



British Columbia Agricultural Packaging Waste Stewardship Study

Final Report

*Prepared for the
Agriculture Environment Initiatives Management Committee
on behalf of
Investment Agriculture Foundation of British Columbia
and the
British Columbia Agriculture Council*

June 2012
Prepared by:



451 Ferndale Avenue, London, ON N6C 2Z2

Paul van der Werf Tel: 519-645-7733, email: paulv@2cg.ca

The B. C. Agriculture Council wishes to acknowledge the support of the Agri-Food Futures Fund, Agriculture Environment & Wildlife Fund and the following organizations for making this report possible: Agriculture and Agri-Food Canada, the B.C. Ministry of Agriculture, and the Investment Agriculture Foundation of B.C. The B.C. Agriculture Council is committed to working together with these funding organizations to address issues of importance to the agriculture and agri-food industry in British Columbia. However, opinions expressed in this report are those of the authors, and not necessarily those of the B.C. Agriculture Council, Investment Agriculture Foundation of B.C., the B.C. Ministry of Agriculture or Agriculture and Agri-Food Canada.

Table of Contents

Executive Summary.....	i
1.0 Introduction	i
2.0 Summary of Results	i
 1.0 Introduction	 1
2.0 Methodology	1
2.1 Overview of Extended Producer Responsibility in BC	1
2.2 Waste Characterization.....	1
2.2.1 Desktop Audit.....	3
2.3 Farm Facility Visits (Field Verification)	4
2.4 Recycling Facility Visits	5
2.5 Identify Stewards.....	5
 3.0 Results.....	 6
3.1 Description of Waste Types	6
3.1.1 Seed	6
3.1.2 Feed	6
3.1.3 Fertilizer	6
3.1.4 Pesticides	6
3.1.5 Agricultural Film	8
3.1.6 Silage Film and Bale Wrap	8
3.1.7 Twine and Net Wrap.....	8
3.1.8 Sanitation Products	8
3.1.9 Animal Health Products	8
3.1.10 Sharps.....	8
3.1.11 Engine and Hydraulic Oil.....	8
3.1.12 Plant Pots, Trays, Liners and Flats	8
3.1.13 Plastic Packaging	8
3.1.14 Cardboard	9
3.2 Estimate of Annual Tonnage of Various Packaging Materials	9
3.2.1 Plastic	10
3.2.1.1 Film Plastic.....	10
3.2.1.2 Woven Plastic Bags	12
3.2.1.3 Twine and Netwrap.....	12
3.2.1.4 Greenhouse Plant Pots, Inserts, Flats, Liners and Nursery Pots.....	13
3.2.1.5 Potted Plant Sleeves	15
3.2.1.6 Plant Tags.....	16
3.2.1.7 Plant Clips	17
3.2.1.8 Clamshell Packaging	17
3.2.1.9 Plastic Jugs, Pails and Drums.....	18
3.2.1.10 Animal Health Products	19
3.2.2 Paper.....	19

3.2.2.1	Unlined Paper Bags	19
3.2.2.2	Lined Paper Bags.....	19
3.2.2.3	Molded Pulp	20
3.2.2.4	Animal Health Products.....	20
3.2.2.5	Cardboard Boxes	20
3.2.2.6	Cardboard Boxes-waxed.....	22
3.2.3	Animal Health Products	22
3.2.4	Summary	22
4.0	Farm Visits	24
4.1	Fraser Valley	25
4.2	Okanagan.....	45
4.3	Vancouver Island	52
4.4	Summary.....	60
5.0	Agricultural Plastics Processors	62
6.0	References and Bibliography	67

Appendix 1	Background Information on Calculations.
Appendix 2	List of Subject Matter Experts and Industry Contacts Interviewed

Key Acronyms used in report

BC	British Columbia
BCAC	British Columbia Agriculture Council
EPR	Extended Producer Responsibility
IC&I	Institutional, Commercial and Industrial
MOE	Ministry of Environment, BC
PPP	Packaging and Printed Paper
HDPE	high density polyethylene
LDPE	low density polyethylene
PP	Polypropylene
PS	Polystyrene
OCC	old corrugated cardboard

Executive Summary

1.0 Introduction

CleanFARMS is a non-profit industry stewardship organization committed to environmental responsibility through the proper management and disposal of agricultural waste.

