2010

Pesticide Sales in British Columbia

Integrated Pest Management Program

Ministry of Environment

BRITISH COLUMBIA | Ministry of Environment

Executive Summary

In order for any regulatory agency to operate in an effective, risk-based fashion, it is important to have current data on key aspects of the industries it regulates. The Ministry of Environment's Integrated Pest Management (IPM) Program regulates the sale and use of pesticides in British Columbia, and strives to reduce risk to human health and the environment from pesticides by carrying out targeted actions and strategies. To help achieve this goal, we undertook an analysis of current data on the sale of pesticides in the province, which can be used as a tool in the guidance of policy development and program management.

To carry out this analysis, IPM Program staff designed and built a database and information management system to process the large volume of pesticide sales and use data that is collected annually from pesticide vendors and users. We then used this system to analyse the 2010 sales of all commercial pesticides, breaking down the data by pesticide type, sector of use, region of sale, and agricultural pesticide use intensity. Where possible, our data was then compared to previous data for B.C. from 2003, and the most current data from other provinces.

The highlights of our results for 2010 commercial pesticide sales include:

- Pesticide vendors in B.C. sold a total of 2,955,302 kilograms of commercial formulated products, which represented a total of 1,289,933 kilograms of active ingredient.
- The top five active ingredients sold were insecticidal mineral oil, glyphosate, sulphur, chlorothalonil, and herbicidal mineral oil.
- Herbicides accounted for 35% of the active ingredient sales, followed by insecticides at 33%, fungicides at 27%, and all other pesticide types at 5%.
- Pesticide products sold into the agricultural sector accounted for 87% of all active ingredient sales, with industrial vegetation, noxious weed and forestry products accounting for 6% of sales, turf, golf course, and landscaping products accounting for 5% of sales, and structural and mosquito products accounting for 2% of sales.
- Forty five percent of all pesticides were sold in the Lower Mainland region, while 44% were sold in the Southern Interior region, and 11% were sold in the North region.
- Since 2003, sales of many active ingredients have changed considerably. Sales of many older active ingredients such as azinphos-methyl and endosulfan have declined, while sales of many newer actives such as imidacloprid have increased. Sales of glyphosate have increased by 106% and sales of 2,4-D have increased by 44% since 2003.

- In comparison to other provinces, B.C. pesticide sales are lower than those in Alberta, which reported sales of 12.5 million kilograms of active ingredient in 2008, and those in Québec, which reported sales of 4.0 million kilograms of active ingredient in 2009.

- The agricultural pesticide use intensity for the province was 1.81 kilograms of active ingredient per hectare of cropland. This measure of pesticide use intensity in agriculture is higher than Alberta's, at 1.02, but lower than Québec's, at 3.12, likely reflecting differences in factors such as crop type and pest pressure among the three provinces.

Some of the key factors driving the significant changes in the sales of many active ingredients include: product registrations ending for many older pesticides, the registration of products with new chemistries, and forces affecting agriculture such as changes in crop type, pest pressures, and pest management practices. Our results reflect the fact that industries using pesticides in B.C. are constantly evolving, and this type of analysis is essential for us to have current knowledge upon which to prioritize activities and implement effective strategies for risk reduction.

Looking forward, it is hoped the scope of future reports can be broadened to include data on pesticide users in B.C., which would further increase our knowledge of a number of sectors, and should help us to better understand the underlying reasons behind some of the sales trends reported here. The reporting and sharing of this type of information will not only help the IPM Program to continue to work in collaboration and dialogue with other agencies, industry stakeholders, and the public, but also serve to promote the mandate of transparency and open government for British Columbians.

Photo source: PNASH

Products sold into the agricultural sector accounted for 87% of all commercial pesticide active ingredient sales in British Columbia in 2010

Acknowledgments

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Introduction

Background

Each year, the Ministry of Environment's Integrated Pest Management Program collects pesticide sales and use data from licensed pesticide vendors and users in B.C. The data collected represents valuable information on pesticide sales and use trends in different sectors and regions of the province over time. However, the large amount of data collected each year makes it challenging for the Ministry to enter, analyse, and report out on this data regularly. To improve this process, the Ministry recently developed a new database and information tracking system that can efficiently handle the large volume of annual sales and use data collected from pesticide vendors and users. These new systems now give us the capacity to conduct this type of analysis and report out on a more regular basis, which should lead to a better understanding of how sales and use trends in B.C. are changing over time.

The last major report out on B.C. pesticide sales and use data occurred in 2005, and represented a comprehensive survey of pesticide sales and use data from the calendar year of 2003 (ENKON Environmental Limited, 2005). Previous surveys of B.C. pesticide sales and use had been conducted for data collected in 1999 (ENKON Environmental Limited, 2001), in 1995 (Norecol, Dames & Moore, 1997), and in 1991 (Norecol Environmental Consultants, 1993). The long-term objective of those surveys was to determine trends in pesticide sales and use over time. Since the last survey of pesticide sales and use in 2003, the *Integrated Pest Management Act* has replaced the old *Pesticide Control Act*. In addition, a number of regulatory and market-driven forces have significantly changed the landscape for pesticide sales and use in this province, including the removal of older products from the market, the registration of new active ingredients, and the implementation of municipal pesticide use restrictions in many areas. However, to date we have not had the capacity to fully analyse annual pesticide sales or use data, which would give us a clearer picture of the specific nature of the changes occurring.

A number of other regulatory bodies in Canada have also reported out on pesticide sales in recent years. Alberta has produced a summary of pesticide sales every five years since 1988, with the most recent report detailing pesticide sales in 2008 (Byrtus, 2008). Québec has tabulated sales data every year since 1992, with the most recent data available for 2009 (Ministère du Développement durable, de l'Environnement et des Parcs, 2012). Prince Edward Island (P.E.I.) has pesticide sales data available for the year 2008 (P.E.I. Department of Environment, Energy and Forestry, 2009). At the federal level, Environment Canada produced a compilation of sales and use data from across Canada (Brimble, Bacchus, & and Caux, 2005), and the Pest Management Regulatory Agency (PMRA) recently published a national report on pesticide sales for the years 2007 and 2008 (Pest Management Regulatory Agency, 2012). All of these reports emphasize the value in using sales data to understand trends in the pesticide industry and to guide strategies for risk reduction.

For the B.C. Ministry of Environment, the analysis and reporting of pesticide sales and use data is important for a number of reasons. It allows us to detect broad trends in pesticide sales and use, and it allows us to track trends for specific products and active ingredients over time. It is important in identifying specific compliance issues, such as licensed companies selling or using

products no longer registered in Canada. The data collected can be shared with other pesticide regulatory agencies, which may help to identify areas where efficiencies can be gained through collaborative projects. In addition, making data easily accessible to the public and stakeholder groups fits well with the B.C. Government's broader goals of openness and transparency. Finally, a sound understanding of pesticide sales and use in the province informs how we allocate resources, and is an important tool for the prioritization of activities and the development of an effective, risk-based regulatory system.

Scope of this report

The scope of this report includes the sales data from all licensed pesticide vendors who sold non-excluded Commercial- or Restricted-class pesticides in B.C. in the calendar year of 2010. This report includes data on both the quantity of formulated product and the quantity of active ingredient sold, and provides detailed summaries of every active ingredient sold in B.C. in 2010. In contrast to previous reports, the scope of this report is narrower than the sales and use surveys conducted for B.C. between 1991 and 2005. This report does not include data on:

- Pesticide use reported by pesticide user licence or confirmation holders
- Sales or use of domestic pesticides
- Sales or use of excluded pesticides, such as swimming pool algaecides, or anti-sapstain wood preservatives used by pressure-treatment wood preservation facilities.

Goals of this report

The specific goals of this report are as follows:

- To gain an accurate view of current pesticide sales broken down by pesticide type, sector of use, specific actives, and region of B.C.
- To compare the data with previous sales data collected for B.C., to examine how pesticide sales in B.C. have changed since 2003, and to compare sales in B.C. with sales data reported by other provinces in Canada.
- To identify any administrative errors and inconsistencies found in the data collected, with a view to providing constructive feedback to vendors and improving the data that is collected each year.
- To establish a process for analysing data and reporting out regularly on pesticide sales for B.C., with a view to broadening the scope of future reports to include the use of pesticides by licence holders, confirmation holders, and other pesticide users, such as wood preservation facilities or golf courses.

Methods

Data collection

Each year, commercial pesticide vendors in B.C. are required to submit an Annual Summary of Reportable Pesticide Sales to the Ministry of Environment. For each non-excluded Commercial- or Restricted-class product sold, the vendor lists the product name, the active ingredient, the *Pest Control Products* (P.C.P.) *Act* registration number, and the total amount of the product sold, in litres or kilograms, over the previous calendar year. Each vendor is also required to maintain a register that includes the name and P.C.P. number of the pesticide purchased, the size and number of containers purchased, the name and address of the purchaser, and the name and certificate number of the dispenser who made the sale. While this register is not submitted annually to the Ministry, it must be kept for a period of three years, allowing Ministry staff to audit the information provided in the annual summary if necessary.

