

Pesticides in Alberta's Agricultural Watersheds

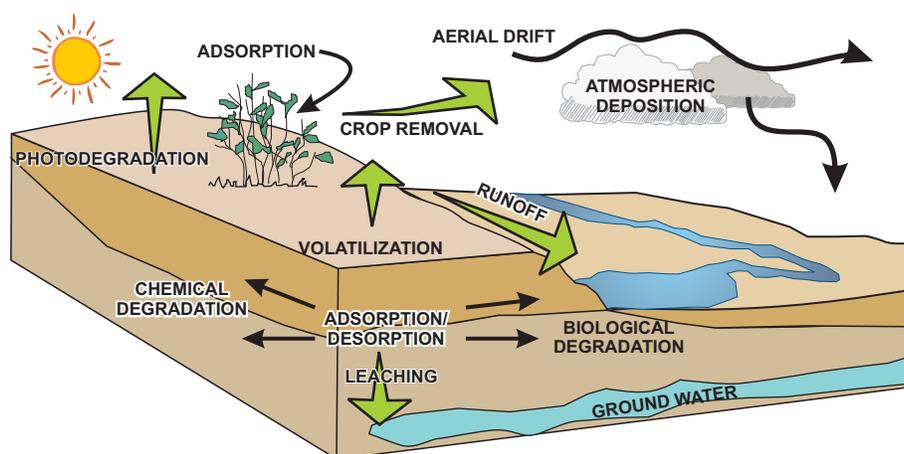
Pesticides are an integral part of agricultural production and agriculture is the largest user of pesticides in Alberta with 97% of sales being used for this purpose in 2008. Producers in Alberta are legally responsible for safe pesticide use under the Environmental Protection and Enhancement Act, and producer awareness of pesticides is very high. Monitoring studies have shown that pesticides are reaching Alberta's agricultural streams, including irrigation water. While pesticide concentrations in surface water are generally low, they are commonly detected and the potential risks to aquatic life and irrigated crop production are not completely understood. These findings highlight the need for pesticide applicators to minimize the risk of mobilizing pesticides into surface water before, during, and after spraying.

How do pesticides get into the surface water?

Pesticides, which include herbicides, fungicides and insecticides, can be carried from fields into water bodies in several ways. Pesticides can directly enter the water as drift from spray. They can also be transported if they are dissolved in runoff water, attached to soil particles and carried by wind or runoff water, or volatilized and deposited by rain or snow. Volatilization occurs when soil or liquid pesticide residues vaporize following application, however not all pesticides volatilize. The likelihood of volatilization depends on the vapour pressure of the pesticide along with environmental factors such as temperature, relative humidity, and air movement. Once airborne, volatile pesticides can move long distances off-site and eventually be deposited through precipitation.

Factors that affect pesticide movement include soil properties (texture and organic matter), moisture conditions (rainfall and irrigation), water table levels, and pesticide characteristics (solubility, mobility, and degradation rate).

- Pesticides dissolved in water will move faster through soils that are coarse in texture like gravel or sand and have lower organic matter content.
- Pesticide runoff risks are increased during snowmelt, rainfall and irrigation. Runoff risks are also higher if the water table is high.
- Pesticide movement through soil will occur faster with those chemicals that have higher solubility and lower adhesion characteristics.
- Further, those pesticides with a slow degradation rate are more likely to be found in the soil in the future.



Modes of pesticide transport in the environment (ARD 2010).

What we know about pesticides in agricultural surface waters

Two monitoring programs examined pesticide presence within surface waters in agriculturally dominated watersheds in Alberta: the Alberta Environmentally Sustainable Agriculture (AESA) Stream Survey from 1999 to 2006 and the Assessment of Water Quality in Alberta's Irrigation Districts in 2006 and 2007.

The studies found that pesticides are commonly detected in Alberta's streams. From 1999 to 2007, pesticides were detected in nearly all samples from Alberta's irrigation canals and in more than half of the samples collected from small streams in Alberta's agricultural region. Pesticides that had the most frequent detections were those with higher sales, greater mobility and longer persistence such as 2,4-D, MCPA, and glyphosate. Glyphosate (RoundUp®), the top selling active ingredient in Alberta, was detected in 33% of samples taken in 2007 from small agricultural streams in Alberta; however, all concentrations were below protection of aquatic life and livestock drinking water guidelines. Monitoring studies also revealed that most often, two pesticide compounds were found in water samples, but on occasion, as many as eight pesticide compounds were found in a single water sample. Guidelines for livestock watering and the protection of aquatic life were rarely exceeded. However, guidelines for irrigation were frequently exceeded, and this may be a concern for sensitive crops.

What we don't know about pesticides in agricultural surface water

In the AESA Stream Survey, there were 21 pesticides that were detected that currently do not have guidelines. Of these, there were four herbicides (triclopyr, clopyralid, mecoprop, and imazamethabenz-methyl) that were detected in 10 to 15% of samples. Similar herbicides were detected in the irrigation district canals including clopyralid, dichlorprop, and mecoprop; however, their detection frequencies were less, ranging from 3 to 12% of samples. Without guidelines, it is not possible to assess risk of these pesticides.