CleanFARMS was awarded a grant from the British Columbia Agriculture Council (BCAC) to complete an agricultural packaging waste characterization study (Study) in British Columbia (BC). In addition to the funding provided by BCAC, the Canadian Animal Health Institute (CAHI), CleanFARMS and other organizations provided additional funding and/or in kind support towards the Study.

2cg Inc., with assistance from Donald Field, Maura Walker and Associates and Ecoinspire, were retained to undertake this Study. The focus of this Study was on packaging wastes. It also included an overview of sharps generation (e.g. needles etc.).

The Study involved considerable desktop research and field research. It focused on collecting and summarizing existing sources of information and interviewing various subject matter experts and collecting/confirming data on farm visits. All data collected was summarized and estimates of the annual generation of various wastes were made. It should be noted that the results of this Study represent the development of baseline data and the start of an iterative process to refine and expand these estimates.

The intention is to use this information to assess the feasibility and opportunity for the development of product stewardship programs for this packaging as well as to assess the impact of the first phase of the inclusion of Packaging and Printed Paper in the BC Recycling Regulation.

2.0 Summary of Results

Desktop Research

Table 1 presents an overview of the different types of packaging wastes generated by different farm types.

Possible waste generation streams have been broken into **inputs** required for farm production and **outputs** required to ship products to market.

Inputs will create wastes that need to be managed at the farms. Inputs are the key focus of this Study. It is important to note that many key farm inputs are sold primarily in bulk and therefore generate no packaging waste. When these inputs are packaged they generate wastes.

Table 1 Packaging waste types by type of production

Location	Inputs	Waste Types	Output	Waste Types	Potential to Enter Residential Waste Stream
Farm Type					
Crops					
Field Crops and Seed Production	Seed	Woven plastic bags, paper bags	Harvested crops	Plastic packaging materials (e.g. bale wrap).	No
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
Fruit and Vegetable Production	Seed/Propagation	Plastic trays, film plastic bags, Woven plastic bags, packaging materials	Harvested crops	Paper packaging materials (e.g. cardboard), plastic packaging materials (e.g. LDPE, PET, PS).	Yes
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
Greenhouse Production	Seed/propagation	Film plastic bags, Woven plastic bags, plastic pots, trays and flats	Harvested crops	Paper packaging materials (e.g. cardboard), plastic packaging materials (e.g. pots)	Yes
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
	Other	Plastic twine and plant clips			
Nursery Production	Seed/Propagation	Plastic trays, film plastic bags, woven plastic bags, packaging materials	Harvested crops	Paper packaging materials (e.g. cardboard), plastic packaging materials (e.g. pots)	Yes
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
Sod Production	Seed	Film plastic bags, woven plastic bags	Harvested crops		No
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
Livestock and Livestock products (e.g. milk and eggs)	Feed	Paper bags, film plastic bags, woven plastic bags, paper bags	Livestock Livestock products	Paper or plastic packaging materials (eggs)	Yes
	Supplements	Film plastic bags, woven plastic bags, paper bags, plastic jugs, plastic pails			
	Sanitation products	Plastic jugs, pails and drums			
Non-Farm Locations					
Veterinary clinics	Na	Na	Medicine Surgical Companion animal food products Companion animal sundry items (e.g. toys)	Paper, plastic and glass packaging, plastic, leftover medicine Sharps (needles, syringes, scalpels, lancets) Paper packaging materials (e.g. cardboard, boxboard), plastic packaging materials.	Yes No Yes

Outputs generate wastes that are managed by customers, be they wholesalers, retailers or consumers.

Table 2 presents a summary of packaging wastes generated on BC farms. These are essentially all packaging materials. An estimated 5,500 tonnes/year of non-organic wastes are generated on BC farms. About two thirds of this waste is plastic.