Annual Summaries of Reportable Pesticide Sales were received from 56 pesticide vendors, which represented 100% of the vendors licensed to sell commercial and restricted pesticides in B.C. in 2010. As a number of vendors sell pesticides from multiple outlets, the total number of outlets with Reportable Pesticide Sales was 69.

Quality control and analysis was performed on the summary data reported, and several consistent types of errors were observed. A number of vendors incorrectly reported their sales of domestic pesticides, and these products were not included in the analysis. In addition, some vendors reported sales of certain commercial pesticides excluded from the licensing requirements, as they are listed in Schedule 2 of the *IPM Act* Regulation. For example, the sales of products such as swimming pool algaecides and hard surface disinfectants are not required to be reported;these products were also excluded from the analysis.

A number of summaries contained other errors and irregularities in the data reported. The most common errors included the pesticide name not matching the P.C.P. number, or the amount of pesticides sold reported in units other than litres or kilograms. For all summaries where a discrepancy or error could not be resolved, the vendor was contacted directly by Ministry staff, and clarification obtained.

Data management

All summary data was entered into a database designed and built by Ministry staff in collaboration with an information technology contractor. This database contains information from the PMRA on all registered pesticides in Canada. For each pesticide entered, the database uses the percent active ingredient guarantee listed on the label to convert the quantity of product to quantity of active ingredient. If a product contains multiple active ingredients, the database calculates the quantity of each active ingredient present.

For some products, the quantity of active ingredient is listed on the label in non-standard units. For example, the product containing the biological pesticide *Bacillus subtilis* lists only the bioactive units per litre or kilogram. Whenever possible, we contacted the manufacturer to

obtain the percent active ingredient for the product to calculate the amount of active ingredient sold, which was done for all products containing the biological pesticide *Bacillus thuringiensis kurstaki* (Btk) that do not list the percent active on the label. For any biological pesticide where we could not obtain information on percent active from the manufacturer (e.g. *Bacillus subtilis*), one kilogram of formulated product was considered equal to one kilogram of active ingredient. While this method likely over-estimates the actual amount of active ingredient sold for these products, it is consistent with the approach used for previous pesticide sales surveys in B.C. (ENKON Environmental Limited, 2005).

Grouping of pesticides by type

Pesticides are commonly grouped by type based on the pest targeted or on their intended use. For the purposes of this report, we grouped the pesticides reported sold into the following types:

- Herbicides
- Insecticides (which includes acaricides/miticides)
- Fungicides
- Rodenticides
- Adjuvant/surfactants
- Soil fumigants
- Plant Growth Regulators
- Molluscicides
- Wood preservatives
- Fumigants
- Animal repellents

A small number of pesticides can be categorized as falling under more than one pesticide type. For the purposes of this report, each of these products was categorized as only one pesticide type, based on the primary use pattern of the product. For example, lime sulphur may be used as a fungicide or an insecticide, but was categorized as a fungicide because that represents the primary use pattern of the product.

Grouping of pesticides by sector of use

Each pesticide sold was also categorized by sector of use, based on the primary use pattern indicated on the label. While the majority of products clearly fall into a discrete sector of use, a number of products have multiple uses listed on the label that allow for use in different sectors. For example, many herbicides have both agricultural and industrial vegetation uses on the label, which makes it difficult to determine the sector of use simply from the sale of the product. For these products, the sector of use was determined by a combination of a) knowledge of the primary use of the product, b) the type of vendor who sold the product, and c) in some cases, personal communications with vendors to inquire as to who the primary users of the product are.

All products were categorised as belonging in one of five different groups based on sector of use:

1) *Agriculture* – includes all agricultural products, including those used in greenhouses, nurseries, livestock production, and formaldehyde-containing products used in poultry and mushroom operations.

2) *Industrial vegetation, noxious weeds, and forestry* – includes all herbicides used for controlling industrial vegetation and noxious weeds, and all herbicides and insecticides used in forestry and forest health programs.

3) *Mosquito* – includes all larvicides and adulticides used for mosquito control.

4) *Structural and fumigation* – includes all structural products, all rodenticides, all fumigants, and all wood preservatives.

5) *Turf, golf course, and landscaping* – includes all turf and lawn care products, all products used on golf courses, and other products used primarily in a landscaping context, such as for controlling pests on ornamental plants in landscapes.

In addition, to gain a better understanding of the sales of products containing glyphosate and 2,4-D, sales for all glyphosate products were further broken down by sector of use, based on the product label. Similarly, sales for products containing 2,4-D were further broken down by sector of use, chemical formulation (e.g. amine, ester, or acid), and whether or not the product contains only 2,4-D or multiple actives (e.g. 2,4-D, mecoprop, and dicamba).

Reporting of sales of selected active ingredients

We chose to highlight the sales of a number of active ingredients which may be of particular interest to regulators, industry groups, or members of the public with respect to potential concerns for human health and environmental impacts. The sales of each of these active ingredients were compared to sales reported in 2003 to obtain the percent change since 2003.

Calculation of agricultural pesticide use intensity

The agricultural pesticide use intensity gives a rough measure of the intensity of pesticide use in the agricultural sector, calculated using the quantity of pesticides sold into the agricultural market and the total area of cropland in B.C. The latter was determined by using data from Statistics Canada's 2011 Census of Agriculture (Statistics Canada, 2012). The total cropland area was determined by adding up the land in crops (599,674 hectares) and the summerfallow land (17,836 hectares). The land in crops includes field crops, vegetables, fruit, nursery crops, and sod. The summerfallow land was included in the total to reflect the increased use of "chemfallow" practices on fallow land. The acreage used for tame or seeded pasture (226,298 hectares) was not included in the total, as very few pesticides are used for this purpose. Since the Census of Agriculture is only conducted every five years, the 2011 cropland area was used as

a proxy for the 2010 cropland area. This methodology for calculating total cropland area is generally consistent with that used by Alberta (Byrtus, 2008) and Québec (Ministère du Développement durable, de l'Environnement et des Parcs, 2012).

Breakdown of pesticide sales by region

Overall pesticide sales in B.C. were further broken down into sales in three regions of the province, depicted on the map shown:

1) The **Lower Mainland Region**, which includes the Lower Mainland and Vancouver Island sub-regions.
2) The **Southern Interior Region**, which includes the Thompson-Nicola, the Okanagan, and Kootenay sub-regions.
3) The **North Region**, which includes the Cariboo, Skeena, Omineca, and Peace sub-regions.

Results

Overall pesticide sales

Pesticide vendors in B.C. reported selling a total of 743 unique pesticide products (i.e. either Commercial or Restricted pesticides) in 2010. These 743 unique products contained a total of 269 unique active ingredients.

In total, vendors reported sales of 2,955,302 kg of formulated products in 2010, which represented sales of 1,289,933 kg of active ingredient (Table 1). Herbicides, fungicides, and insecticides represented the largest quantities of pesticides sold.

Table 1: Quantity of formulated product sold (in kilograms) by pesticide type in B.C. in 2010

Pesticide type	Quantity of product sold (in kilograms)	Quantity of active ingredient sold (in kilograms)
Herbicide	1,335,122	459,185
Insecticide	794,032	430,768
Fungicide	645,119	336,489
Rodenticide	62,233	148
Adjuvant/surfactant	42,208	34,533
Soil Fumigant	19,619	8,638
Plant Growth Regulator	18,137	3,577
Molluscicide	15,929	308
Wood Preservative	13,040	9,944
Fumigant	8,547	6,184
Animal Repellent	1,315	158
Grand total	**2,955,302**	**1,289,933**

Expressed as a percentage of the total quantity of active ingredient sold, herbicides represented 36%, insecticides represented 33%, fungicides represented 26%, adjuvants and surfactants represented 3%, and all other types of pesticides represented 2% (Figure 1).

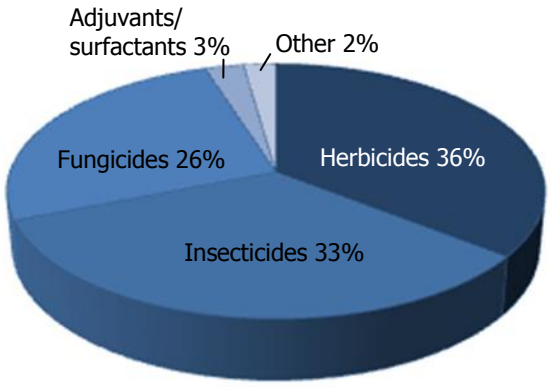

Figure 1: Pesticide sales by type

Table 2: Pesticide sales in B.C. in 2010 by sector of use indicated on the product label.

Sector(s) of use	Quantity of product sold (in kilograms)	Quantity of active ingredient sold (in kilograms)
Agriculture	2,240,085	1,116,859
Industrial vegetation, noxious weeds, and forestry	363,351	81,679
Turf, golf course, and landscaping	175,500	59,524
Structural and fumigation	99,511	18,646
Mosquito	76,855	13,225
Grand total	**2,955,302**	**1,289,933**

Pesticide sales by sector

Sales of products into the agricultural sector represented the largest amount by sector in B.C. in 2010 (Table 2). Expressed as a percentage of the total quantity of active ingredient sold, 87% of pesticides were sold for agricultural uses, 6% sold for industrial vegetation, noxious weeds, and forestry uses, 5% were sold for turf, golf course, and landscaping, with the remaining 2% sold for mosquito, structural, and fumigation uses (Figure 2).