Products such as Remedy EC®/Remedy MSO®, Lontrel 360®/Lontrel Dry®, Eclipse III®, Curtail M®, FlaxMax®, Mecoprop-P®, and Assert 300® contain the herbicides mentioned above that do not have water quality guidelines.

Although the studies provided a better understanding of pesticide occurrence in Alberta's agricultural surface waters, we do not understand the effects of multiple pesticide compounds co-existing in water in addition to other contaminants that may be present. Alberta Environment and Sustainable Resource Development suggested the occurrence of pesticide mixtures may pose a toxicity risk to aquatic life.

Of the 1627 samples taken during the AESA Stream Survey, 4% had simultaneous exceedences of two or three guidelines. Within irrigation district canals, 23% of 647 samples had simultaneous exceedences of two or three guidelines.



What can you do to reduce the risk of pesticides entering surface waters?

One or more of these categories may be applicable to your operation.

Prevent runoff and direct contact

- Refer to the Crop Protection Book to better understand the chemical properties like the persistence and mobility of the pesticides you use.
- Read and follow pesticide labels.
- Calibrate your sprayer to ensure it is applying at the recommended application rates.
- Mix and load equipment and ensure application is at least 30 m away from water bodies as specified in Alberta's Environmental Protection and Enhancement Act.
- Stop back siphoning or over filling of the sprayer.
- Clean up spills immediately.
- Before spraying, check equipment for leaks and malfunctions.
- Pesticides should not be applied if it is raining or if rain is forecasted within 24 hours.
- Store containers above the floodplain and in a locked storage area.
- Triple rinse empty containers with water and dispose of containers properly.

Prevent spray drift

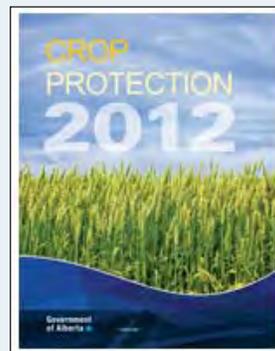
- Refer to the Crop Protection Book or contact a specialist to ensure you choose the right chemical for your environment.
- Apply pesticides when spray drift risk is low (wind should be less than 16 km/h) and when winds are blowing away from farmsteads, sensitive crops, and/or water bodies.
- Leave a 30-m buffer between water bodies and spray area.
- Calibrate your sprayer and use appropriate nozzles for proper application rates.
- Use appropriate adjuvants and stickers to reduce the risk of spray drift.

Prevent volatilization

- Decrease volatilization by using pesticides that have a low vapour pressure.
- Understand how volatilization can increase depending on soil, weather conditions, and droplet size. Pesticides volatilize most readily from sandy and wet soils. Hot, dry, or windy weather and small spray drops also increase volatilization.
- Where recommended, incorporate the pesticide into the soil as this can help reduce volatilization.

Prevent leaching or sub-surface runoff

- Refer to the Crop Protection Book to understand the potential for the active ingredient to leach and persist in the environment.
- Be particularly cautious if you have a shallow water table and coarse-textured soils in the field being treated, as these conditions increase the risk for leaching and contamination.



The Crop Protection Book often highlights environmental precautions including solubility, adsorption, and degradation rates of agricultural pesticides.

Be Aware

Education and awareness may be the best approach to protect agricultural production and our watersheds from non-target pesticides.

- A Pesticide Applicator Certificate is offered through Lakeland College and is required if you are applying pesticides on property not owned, rented or leased by you. It is also required if you are hired to spray.
- A Farmer Pesticide Certificate is offered online by Alberta Agriculture and Rural Development and is mandatory if you are using aluminum phosphide. This certification is encouraged for every producer.
- Be aware that there is potential for crop damage when utilizing irrigation water, particularly on special crops. Watch for symptoms and call the Ag-Info Centre (310-FARM) if you suspect pesticide related crop damage.

Where can I learn more on-line?

<http://www.agric.gov.ab.ca>

Enter the following in the search option:

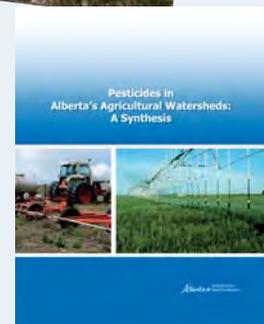
- Crop Protection
- Farmer Pesticide Certificate
- Pesticide container disposal sites
- Assessment of Environmental Sustainability in Alberta's Agricultural Watersheds - Volume 3: AESA Water Quality Monitoring Project
- Irrigation Districts Water Quality Project 2011 to 2015
- Pesticides in Alberta's Agricultural Watersheds: A Synthesis

Prepared by:

Colleen Phelan and Kristen Lorenz
Water Quality Branch
Irrigation and Farm Water Division
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Editors:

Andrea Kalischuk, Harry Brook, and Barry Olson
of Alberta Agriculture and Rural Development.



For more information:

Irrigation and Farm Water Division
Agriculture Centre
100, 5401 – 1 Avenue South
Lethbridge, Alberta, Canada, T1J 4V6
Phone 403-381-5140