Table 2 Summary of Key Packaging Waste Generated on British Columbia Farms (Inputs)

Plastic	tonnes/year	Comments
LDPE	2,136	Fertilizer bags, grow bags, greenhouse film, silage film, bale wrap, greenhouse soil
PP	580	Fertilizer and seed bags (woven), twine, greenhouse twine, plant tags and a portion of the following plant pots, inserts, flats, liners and pot sleeves
PS	31	Plant pots, inserts, flats, liners
PET	250	Clamshells
HDPE	612	Pesticide, sanitation products, oil jugs, pails, drums, net wrap
Other Plastic	11	Animal health products
Sub-total	3,620	
Paper		
Unlined Kraft Paper	298	Feed
Lined Kraft Paper	2	Seed (corn) bags
Molded Pulp	97	Portion of molded pulp paper packaging
Other Paper	0.2	Animal health products
Cardboard	1,180	Plant pots, inserts, flats, liners (receipt), pesticides (jugs packaged in boxes) and portion of fruit and vegetables packaging (does not include baskets)
Cardboard (waxed)	129	Waste packaging fruit and vegetables (does not include baskets)
Sub-total	1,706	
Glass		
Glass Bottles	216	Animal health products
Total	5,541	

Figure 1 provides an overview of the estimated waste composition of non-organic wastes generated on BC farms.

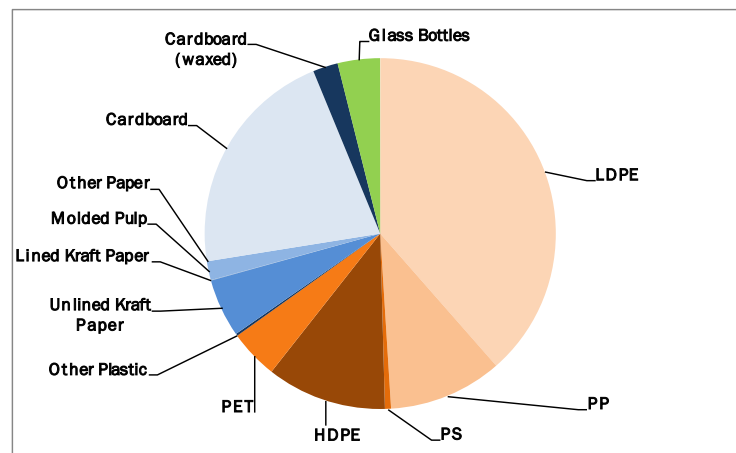


Figure 1. Estimated Waste Composition- Input

Table 3 presents a summary of key waste producing packaging materials that are used to convey farm products to the marketplace. An estimated 32,000 tonnes/year of packaging waste leaves BC farms. About three quarters of this waste is paper fibre.

Table 3 Summary of Key Waste Producing Packaging Materials used to Convey Farm Products to the Marketplace (Outputs)

Plastic	tonnes/year	Comments
LDPE	124	Fruit and vegetable packaging
PP	1,009	Plant pots, inserts, flats, liners , pot sleeves
PS	618	Plant pots, inserts, flats, liners
PET	4,995	Clamshells
HDPE	200	Nursery pots
Other		
Sub-total	6,945	
Paper		
Unlined Kraft Paper	0	
Lined Kraft Paper	0	
Molded Pulp	1,943	Packaging fruit
Cardboard	20,215	Packaging fruit, vegetables and flowers (does not include baskets); greenhouse potted plants
Cardboard (waxed)	2,577	Packaging fruit and vegetables (does not include baskets)
Sub-total	24,736	
Total	31,681	

Figure 2 provides an overview of the estimated waste composition of non-organic wastes generated on BC farms.