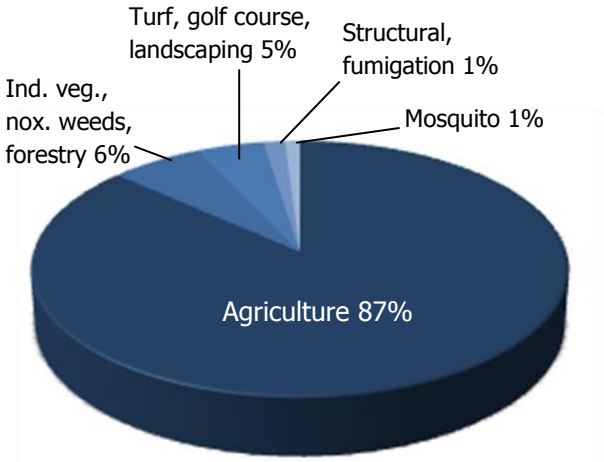

Figure 2: Pesticide sales by sector

The top 20 active ingredients sold

The top 20 active ingredients sold in B.C. in 2010 are listed in Table 3. The full list of all active ingredients sold in B.C. in 2010 is given in *Appendix 1*.

Table 3: The top 20 pesticide active ingredients sold by quantity in B.C. in 2010

Active ingredient	Pesticide type	Primary sector(s) of use	Quantity sold in 2010 (kg)	Quantity sold in 2003 (kg)	% change since 2003
Insecticidal mineral oil	Insecticide	Agriculture	304,436	317,108	-4%
Glyphosate	Herbicide	Agriculture, industrial vegetation, forestry	260,326	126,269	+106%
Sulphur	Fungicide	Agriculture	91,580	73,408	+25%
Chlorothalonil	Fungicide	Agriculture, turf management	50,768	33,505	+52%
Herbicidal mineral oil (i.e. mineral spirits)	Herbicide	Agriculture	40,180	23,575	+70%
Lime sulphur	Fungicide	Agriculture	31,111	20,524	+52%
Diazinon	Insecticide	Agriculture	28,518	27,074	+5%
2,4-D	Herbicide	Turf management, industrial vegetation	27,943	19,425	+44%
MCPA	Herbicide	Agriculture	24,470	23,598	+4%
Bacillus thuringiensis kurstaki (Btk)	Insecticide	Forestry	24,342	56,761	N/A*
Copper oxychloride	Fungicide	Agriculture	21,091	19,562	+8%
Carbaryl	Insecticide	Agriculture	18,677	12,363	+51%
Metiram	Fungicide	Agriculture	17,520	15,293	+15%
Mancozeb	Fungicide	Agriculture	16,863	34,888	-52%
Captan	Fungicide	Agriculture	16,378	25,500	-36%
Bacillus subtilis	Fungicide	Agriculture	16,058	0	N/A
Formaldehyde	Fungicide	Agriculture	13,955	21,822	-36%
Nonylphenoxypolyethoxyethanol	Adjuvant/ surfactant	Agriculture	13,876	8,781	+58%
Triclopyr	Herbicide	Forestry, industrial vegetation	13,331	450	+2862%
Bacillus thuringiensis israelensis (Bti)	Insecticide	Mosquito control	11,949	39,153	-69%
Quintozene	Fungicide	Turf management, agriculture	9,873	8,848	+12%

*calculation of active ingredient for Btk products was done differently for 2010 sales compared to 2003 sales, and therefore a direct comparison is not applicable. See discussion section for details.

Sales of selected active ingredients

Listed in alphabetical order, the sales of selected active ingredients which may be of particular interest to regulators, industry groups, or members of the public are given in Table 4 below (note: some of these products also appear on the previous table).

Table 4: Quantity of selected active ingredients of interest sold (in kilograms)

Active ingredient	Pesticide type	Primary sector(s) of use	Quantity sold in 2010 (kg)	Quantity sold in 2003 (kg)	% change since 2003
2,4-D	Herbicide	Turf, ind. vegetation	27,943	19,425	+44%
Acetamiprid	Insecticide	Agriculture	219	119	+84%
Aluminum phosphide	Fumigant	Fumigation	2,879	196	+1369%
Atrazine	Herbicide	Agriculture	43	11,535	-99%
Azinphos-methyl	Insecticide	Agriculture	2532	6,499	-61%
Brodifacoum	Rodenticide	Structural	0.57	0.42	+36%
Bromadiolone	Rodenticide	Structural	1.25	0.53	+136%
Carbaryl	Insecticide	Agriculture	18,677	12,363	+51%
Carbofuran	Insecticide	Agriculture	236	484	-51%
Chlorothalonil	Fungicide	Agriculture, turf	50,768	33,505	+52%
Chlorpyrifos	Insecticide	Agriculture	4,235	4,561	-7%
Cypermethrin	Insecticide	Agriculture	333	199	+67%
Deltamethrin	Insecticide	Agriculture	956	71	+1247%
Diazinon	Insecticide	Agriculture	28,518	27,074	+5%
Dichlobenil	Herbicide	Agriculture	6,338	6,645	-5%
Endosulfan	Insecticide	Agriculture	2,101	4,729	-56%
Glyphosate	Herbicide	Agriculture, ind. vegetation, forestry	260,326	126,269	+106%
Imidacloprid	Insecticide	Agriculture	1,297	425	+205%
MCPA	Herbicide	Agriculture	24,470	23,568	+4%
Metam-sodium	Soil fumigant	Agriculture	4,601	28,582	-84%
Methomyl	Insecticide	Agriculture	2,278	338	+574%
Methyl Bromide	Fumigant	Fumigation	3,296	9,948	-67%
Oxamyl	Soil fumigant	Agriculture	1,068	698	+53%
Paraquat	Herbicide	Agriculture	8,052	5,418	+49%
Permethrin	Insecticide	Agriculture	1,485	2,055	-28%
Quintozene	Fungicide	Turf, agriculture	9,873	8,848	+12%
Strychnine	Rodenticide	Agriculture	28.1	47.0	-40%
Thiacloprid	Insecticide	Agriculture	118	0	N\A

Agricultural pesticide use intensity

The total area of cropland in B.C. reported for 2011 was 617,510 hectares (Statistics Canada, 2012). The total amount of active ingredient sold into the agricultural sector in B.C. in 2010 was 1,116,859 kilograms. Using the 2011 cropland area as a proxy for 2010, the agricultural pesticide use intensity for 2010 was 1.81 kilograms of active ingredient per hectare.

Sales by region in B.C.

The Lower Mainland sold 582,170 kg of active ingredient, or 45% of the total for the province, the Southern Interior region sold 562,998 kg of active ingredient, or 44% of the total, and the North sold 144,764 kg of active ingredient, or 11% of the total (Figure 3). However, the sales figures for the Lower Mainland are likely slightly over-represented compared to those from the Southern Interior, as one vendor with an outlet in the Southern Interior reported all sales from their main outlet in the Lower Mainland.

The full list of sales of each active ingredient by region of B.C. is given in *Appendix 2*.

Sales of products containing glyphosate

In total, there were 260,326 kilograms of formulated products sold containing glyphosate. Of that total, 73% (190,310 kg) of products sold had labels allowing agricultural and industrial vegetation management uses (Figure 4). Nineteen percent (49,147 kg) of products had labels solely allowing agricultural uses, and 8% (20,865 kg) of glyphosate products sold were forestry products.

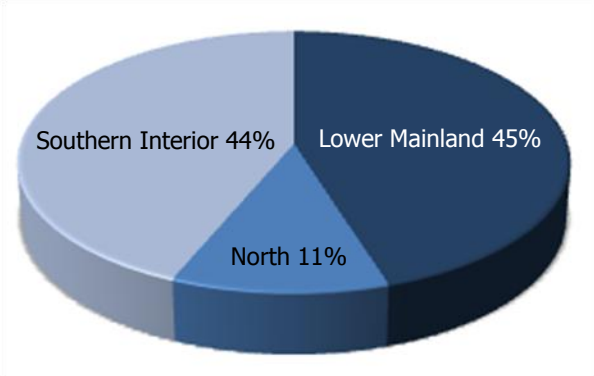

Figure 3: Pesticide sales by region

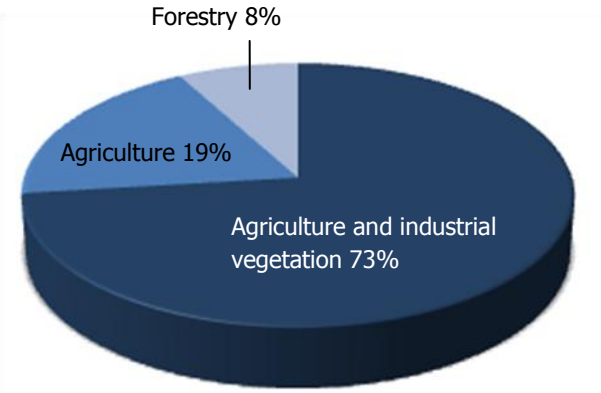

Figure 4: glyphosate formulated products sold by use indicated on the label

Sales of products containing 2,4-D

In total, there were 110,111 kilograms of formulated products sold containing 2,4-D. Of that total, 59% (64,650 kg) of products had labels exclusively allowing turf management uses (Figure 5). Twenty eight percent (31,305 kg) had labels allowing industrial vegetation (including noxious weed) management, 5% (5,828 kg) had labels allowing both industrial vegetation and agriculture uses, 5% (5,219 kg) had labels allowing agriculture uses only, and 3% (3,110 kg) had labels allowing agriculture, industrial vegetation, and turf uses.

