse with clean water.

Some herbicides are particularly hard on roller pumps. Take special care to rinse out those pumps after the use of these herbicides. After cleaning the system thoroughly, it is a good practice to add a small amount of oil (not diesel or stove oil) to the system to maintain the roller pump in good condition.

## Special Precautions

1. Make sure the area treated is equal to the area used for calculating the rate. For example, if you calculate the rate for a granular application for 1.8 x 1.8 m around a vine, but only treat a 1.2 x 1.2 m area, the calculated amount of herbicide covers 1.44 m<sup>2</sup> instead of 3.24 m<sup>2</sup>. You end up applying more than double the rate.
2. Uniform application is important to assure both crop safety and the desired pest control. For example, if you halve the travel speed at the end of rows of a sprayer calibrated at 3.2 km/hr, you will apply twice the amount of chemical at the slower speed.
3. Do not use a herbicide sprayer for applying other pesticides or liquid fertilizers.
4. Do not apply herbicides by hand gun as their high operating pressures can cause drift and uneven application. Spray drift may injure vine foliage and fruit, and may be a hazard to the applicator, e.g., paraquat (Gramoxone)☠.
5. Portable spinning disc applicators (e.g. Herbi) apply chemicals in ultra low volumes of water. Droplet sizes are small and the spray is prone to drift even in situations of low wind or updrafts in hot, calm weather.

# 7 Pesticide Application

## Spray Record Form

Date	Block	Section	Acres	Tractor Operator	Product & PCP #	Target	Rate/ha	Water Volume (L/ha)	Application Type/Sprayer Used	Nozzle Type & # Used	Sprayer PSI	Date & Start Time	Finish Time	Re Entry Date/Time	Weather Condition and T°

Download additional copies (legal size) from BCMAL website: [www.al.gov.bc.ca/grape/factsheets.htm](http://www.al.gov.bc.ca/grape/factsheets.htm)

Please refer to the **[Pest Control Products Recommended for Use on Grapes in British](#)**