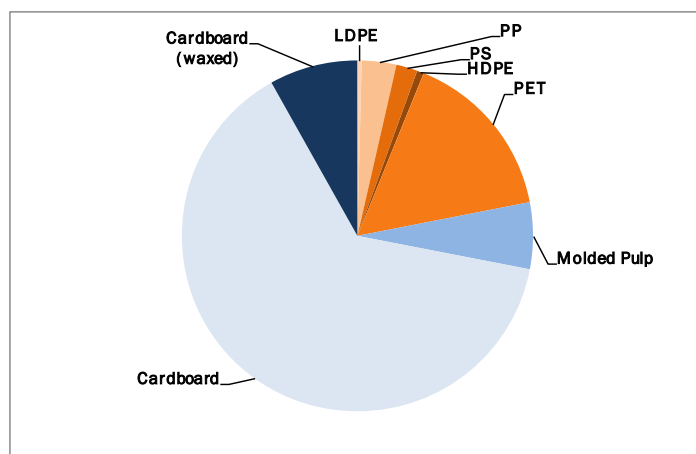


Figure 2. Estimated Waste Composition- Output

Farm Visits

Table 4 presents an overview of how various packaging waste streams are managed on different farm types.

A mixture of landfilling, recycling, re-use, and burning are used to manage wastes. There were a number of examples of recycling programs utilized. It is clear that both farmers and retailers are making efforts to avoid the landfilling of wastes.

Key findings include:

- The key input Feed is largely sold in bulk, not generating any packaging waste at the farm.
- The key inputs Fertilizers and Seed, are also sold in bulk, however, a larger portion is sold in bags, pails, or mini totes creating a packaging waste issue for the farmer.
- Some farm types generate significantly more packaging waste than others e.g. Dairy, Beef, Greenhouse and Nursery.
- Many farms visited had an Environmental Farm Plan;
- Efforts and cost to collect and transport waste to a recycler are negatively impacted by geographical distances in the province;
- There were a number of examples of return to retail programs for some waste streams (e.g. jugs, pails, drums);
- Return to retail programs were inconsistent and not available across the Province; and
- There were essentially no recycling programs and limited recycling opportunities for LDPE bags and unlined and lined paper bags.

Some of the data collected was used to help calculate total wastes generated in the Province.

Table 4 Management of various input waste streams by farm type

	Grain and Oilseed	Livestock	Greenhouse Vegetable, Potted Plants, Bedding Plants	Field Vegetable	Fruit and Tender Fruit	Nursery
Low density polyethylene (LDPE) bags and other film	Landfill	Landfill Some recycling of bale and silage wrap	Landfill Some recycling of greenhouse floor & inside wall film	Landfill Some re-use of ground cover & mulch film then recycling	Landfill Some re-use of ground cover & netting then recycling	Landfill Some recycling of film
Woven polypropylene (PP) bags	Landfill Limited take back programs	Landfill Limited take back programs	na	na	na	na
Twine (PP)	Landfill	Landfill Some recycling	Landfill	na	na	Landfill
Pots, trays, inserts and flats (PP, PS, HDPE)	na	na	Landfill Collection for Recycling programs Some reuse of plug trays & pots	na	na	na
High density polyethylene (HDPE) jugs, pails, drums, flats, lugs & totes	Take back to retail programs (pesticides, some oil products) Re-use (oil)	Take back to retail programs (pesticides, some sanitation and oil products) Re-use (oil, sanitation)	Take back to retail programs (pesticides, some oil products and antifreeze) Re-use (oil) Re use RPC trays	Take back to retail programs (pesticides, some oil products and antifreeze) Re-use (oil) Re-use totes	Take back to retail programs (pesticides, some oil products and antifreeze) Re-use (oil) Re-use, pails, flats, lugs & totes))	Take back to retail programs (pesticides, some oil products and antifreeze) Re-use (oil)

	Grain and Oilseed	Livestock	Greenhouse Vegetable, Potted Plants, Bedding Plants	Field Vegetable	Fruit and Tender Fruit	Nursery
Unlined and lined paper bags	Landfilled Recycled	Landfilled Recycled	Landfilled Recycled	Landfilled Recycled	Landfilled Recycled	Landfilled Recycled
Cardboard	Recycled	Recycled	Recycled	Recycled	Recycled	Na
Animal Health Waste	na	Removed from the farm by vets Cardboard recycled Glass ampoules recycled or disposed	na	na	na	na
Animal Health Waste-sharps	na	Removed from the farm by vets Take back programs Landfill	na	na	na	na

Page left intentionally blank

1.0 Introduction

CleanFARMS is a non-profit industry stewardship organization committed to environmental responsibility through the proper management and disposal of agricultural waste.