Ninety percent (98,731 kg) of all 2,4-D products sold were combination products that contained at least one other active ingredient.

Ninety five percent (104,874 kg) of all 2,4-D products sold contained 2,4-D in the amine form, with 4% (4,063 kg) having the ester form, and 1% (1,175 kg) having the acid form.

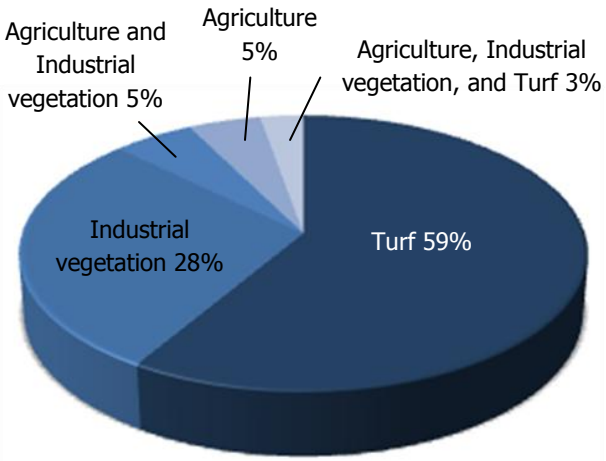

Figure 5: 2,4-D formulated products sold by use indicated on the label

Discussion

Overall pesticide sales

Pesticide vendors in B.C. sold 1,289,933 kilograms of pesticide active ingredient in 2010. This total is approximately 13% (143,670 kg) higher than the total quantity of active ingredient reported sold by pesticide vendor licence holders in 2003, when 1,146,263 kilograms of active ingredient were reported sold. While this appears to represent a slight increase in sales, differences in methodology between the 2003 to 2010 reports make direct comparisons between the overall numbers for pesticide sales difficult. For example, the authors of the 2005 report assumed that one kg of product sold equalled one kg of active ingredient sold for all biological pesticides, including *Bacillus thuringiensis kurstaki* (Btk) (ENKON Environmental Limited, 2005). In contrast, we obtained information direct from the manufacturer for the percent active for many biological pesticides, and used this to calculate the actual amount of active ingredient sold, as this represents a more accurate method for this active ingredient, which is sold in large quantities. Therefore, several more years of data, analysed using the same methods in the current report, will be necessary to determine if overall pesticide sales in the province are changing over time.

The total amount of commercial pesticides sold in B.C. can be compared to reported pesticide sales from several other provinces in Canada. While B.C. sold 1.3 million kilograms of active ingredient in 2010, Alberta reported sales of 12.5 million kilograms of active ingredient in 2008, Québec reported sales of 4.0 million kilograms of active ingredient in 2009, and P.E.I. reported sales of 680,000 kilograms in 2008 (Table 5).

Table 5: Comparison of recently-reported sales of commercial pesticides in B.C., Alberta, Québec, and Prince Edward Island (P.E.I.)

	British Columbia (2010)	Alberta (2008)[1]	Québec (2009)[2]	Prince Edward Island (2008)[3]
Kilograms of active ingredient sold	1,289,933	12,476,095	3,983,257	680,552*

[1] - (Byrtus, 2008)

[2] - (Ministère du Développement durable, de l'Environnement et des Parcs, 2012)

[3] - (P.E.I. Department of Environment, Energy and Forestry, 2009)

* - Data from P.E.I. does not include any mineral oil formulations

Sales by pesticide type

Sales by pesticide type were markedly different in B.C. compared to Alberta and Québec. By amount of active ingredient sold, herbicides and insecticides made up a relatively balanced 36% and 33%, respectively, of the total sales in B.C. In contrast, herbicides and insecticides made up 82% and 2%, respectively, of total sales in Alberta (Byrtus, 2008), and 60% and 12%, respectively, of total sales in Québec (Ministère du Développement durable, de l'Environnement et des Parcs, 2012). The proportionately greater sales of insecticides in B.C. is likely driven by industries such as the tree fruit, grape, and berry producers, which typically experience higher levels of insect pest pressure than weed pressure, and therefore generally use relatively greater quantities of insecticides than herbicides during production.

Sales of pesticides by sector

The majority of pesticides sold in B.C. in 2010 were sold into the agricultural sector, with 87% of active ingredient sales. This percentage is slightly more than that reported in Québec, at 83.9% (Ministère du Développement durable, de l'Environnement et des Parcs, 2012), however it is less than that for Alberta, at 96.5% (Byrtus, 2008). Differences in percentage sales into the agricultural sector between provinces are likely related to a number of factors, including the relative size of the agricultural sector compared to other industries that use pesticides, total crop acreage, differences in crop type, and differences in pest pressure.

As previous surveys for B.C. did not include a breakdown of pesticide sales by sector, it is not possible to compare current and past sales data. Several more years of data will be required to determine if these percentages are changing over time.

Agricultural pesticide use intensity

The agricultural pesticide use intensity for B.C. of 1.81 kg a.i./ha is higher than that calculated for Alberta, at 1.02 kg a.i./ha (Byrtus, 2008), but lower than that calculated for Québec, at 3.12 kg a.i./ha (Ministère du Développement durable, de l'Environnement et des Parcs, 2012). A number of factors will influence this measure, including crop type, pest pressure, cropping practices, and the general adoption of IPM practices in different areas of agriculture. Compared to Alberta, it is likely a higher pesticide use intensity in B.C. is related to the predominance of the tree fruit and berry industries here, which generally use greater amounts of chemical inputs than are used in field crop production (Brimble, Bacchus, & and Caux, 2005).

A previous measure of agricultural pesticide use intensity of 1.80 kg a.i./ha for B.C. was calculated using 1999 data (Brimble, Bacchus, & and Caux, 2005). It is interesting to note this value is essentially the same as that calculated for 2010, despite the changes in pesticide use patterns in agriculture over that time.

Changes in pesticide use intensity over time as a result of changing pest pressure have been observed by other provinces. Byrtus (2008) noted that a Lygus bug outbreak in 1998 and a grasshopper outbreak in 2003 both resulted in sharp increases in those years for the products used to control those pests. Sudden outbreaks of existing or invasive pests in agriculture can

undermine the efforts of many grower groups who are working towards adopting IPM practices and reducing their use of pesticides. A recent example of this is the Spotted Wing Drosophila, a serious pest of tree fruit and berries that was first found in B.C. in 2009, and is now widespread in the Coastal and Interior growing areas (BC Ministry of Agriculture, 2012). As this new pest requires a high level of chemical control and multiple cover sprays per year, it is likely future sales reports will show an increase in the sales of the active ingredients currently registered for control of this pest (i.e. malathion, cypermethrin, spinosad, and spinetoram). This could impact the overall agricultural pesticide use intensity for the province in the future.

Blueberry fruit infested with the pupae of the Spotted Wing Drosophila. This invasive pest requires a high level of chemical control and multiple cover sprays per year.

Sales of specific active ingredients

Our results suggest that between 2003 and 2010, there have been significant changes in the sales of a number of active ingredients, many of which may have potential concerns for human health and the environment as a result of factors such as toxicity, persistence, mobility in soils, use pattern, etc.

Discussion on highlights of some of these changes since 2003 include:

- Sales of the fumigant aluminum phosphide have increased by 1369%, while sales of the fumigant methyl bromide have decreased by 67%. This change likely reflects changes in the fumigation industry in the Lower Mainland, where an industry-driven shift away from the use of methyl bromide and towards the use of aluminum phosphide has occurred in recent years. It should be noted that methyl bromide sales may under-estimate the use of this fumigant in the province, as several fumigation companies that operate in B.C. may be importing product from the United States (J. Fournier, Ministry of Environment, personal communication).

- Sales of the "second generation" anticoagulant rodenticides bromadiolone and brodifacoum have increased significantly, likely as a result of a shift in the structural pest control industry to these products and away from "first generation" anticoagulant rodenticides.

- Sales of glyphosate increased by 134,057 kg, or 106%, between 2003 and 2010. This increase is similar to the 84% increase in glyphosate sales reported in Alberta between 2003 and 2008, which the authors attributed largely to changes in cropping practices, including the introduction of glyphosate-tolerant crops and the adoption of zero-tillage practices (Byrtus, 2008). Changes in cropping practices may be a contributing factor to the rise in glyphosate sales in B.C., as glyphosate-tolerant corn is now common, as is the use of glyphosate for non-selective vegetation management in canola production in the Peace area (M. Waring, Ministry of Agriculture, personal communication). Another possible driver of this increase is the use of glyphosate in blueberry production, where the number of hectares planted more than doubled between 2003 and 2010 (Statistics Canada, 2013).

- Sales of 2,4-D in B.C. increased by 44% between 2003 and 2010, which is similar to the 23% increase reported in Alberta between 2003 and 2008 (Byrtus, 2008). Given the broad range of uses on the labels of these products, an analysis of the use of 2,4-D products by licensed landscape companies, industrial vegetation companies, and agricultural users in B.C. is necessary to determine specifically which sectors are accounting for the increases in the sales of this active ingredient.

- Sales of the agricultural herbicide atrazine decreased from 11,535 kg in 2003 to 43 kg in 2010, as a result of changes to the labels of products containing atrazine that disallowed their use in B.C. (Y. Herbison, PMRA, personal communication). However, some recently-registered products containing atrazine have labels that allow their use in B.C., therefore it is anticipated that sales of this active may increase in the future.

- Sales of the agricultural insecticide azinphos-methyl have decreased in the province as a whole by 61% since 2003. However, there is a sharp difference in the sales trends by region for this active ingredient: sales in the Lower Mainland actually increased from 1,240 kg to 1,819 kg between 2003 and 2010, while sales in the Southern Interior decreased significantly from 5,259 kg in 2003 to 713 kg in 2010. The reduction in azinphos-methyl sales in the Southern Interior is largely attributed to the success of the Sterile Insect Release program, which has observed a 93%

Photo: BC Ministry of Agriculture

Azinphos-methyl is an organophosphate insecticide traditionally used to control codling moth (above) in orchards. This product has now been phased out from use completely due to concerns for risk to workers.

reduction in sales of organophosphates into the tree fruit market since the program's inception in 1992 (Sterile Insect Release Program, 2011). Given that all uses of this product were phased out as of December 31st, 2012 in light of risks to workers (Pest Management Regulatory Agency, 2007), there should be no future sales of this active ingredient after 2012.

- Sales of products containing carbofuran declined by 51% to 236 kg in 2010. All uses of this active are being phased out due to unacceptable risks to human health and the environment, with the last date of retail sale being December 31st, 2010 (Pest Management Regulatory Agency, 2010). Therefore, there should be no sales of this active after 2010.

- Sales of the neonicotenoid insecticides imidacloprid, acetamiprid, and thiacloprid all increased, likely reflecting the adoption of these newer active ingredients as part of IPM programs in horticulture and landscapes.

- Sales of products containing the agricultural soil fumigant metam-sodium decreased by 84%, from 28,582 kg in 2003 to 4,601 kg in 2010. As this product is most commonly used during replanting, this difference is likely a result of a spike in use of metam-sodium in the Lower Mainland circa 2003, when there was a higher level of replanting among berry producers than there was circa 2010 (C. Cruise, Terralink Horticulture, personal communication).

- Sales of products containing the insecticide methomyl increased by 574%, from 338 kg in 2003 to 2,278 kg in 2010, with almost all of the sales occurring in the Lower Mainland. This may be a result of increased use of this product for field crop production in the absence of alternative pesticides for certain key pests.

- Sales of products containing endosulfan decreased by 56% since 2003. As the PRMA has recently announced that all uses of this product will be discontinued after 2016 (Pest Management Regulatory Agency, 2011), it seems likely sales of this product will continue to decline as growers shift towards alternative control options.

The significant changes in sales, either increasing or decreasing, for a number of these key active ingredients suggests it is important for the Ministry of Environment to continue to track sales on a regular basis in the future, to ensure our risk-reduction strategies are based on current information.

Regional breakdown of pesticide sales

Approximately 90% of all pesticides were sold in the Lower Mainland and Southern Interior Regions, which is largely due to the concentration of agriculture in these regions compared to the North Region. The majority of the pesticides sold in the North were sold in the Peace area, reflecting the concentration of agriculture there. As one vendor sold products from outlets in multiple regions but only reported from their main office in the Lower Mainland, this likely led to a slight over-representation of sales for this region. For future reporting, we are encouraging

all vendors who have multiple outlets to report sales separately for each individual outlet, which should give us a more accurate regional breakdown of sales.

It should be noted the sale of a pesticide in a region does not necessarily imply use in that region. Certain industries, such as industrial vegetation management, often purchase pesticides through retailers located in the Lower Mainland, but then use the pesticides throughout the province. Similarly, the large volumes of glyphosate used in forestry, primarily in the North region, may be purchased from distributors who report sales for the whole province from the Lower Mainland. For these industries, an analysis of reported pesticides used by licensed companies and large-industry confirmation holders would provide a more accurate regional breakdown than an analysis of pesticide sales.

Breakdown of Glyphosate and 2,4-D sales

It was hoped a more detailed analysis of the products sold containing glyphosate and 2,4-D would provide a clearer picture of the sector of use for these two actives. However, as a large number of these products have broad labels that allow for use in multiple sectors, it is very difficult to accurately determine the ultimate sector of use of these products. For example, while 59% of products containing 2,4-D exclusively have turf uses, it is not known whether the ultimate use of these products was by landscape companies, golf courses, municipalities, or sod farms, which essentially represents an agricultural use.

Limitations of data

Annual sales summaries were received from all companies who possessed a licence to sell commercial pesticides in B.C. in 2010, which provided a complete data set from all licensed vendors. Unfortunately, our data does not account for products purchased outside of the province and brought in, internet sales, or sales from unlicensed companies operating within B.C. However, it is estimated the volume of commercial products from those sources is likely relatively low, and we feel confident our analysis is based on a reasonably complete data set for the province.

Any errors and inaccuracies discovered during the quality control and analysis stage were corrected by directly contacting the vendor for clarification. However, a small number of inaccuracies were missed during the quality control stage. For example, we discovered many vendors were not reporting their sales of gibberellic acid, as they assumed it was considered an excluded pesticide, which led to the under-reporting of this active ingredient for 2010. We hope our interactions with all vendors contacted will improve reporting compliance and accuracy in future years, which should significantly reduce the amount of time required for data entry and quality control.

Reporting of both quantity of actives and quantity of formulated product

Most pesticide regulatory agencies that report out on annual pesticide sales do so only for quantities of active ingredient sold. However, we chose to report out on both quantities of formulated products and active ingredients sold to give a comprehensive picture of the nature of

pesticide sales in the province. This is especially true for certain types of pesticides where there are very low concentrations of active ingredient in the product, which creates a large differential between the amounts sold for formulated product versus active ingredient. For example, most rodenticides are formulated at less than 0.01% active ingredient. In 2010, there were 62,233 kg of formulated rodenticides sold in B.C., however that represented only 148 kg of active ingredient sold. If we are to use our data to prioritize activities on areas of higher risk, in the case of rodenticides, it is instructive to know the amount of formulated product sold in addition to the amount of active ingredient sold, as even small amounts of most formulated rodenticides have the potential to cause serious harm to humans, pets, or wildlife if used improperly.

Conclusions and future work

Our results indicate that while it is difficult to determine if overall sales of commercial pesticides in B.C. have increased since 2003, sales of many individual active ingredients have changed considerably during this time, reflecting significant changes in recent years in many of the sectors that use pesticides in the province. Furthermore, we can anticipate a number of future changes in sales for certain active ingredients as a result of product registrations ending, new products being registered, and industry-driven changes in various sectors. This suggests that to be effective, our risk-reduction strategies should be based on current information, anticipatory, and flexible in nature, to adapt to trends in industries as they occur.

As the scope of this report was relatively narrow, it does not paint the full picture of pesticide sales and use in the province. However, given that a methodology has now been established and process improvements made to data collection and management, it is hoped the scope of future reports can be broadened to include:

- The use of pesticides by license holders, e.g. landscape and structural companies.
- The use of pesticides by large-industry confirmation holders, e.g. forestry and utility companies.
- The sale of domestic pesticides. While domestic sales are not tracked by the Ministry of Environment, this data may be available through vendors, distributors, or the PMRA.
- The high-volume use of certain excluded pesticides, such as the use of anti-sapstains and other wood preservatives.

Another possibility for future work is to use pesticide sales or use data to conduct a more comprehensive analysis of risk to human health and the environment from pesticides in B.C. A number of indices of pesticide risk have been developed in recent years, including the Environmental Impact Quotient (Kovach, Petzoldt, Degni, & Tette, 1992), the Pesticide Occupational and Environmental Risk Indicator (Vercruysse & Steurbaut, 2002), and Québec's IRPeQ, or "Indicateur de risque des pesticides du Québec" (Samuel, Dion, St-Laurent, & April, 2012). In the case of Québec, analysts combined their IRPeQ index with agricultural pesticide sales data to obtain a measure of risk to both human health and the environment. The results of this analysis indicated that while pesticide sales have increased in recent years, the measure of environmental and human health risks actually decreased over the same time period, as older, more toxic pesticides are replaced by newer products that have improved environmental and human health profiles. A similar analysis for British Columbia would help to further our knowledge of how risks to human health and the environment from pesticides are changing over time.

If future work can include these types of analyses and be conducted on a regular basis, a more complete picture of pesticide trends in this province will emerge, which may help to elucidate some of the reasons behind the changes in commercial pesticide sales observed in this report. This will further our understanding of the sales and use of pesticides in British Columbia, and the associated levels of risk to human health and the environment that may exist.