CleanFARMS was awarded a grant from the British Columbia Agriculture Council (BCAC) to complete an agricultural packaging waste characterization study (Study) in British Columbia (BC). In addition to the funding provided by BCAC, the Canadian Animal Health Institute (CAHI), CleanFARMS and other organizations provided additional funding and/or in kind support towards the Study.

2cg Inc., Maura Walker and Associates, Ecoinspire and Donald Field were retained to undertake this Study. The focus of this Study was on agricultural packaging wastes. It also included an overview of sharps generation (e.g. needles etc.).

The Study involved considerable desktop research and field research. It focused on collecting and summarizing existing sources of information and interviewing various subject matter experts and collecting/confirming data on farm visits. All data collected was summarized and estimates of the annual generation of various wastes were made. It should be noted that the results of this Study represent the development of baseline data and the start of an iterative process to refine and expand these estimates.

The intention is to use this information to assess the feasibility and opportunity for the development of product stewardship programs for this packaging as well as to assess the impact of the first phase of the inclusion of Packaging and Printed Paper in the BC Recycling Regulation.

2.0 Methodology

2.1 Overview of Extended Producer Responsibility in BC

An overview of the BC Recycling Regulation 449/2004 requirements and the current situation in BC was prepared. When looking at material flows from a stewardship perspective, it is important to determine what is flowing and in what amounts but also who produces the products and to whom they are sold. The relevant producers and product sectors were determined from this perspective and in consultation with CleanFARMS. The producers and products were compared to the Regulation to determine the potential impact on the agriculture sector.

2.2 Waste Characterization

Undertaking a waste characterization study helps develop an understanding of the waste stream and its composition.

The following list of general packaging categories and sub-categories were considered based on discussion with CleanFARMS:

Category	Examples of Sub Categories
Plastic	Greenhouse film (LDPE) Silage film and bale wrap (LDPE) Plastic bags (LDPE) Woven plastic bags and bulk bags (PP) Twine (PP) Jugs, Pails and Drums (HDPE) Pots, trays, inserts, flats, tags (PP, PS, HDPE) Clamshell packaging (PET, PS)
Paper packaging	Kraft Paper bags (unlined) Kraft Paper bags (lined) Molded pulp liners Corrugated cardboard (OCC) Corrugated cardboard-waxed (OCCw)
Glass	Animal health products
Sharps	Needles, syringes, scalpels, lancets

These categories were adapted from those used in other, similar CleanFARMS studies. Most of the wastes noted are packaging wastes.

The waste characterization was developed through a combination of the following methods:

1. Existing farm waste generation data;
2. Estimate product and packaging sales to the agriculture sector from agricultural suppliers; and
3. Estimate of waste generated per unit of production on farms.

The flow of these wastes was estimated including:

1. Wastes generated on farm; and
2. Wastes generated off-farm (Wholesale, IC&I, residential).

Estimate of product and packaging sales to the agricultural sector

This involved identifying the major materials sold to BC farms, interviewing key subject matter experts in each agricultural sector and obtaining relevant sales/quantity data.

Estimate of Waste Resulting from Sales to Farms

Estimates of the amount of waste generated per unit of consumption were developed.

Estimate of Waste Generated Per Unit of Production

This was accomplished by estimating inputs for various farm level activities. For instance, knowing the per hectare (ha) inputs (e.g. fertilizer, seed, pesticides, feed) for various crops and livestock and understanding how these inputs are packaged

was used to help develop an estimate of the kilograms (kg) of waste generated per ha of production or per livestock unit. This was applied to the total area in production for each crop (i.e. kg of input/ha * kg waste/kg of input * ha production) and per head of livestock.

Existing Farm Waste Generation Data

Any available BC farm non-organic waste generation data was collected from a variety of sources.

Estimates of Farm-based Packaging at IC&I and Residential Sectors (through direct sales or distribution chains)

This was established through collecting data from on-farm sales and using estimates of packaging types, amounts per product and distribution channel (to IC&I, direct sales or through distribution to retailers). Key subject matter experts were interviewed and where data was not specific, estimates of relative sales to the residential sector versus farms were used.