Works Cited

BC Ministry of Agriculture. (2012, 07 09). *Spotted Wing Drosophila (Fruit Fly) Pest Alert*. Retrieved 12 14, 2012, from BC Ministry of Agriculture: www.agf.gov.bc.ca/cropprot/swd.htm

Brimble, S., Bacchus, P., & and Caux, P.-Y. (2005). *Pesticide Utilization in Canada: A Complilation of Current Sales and Use Data*. Environment Canada.

Byrtus, G. (2008). *Overview of 2008 Pesticide Sales in Alberta*. Edmonton: Alberta Environment.

ENKON Environmental Limited. (2005). *Survey of Pesticide Use in British Columbia: 2003*.

ENKON Environmental Limited. (2001). *Survey of Pesticide Use in British Columbia: 1999*. Environment Canada, Pacific and Yukon Region.

Kovach, J., Petzoldt, C., Degni, J., & Tette, J. (1992). A method to measure the environmental impact of pesticides. *New York's Food and Life Sciences Bulletin* .

Ministère du Développement durable, de l'Environnement et des Parcs. (2012). *Bilan des ventes de pesticides au Québec pour l'année 2009*. Québec: Ministere du Développement durable, de l'Environnement et des Parcs.

Norecol Environmental Consultants. (1993). *A comprehensive survey of pesticide use in British Columbia: 1991*. Pesticide Management Branch Publication #93-3.

Norecol, Dames & Moore. (1997). *A comprehensive survey of pesticde use in British Columbia: 1995*. Technical Report DOE FRAP 1997-16.

P.E.I. Department of Environment, Energy and Forestry. (2009). *2008 Retail Pesticide Sales Report*.

Pest Management Regulatory Agency. (2012). *Pest Control Products Sales Report for 2007 and 2008*. Ottawa: Health Canada.

Pest Management Regulatory Agency. (2010). *Re-evaluation Decision: Carbofuran*. Ottawa: Pest Management Regulatory Agency.

Pest Management Regulatory Agency. (2011). *Re-evaluation Note 2011-01: Discontinuation of Endosulfan*. Ottawa: Pest Management Regulatory Agency.

Pest Management Regulatory Agency. (2007). *Re-evaluation Note: Update on the Re-evaluation of Azinphos-methyl*. Ottawa: Pest Management Regulatory Agency.

Samuel, O., Dion, S., St-Laurent, L., & April, M.-H. (2012). *Indicateur de risque des pesticides du Québec - IRPeQ - Sante et environnement*. Québec: Ministere de l'Agriculture, des Pecheries et de l'Alimentation/Ministere de Developpement durable, de l'Environnement et des Parcs/Institut national de sante publique du Québec.

Statistics Canada. (2013, 03 22). CANSIM table 001-0009: Area, production, and farm gate value of fresh and processed fruits, by province.

Statistics Canada. (2012, 12 12). CANSIM Table 004-0002: Census of Agriculture, total area of farms and use of farm land, Canada and provinces.

Sterile Insect Release Program. (2011). *Guide to the SIR Program*. Kelowna: Sterile Insect Release Program.

Vercruysse, F., & Steurbaut, W. (2002). POCER, the pesticide occupational and environmental risk indicator. *Crop Protection 21(4)* , 307-315.

Appendices

Appendix 1: Quantity of active ingredient sold (in kilograms) for all reportable Commercial and Restricted pesticides in B.C. in 2010

Active Ingredient	Quantity sold (in kilograms)
Insecticidal mineral oil	304,436
Glyphosate	260,326
Sulphur	91,580
Chlorothalonil	50,768
Herbicidal mineral oil (i.e. mineral spirits)	40,180
Lime Sulphur	31,111
Diazinon	28,518
2,4-D	27,943
MCPA	24,470
Bacillus thuringiensis kurstaki (Btk)	24,342
Copper Oxychloride	21,091
Carbaryl	18,677
Metiram	17,520
Mancozeb	16,863
Captan	16,378
Bacillus subtilis*	16,058
Formaldehyde	13,955
Nonylphenoxypolyethoxy ethanol	13,876
Triclopyr	13,331
Bacillus Thuringiensis Israelensis (Bti)	11,949
Quintozene	9,873
Glufosinate Ammonium	9,737
Simazine	9,686
Surfactant Blend	9,629
Paraquat	8,052

Active Ingredient	Quantity sold (in kilograms)
Didecyl Dimethyl Ammonium Chloride	7,255
Mecoprop	7,174
Boscalid	6,338
Dichlobenil	6,338
Potassium Soaps Of Fatty Acids	5,806
Fosetyl-al	5,681
Iprodione	5,576
Malathion	5,311
Linuron	4,820
Metam-sodium	4,601
Acetic Acid	4,561
Octylphenoxypolyethoxy ethanol	4,240
Chlorpyrifos	4,235
Copper Hydroxide	3,819
Dimethoate	3,539
Napropamide	3,463
Dicamba	3,432
Methyl Bromide	3,296
Ferbam	3,139
Picloram	3,118
Dazomet	2,968
Aluminum Phosphide	2,879
Propiconazole	2,822
Bromoxynil	2,715
Pyraclostrobin	2,714
Azinphos-methyl	2,532

Active Ingredient	Quantity sold (in kilograms)
Aluminum Silicate	2,518
Thiophanate-methyl	2,492
Cyprodinil Technical	2,389
Methomyl	2,278
Diuron	2,249
Endosulfan	2,101
S-metolachlor And R-enantiomer	1,895
Disodium Octaborate Tetrahydrate	1,879
Diquat	1,877
Fludioxonil	1,670
Bentazon	1,596
Thiabendazole	1,568
Paraffin Base Petroleum Oil	1,526
Trifluralin	1,494
Permethrin	1,485
Metalaxyl-m And S-isomer	1,464
Maleic Hydrazide	1,459
Mineral Oil - Paraffin Base	1,336
Siloxylated Polyether	1,310
Imidacloprid	1,297
Pendimethalin	1,281
Thiram	1,243
Triallate	1,124
Bacillus Sphaericus	1,109
Petroleum Hydrocarbon Blend	1,105
Oxamyl	1,068
Amitrole	1,037
Fenhexamid	1,027

Active Ingredient	Quantity sold (in kilograms)
Propamocarb Hydrochloride	1,010
Metsulfuron-methyl	1,001
Terbacil	997
Aromatics	980
Myclobutanil	959
Deltamethrin	956
Clopyralid	928
Pinoxaden	918
Clodinafop-propargyl	897
Clethodim	882
Trifloxystrobin	842
Pyrimethanil	835
Tebufenozide	816
Iodocarb	810
Mesotrione	788
Acephate	772
Tralkoxydim	762
Quizalofop P-ethyl	736
Naled	725
Fenoxaprop-p-ethyl	668
Boracic Acid	663
Imazamethabenz-methyl	642
Fluroxypyr	636
Spinosad	631
Hydrogen Peroxide	603
Ziram	595
Cyromazine	561
Methamidophos	557
Ethephon	552
Oxadiazon	549

Active Ingredient	Quantity sold (in kilograms)
Azoxystrobin	543
Flumioxazin	528
Spinetoram	496
Pymetrozine	487
Carbathiin	483
Daminozide	472
Tebuconazole	448
Prometryne Plus Related Active Triazines	446
Dimethenamid-p	438
Chlormequat Chloride	437
Metribuzin	434
Carfentrazone-ethyl	433
Trinexapac-etyl	432
Surfactant Mixture	414
Hexazinone	410
Triticonazole	394
Triforine	378
Cymoxanil	355
Aminopyralid	346
Cypermethrin	333
Pottassium Bicarbonate	328
Dichlorvos	312
Pyrasulfotole	310
Chlorantraniliprole	295
Lambda-cyhalothrin	281
Phosmet	275
Thifensulfuron-methyl	262
Fluazifop-p-butyl	249
Tribenuron-methyl	243
Eptc	240

Active Ingredient	Quantity sold (in kilograms)
Piperonyl Butoxide	240
Carbofuran	236
Metaldehyde	232
Mandipropamid	228
Dichlorprop	227
Acetamiprid	219
Imazapyr	214
Quinoxyfen	214
Florasulam	203
Sethoxydim	198
Phosalone	180
Bifenazate	175
Metolachlor	168
Methoprene	167
Dodemorph-acetate	156
Famoxadone	153
Spirotetramat	150
Tefluthrin	149
Fenbutatin Oxide	149
Copper Sulphate	143
Etridiazole	143
Pyroxsulam	138
Methoxyfenozide	131
Thiacloprid	118
Zinc Phosphide	116
Chlorthal-dimethyl	114
Thiamethoxam	113
Ethalfluralin	113
Polyoxyalkylated Alkyl Phosphate Ester	103
Kresoxim-methyl	91

Active Ingredient	Quantity sold (in kilograms)
Oxyfluorfen	91
Iron Hedta	87
Clothianidin	86
Fatty Acids	85
Isoxaben	85
Oxycarboxin	80
Propyzamide	78
Prohexadione Calcium	77
Ferric Phosphate	76
Dimethomorph	75
Fenbuconazole	66
Zoxamide	66
Pyridaben	65
Octylbicyclo Heptene Dicarboximide	64
Imazamox	63
Metalaxyl	61
Mono- And Dipotassium Phosphite	61
Spiromesifen	60
Paclobutrazol	59
Saflufenacil	58
Fenamidone	56
Bromacil	56
Cyfluthrin	54
Abamectin	52
Pyrethrins	52
Cyazofamid	51
Spirodiclofen	48
Novaluron	44
Atrazine	43
Ethofumesate	40

Active Ingredient	Quantity sold (in kilograms)
Clofentezine	37
Flucarbazone	36
Streptomycin	32
Kinoprene	32
6-benzylaminopurine	30
Silicon Dioxide	30
Strychnine	28
Chlorpropham	28
Acequinocyl	25
Propetamphos	22
Tepraloxydim	22
Imazethapyr	20
Desmedipham	20
Phenmedipham	20
Propoxur	19
Metarhizium Anisopliae	17
Nicosulfuron	15
Flusilazole	14
Methylated Seed Oil Of Soybean	14
Copper Sulphate Pentahydrate	13
Naphthylacetic Acid	12
Quinclorac	12
Pyriproxyfen	11
Mcpb	11
Diflubenzuron	11
Magnesium Phosphide	10
Aviglycine Hydrocloride	10
Difenoconazole	9
Thiencarbazone-methyl	8
Streptomyces	8

Active Ingredient	Quantity sold (in kilograms)
Griseoviridis	
Fluazinam	8
Naphthaleneacetamide	8
Chloridazon	6
Nosema Locustae Canning	6
Dodine	5
Tetrachlorvinphos	5
Bispyribac-sodium	4
Borax	3
Hydramethylnon	3
Rimsulfuron	3
Chlorsulfuron	3
Gliocladium Catenulatum	3
Streptomyces Lydicus	2
Fenthion	2
D-trans Allethrin	2
Gibberellic Acid	1
Bromadiolone	1
Vinclozolin	1
Silica Gel	1
Dinocap	1
Resmethrin	1
Trichoderma Harzianum Strain	1
Brodifacoum	1
Cydia Pomonella Granulosis Virus	1
Tetramethrin	< 1
Pirimicarb	< 1
Nicotine	< 1
Uniconazole-p	< 1
Ferric Sodium Ethylenediaminetetraacetic Acid	< 1
Chlorophacinone	< 1
Bendiocarb	< 1
Difethialone	< 1
Diphacinone	< 1
Fluvalinate-tau	< 1
Oxine Benzoate	< 1
Triflusulfuron Methyl	< 1
Bromethalin	< 1
Ancymidol	< 1
Coumaphos	< 1
Warfarin	< 1
Grand total	**1,289,933**

Appendix 2: Quantity of active ingredient (in kilograms) sold by region of B.C. in 2010

Active Ingredient	Lower Mainland and Vancouver Island (kg)	Southern Interior (kg)	North (kg)	Total for Province (kg)
2-4-d	17,272.329	7,057.835	3,613.054	27,943.218
6-benzylaminopurine	0.360	29.701		30.061
Abamectin	49.971	2.014		51.985
Acephate	659.250	112.530		771.780
Acequinocyl	16.906	7.900		24.806
Acetamiprid	107.989	111.446		219.435
Acetic Acid	4,465.500	95.000		4,560.500
Aluminum Phosphide	2,878.618			2,878.618
Aluminum Silicate	23.750	2,493.750		2,517.500
Aminopyralid	185.448	25.464	134.736	345.648
Amitrole	873.180	164.010		1,037.190
Ancymidol	0.021	0.002		0.023
Aromatics	575.050	64.800	340.100	979.950
Atrazine	42.544			42.544
Aviglycine Hydrocloride		10.040		10.040
Azinphos-methyl	1,819.405	712.645		2,532.050
Azoxystrobin	532.048	10.527		542.576
Bacillus Sphaericus	1,109.075			1,109.075
Bacillus Subtilis	13,381.740	2,676.480		16,058.220
Bacillus thuringiensis kurstaki (Btk)	775.670	23,565.860		24,341.530
Bacillus thuringiensis israelensis (Bti)	11,933.940	15.000		11,948.940
Bendiocarb	0.203			0.203
Bentazon	1,164.480	82.080	349.824	1,596.384
Bifenazate	162.495	12.796		175.290
Bispyribac-sodium	4.010			4.010
Boracic Acid	662.569			662.569
Borax	3.232			3.232
Boscalid	4,641.213	1,697.184		6,338.397
Brodifacoum	0.535	0.032	0.002	0.569
Bromacil	21.190	31.830	2.550	55.570
Bromadiolone	1.242	0.005	0.003	1.251
Bromethalin	0.026	0.000		0.026
Bromoxynil	448.000	284.040	1,983.247	2,715.287
Captan	14,965.600	1,412.100		16,377.700
Carbaryl	9,519.236	8,516.940	641.042	18,677.218
Carbathiin	321.000		162.136	483.136
Carbofuran	172.800	63.360		236.160

Active Ingredient	Lower Mainland and Vancouver Island (kg)	Southern Interior (kg)	North (kg)	Total for Province (kg)
Carfentrazone-ethyl	203.789	31.618	197.592	432.998
Chlorantraniliprole	27.230	268.026		295.256
Chloridazon	6.450			6.450
Chlormequat Chloride	429.640	6.900		436.540
Chlorophacinone	0.054	0.158	0.002	0.214
Chlorothalonil	46,808.950	3,949.400	10.000	50,768.350
Chlorpropham	28.000			28.000
Chlorpyrifos	3,941.290	294.130		4,235.420
Chlorsulfuron	3.000			3.000
Chlorthal-dimethyl	114.120			114.120
Clethodim	117.000		765.000	882.000
Clodinafop-propargyl			897.089	897.089
Clofentezine	35.196	1.892		37.088
Clopyralid	156.794	6.406	764.997	928.197
Clothianidin	58.165	28.140		86.305
Copper Hydroxide	3,616.000	202.500		3,818.500
Copper Oxychloride	14,904.500	6,186.500		21,091.000
Copper Sulphate	143.100			143.100
Copper Sulphate Pentahydrate	11.880	1.155		13.035
Coumaphos	0.010			0.010
Cyazofamid	51.120			51.120
Cydia Pomonella Granulosis Virus		0.560		0.560
Cyfluthrin	51.745	1.981	0.005	53.731
Cymoxanil	354.965			354.965
Cypermethrin	269.714	63.085	0.449	333.248
Cyprodinil Technical	1,825.298	563.313		2,388.611
Cyromazine	560.063	1.013		561.075
Daminozide	468.775	2.975		471.750
Dazomet	2,774.200	194.000		2,968.200
Deltamethrin	789.500	99.000	67.800	956.300
Desmedipham	12.120	7.650		19.770
Diazinon	21,578.063	6,937.189	2.343	28,517.595
Dicamba	2,360.254	873.160	198.111	3,431.525
Dichlobenil	6,091.594	241.800	4.800	6,338.194
Dichlorprop	193.000	33.500		226.500
Dichlorvos	312.004	0.486		312.490
Didecyl Dimethyl Ammonium Chloride	7,254.890			7,254.890
Difenoconazole		1.685	7.296	8.981
Difethialone	0.165	0.001		0.166
Diflubenzuron	10.375	0.125		10.500

Active Ingredient	Lower Mainland and Vancouver Island (kg)	Southern Interior (kg)	North (kg)	Total for Province (kg)
Dimethenamid-p	438.144			438.144
Dimethoate	1,955.520	1,578.240	4.800	3,538.560
Dimethomorph	52.400	22.750		75.150
Dinocap		0.705		0.705
Diphacinone	0.148	0.016		0.163
Diquat	1,675.325	112.865	89.040	1,877.230
Disodium Octaborate Tetrahydrate	1,879.080			1,879.080
Diuron	1,631.200	617.680		2,248.880
Dodemorph-acetate	153.600	1.920		155.520
Dodine		5.200		5.200
D-trans Allethrin	1.800			1.800
Endosulfan	710.500	1,390.500		2,101.000
Eptc	240.000			240.000
Ethalfluralin			112.500	112.500
Ethephon	506.400	45.600		552.000
Ethofumesate	10.800	28.800		39.600
Etridiazole	142.353	0.509		142.861
Famoxadone	153.125			153.125
Fatty Acids	84.960			84.960
Fenamidone	51.000	5.000		56.000
Fenbuconazole		65.712		65.712
Fenbutatin Oxide	131.500	17.625		149.125
Fenhexamid	651.250	375.250		1,026.500
Fenoxaprop-p-ethyl	0.564	0.161	666.980	667.705
Fenthion	0.129		1.816	1.946
Ferbam	2,910.800	228.000		3,138.800
Ferric Phosphate	74.571	1.520		76.091
Ferric Sodium Ethylenediaminetetraacetic Acid	0.240			0.240
Florasulam			203.264	203.264
Fluazifop-p-butyl	177.000	50.000	21.500	248.500
Fluazinam	8.000			8.000
Flucarbazone			35.926	35.926
Fludioxonil	1,455.135	214.404		1,669.539
Flumioxazin	354.736	173.512		528.248
Fluroxypyr			636.259	636.259
Flusilazole		14.400		14.400
Fluvalinate-tau	0.129			0.129
Formaldehyde	13,954.920			13,954.920
Fosetyl-al	4,819.048	862.416		5,681.464

Active Ingredient	Lower Mainland and Vancouver Island (kg)	Southern Interior (kg)	North (kg)	Total for Province (kg)
Gibberellic Acid	0.360	1.060		1.420
Gliocladium Catenulatum	2.640			2.640
Glufosinate Ammonium	325.060	1,410.000	8,001.525	9,736.585
Glyphosate	110,596.120	51,679.740	98,049.825	260,325.685
Hexazinone	384.000	25.500		409.500
Hydramethylnon	3.121			3.121
Hydrogen Peroxide	602.640			602.640
Imazamethabenz-methyl			642.285	642.285
Imazamox			62.901	62.901
Imazapyr	189.240	22.800	2.280	214.320
Imazethapyr	1.584		18.866	20.450
Imidacloprid	915.532	381.463		1,296.995
Iodocarb	809.905			809.905
Iprodione	4,785.695	784.500	6.048	5,576.243
Iron Hedta	84.170	2.658		86.828
Isoxaben	84.900			84.900
Kinoprene	31.558	0.098		31.655
Kresoxim-methyl	1.675	89.750		91.425
Lambda-cyhalothrin	29.463	13.722	237.347	280.532
Lime Sulphur	9,714.660	21,396.000		31,110.660
Linuron	4,286.400	533.600		4,820.000
Magnesium Phosphide	10.125			10.125
Malathion	4,443.316	776.010	92.000	5,311.326
Maleic Hydrazide	1,322.480	136.200		1,458.680
Mancozeb	10,213.561	6,648.946		16,862.507
Mandipropamid	227.805			227.805
MCPA	10,862.980	325.850	13,281.572	24,470.402
MCPB	7.500	3.750		11.250
Mecoprop	5,730.252	1,147.500	296.575	7,174.327
Mesotrione	746.381	41.472		787.853
Metalaxyl	3.960		57.000	60.960
Metalaxyl-m And S-isomer	1,333.727	129.025	1.070	1,463.822
Metaldehyde	232.224			232.224
Metam-sodium	4,178.860	422.560		4,601.420
Metarhizium Anisopliae	16.800			16.800
Methamidophos	537.600	19.200		556.800
Methomyl	2,276.214	1.488		2,277.702
Methoprene	166.886			166.886
Methoxyfenozide	2.880	127.680		130.560
Methyl Bromide	3,295.500			3,295.500

Active Ingredient	Lower Mainland and Vancouver Island (kg)	Southern Interior (kg)	North (kg)	Total for Province (kg)
Methylated Seed Oil Of Soybean	14.000			14.000
Metiram	3,088.000	14,432.000		17,520.000
Metolachlor		168.300		168.300
Metribuzin	300.825	125.625	7.500	433.950
Metsulfuron-methyl	5.619	0.696	994.188	1,000.502
Mineral Oil	11,648.010	292,787.595		304,435.605
Mineral Oil - Paraffin Base	1,336.300			1,336.300
Mineral Spirits	37,925.000	2,255.000		40,180.000
Mono- And Dipotassium Phosphite	60.658			60.658
Myclobutanil	194.424	764.300		958.724
Naled	725.034			725.034
Naphthaleneacetamide		7.527		7.527
Naphthylacetic Acid		12.146		12.146
Napropamide	3,355.704	106.797		3,462.501
Nicosulfuron	14.322	0.401		14.723
Nicotine	0.266			0.266
Nonylphenoxypolyethoxyethanol	9,041.076	3,703.400	1,131.600	13,876.076
Nosema Locustae Canning		5.680		5.680
Novaluron	23.000	21.000		44.000
Octylbicyclo Heptene Dicarboximide	63.201	0.673	0.521	64.395
Octylphenoxypolyethoxyethanol	4,056.568	183.330		4,239.898
Oxadiazon	548.432	0.908		549.340
Oxamyl	1,068.000			1,068.000
Oxine Benzoate		0.128		0.128
Oxycarboxin	80.250			80.250
Oxyfluorfen	76.997	13.622		90.619
Paclobutrazol	59.120	0.244		59.364
Paraffin Base Petroleum Oil			1,526.400	1,526.400
Paraquat	6,683.000	1,368.000	1.000	8,052.000
Pendimethalin	410.584	870.200		1,280.784
Permethrin	1,306.924	176.826	0.782	1,484.533
Petroleum Hydrocarbon Blend			1,104.896	1,104.896
Phenmedipham	12.120	7.650		19.770
Phosalone		180.000		180.000
Phosmet	10.000	265.232		275.232
Picloram	1,814.500	878.600	425.000	3,118.100
Pinoxaden			918.234	918.234
Piperonyl Butoxide	227.177	6.892	5.435	239.503
Pirimicarb	0.375			0.375

Active Ingredient	Lower Mainland and Vancouver Island (kg)	Southern Interior (kg)	North (kg)	Total for Province (kg)
Polyoxyalkylated Alkyl Phosphate Ester	78.300		24.300	102.600
Potassium Soaps Of Fatty Acids	4,626.463	1,179.300		5,805.763
Pottassium Bicarbonate		328.015		328.015
Prohexadione Calcium	0.550	76.783		77.333
Prometryne Plus Related Active Triazines	350.400	96.000		446.400
Propamocarb Hydrochloride	1,004.576	5.776		1,010.352
Propetamphos	22.131			22.131
Propiconazole	2,606.110	207.524	8.750	2,822.384
Propoxur	19.118	0.040		19.158
Propyzamide	78.140			78.140
Pymetrozine	486.550			486.550
Pyraclostrobin	2,158.393	507.236	48.750	2,714.380
Pyrasulfotole			310.161	310.161
Pyrethrins	49.532	1.385	1.058	51.975
Pyridaben	47.160	17.550		64.710
Pyrimethanil	99.200	736.000		835.200
Pyriproxyfen	11.330			11.330
Pyroxsulam			138.531	138.531
Quinclorac			12.068	12.068
Quinoxyfen	3.500	210.500		214.000
Quintozene	9,869.500	3.000		9,872.500
Quizalofop P-ethyl	3.072	0.096	732.864	736.032
Resmethrin	0.620			0.620
Rimsulfuron	2.210	0.840		3.050
Saflufenacil	49.656		8.672	58.328
Sethoxydim	194.733	3.465		198.198
Silica Gel			1.000	1.000
Silicon Dioxide		22.500	7.400	29.900
Siloxylated Polyether	1,009.280	300.960		1,310.240
Simazine	8,547.656	1,138.276		9,685.932
S-metolachlor And R-enantiomer	1,839.920	54.900		1,894.820
Spinetoram	257.890	237.720		495.610
Spinosad	195.803	434.728		630.531
Spirodiclofen	3.600	43.920		47.520
Spiromesifen	58.800	0.840		59.640
Spirotetramat	55.200	94.800		150.000
Streptomyces Griseoviridis	8.110			8.110
Streptomyces Lydicus	2.320			2.320
Streptomycin	10.332	21.924		32.256

Active Ingredient	Lower Mainland and Vancouver Island (kg)	Southern Interior (kg)	North (kg)	Total for Province (kg)
Strychnine		28.110		28.110
Sulphur	17,145.701	74,433.950	0.360	91,580.011
Surfactant Blend	6,824.750	904.800	1,899.684	9,629.234
Surfactant Mixture	318.720	95.040		413.760
Tebuconazole	410.808		37.390	448.198
Tebufenozide	642.730	173.510		816.240
Tefluthrin	131.400	18.000		149.400
Tepraloxydim			22.104	22.104
Terbacil	972.800	24.000		996.800
Tetrachlorvinphos	5.000			5.000
Tetramethrin	0.495			0.495
Thiabendazole	1,567.500			1,567.500
Thiacloprid	3.840	113.760		117.600
Thiamethoxam	100.049	8.000	4.676	112.725
Thiencarbazone-methyl			8.400	8.400
Thifensulfuron-methyl	9.767	0.320	251.435	261.521
Thiophanate-methyl	2,383.004	109.400		2,492.404
Thiram	979.050		264.040	1,243.090
Tralkoxydim	48.000		714.080	762.080
Triallate			1,123.700	1,123.700
Tribenuron-methyl	4.876	0.160	237.710	242.747
Trichoderma Harzianum		0.595		0.595
Triclopyr-butotyl	12,855.312	384.000	91.200	13,330.512
Trifloxystrobin	132.264	681.814	28.350	842.428
Trifluralin	1,479.957	13.622		1,493.579
Triflusulfuron Methyl	0.115			0.115
Triforine	312.075	65.550		377.625
Trinexapac-etyl	431.857			431.857
Triticonazole	385.616		8.475	394.091
Uniconazole-p	0.253	0.002		0.255
Vinclozolin	1.200			1.200
Warfarin			0.003	0.003
Zinc Phosphide	35.174	80.800	0.100	116.074
Ziram		595.000		595.000
Zoxamide	52.013	13.642		65.654
Grand Total	**582,170.19**	**562,998.09**	**144,764.38**	**1,289,932.66**