This resulted in estimates of wastes flowing to the IC&I sector and residential sectors. It was assumed that all non-consumable, non-organic packaging (including from animal health and nursery sources) delivered to the residential sector would flow to the residential waste stream.

Data Compilation

Waste characterization data, which came from different sources, was compiled into Excel spreadsheet tables. To the extent possible, estimates of waste generation were developed from two sources of data to help maximize the reliability of the estimate. The compiled data was analyzed and the results of this analysis expressed in tables and figures. This resulted in the presentation of an estimate of waste generation and waste composition.

As this is the first Study of this type (i.e. for agricultural packaging stewardship) undertaken by CleanFARMS in BC, it is important to understand that a baseline materials flow characterization data set has been created. It was developed in such a way so that it can be easily updated so that new sources of data can be added as they become available or are developed.

2.2.1 Desktop Audit

The majority of this Study was undertaken as a desktop audit. This data collection exercise focused on developing: 1. Estimate of material consumption and waste generated by consumption; 2. Estimate of waste generated per unit of production; and 3. Existing farm waste generation data.

The desktop audit consisted of: 1. Research; 2. Data Collection; and 3. Data Analysis.

The data came from a number of sources. The following methods were used to gather data:

Subject Matter Experts

Key agricultural subject matter experts were contacted and interviewed to help identify a list of data sources and industry contacts. Most subject matter contacts

were provided by the BCAC. The subject matter experts were contacted by email and by telephone to obtain relevant information. Subject matter experts did not always respond to these communications.

A list of subject matter experts and industry contacts that were interviewed (by telephone, email) can be found in Appendix 2.

Industry Contacts

Industry contacts (e.g. manufacturers, suppliers, first importers) were contacted and interviewed to gather various data on material sales/quantities to help understand the market size for various materials and what proportion (if any) may go to the residential sector. This included collecting data on the weight of packaging material used to help convey these materials. The industry contacts were contacted by email and by telephone to extract relevant information. Industry experts did not always respond to these communications.

A list of subject matter experts and industry contacts that were interviewed (by telephone, email) can be found in Appendix 2.

Internet Search

A detailed internet search was undertaken to help identify possible data sources of BC agriculture sector material flows. The internet search also attempted to uncover other relevant sources of information outside of BC that could be used to help develop estimates.

Literature Review

A literature review was undertaken to identify similar studies. The literature review provided some insight into how to develop estimates of materials flow and composition.

Section 6, References and Bibliography, presents a list of resource material used for this Study.

There was limited information available regarding previous agricultural waste characterization studies.

CleanFARMS

CleanFARMS already has a number of BC stewardship programs and collects weight-based data for these materials. This data was collected and analyzed. Staff were interviewed to develop a sense of current capture rates of these materials.

2.3 Farm Facility Visits (Field Verification)

Farm visits (field verification) involved: 1. Site visits at a number of representative farms and surveying farmers on materials flow and waste management habits; and 2. Confirmation of the weight of various packaging and other materials.

Site Visits to Farms

The purpose of site visits was to gauge current farm materials flow and waste

management (including on-site disposal) per farm type. This data supplemented data gathered as part of the desk top audit. This included a tour of each farm to see materials flow and waste management first hand.

Table 2.1 presents an overview of the various farms visited. In total, fifteen farms were visited. The primary activity of each farm is noted. Many farms visited included at least one other activity (livestock and mixed crop). This is noted in the text of each farm visit summary. When possible, samples of various packaging were collected and weighed.

Table 2.1 Overview of Farm Visits

Region	Farm Type (Primary operation)
Fraser Valley	Ornamental Nursery
Fraser Valley	Greenhouse, Cut Flower, Potted Plant and Cut Flower Packaging Farm
Fraser Valley	Tomato, Cucumber and Pepper Farm (Greenhouse)
Fraser Valley	Berry Farm
Fraser Valley	Vegetable
Fraser Valley	Blueberry Packing House
Fraser Valley	Dairy Farm
Fraser Valley	Poultry Farm (Broiler & Layer),
Okanagan	Apple Farm
Okanagan	Cherry Orchard and Packaging Plant
Okanagan	Apple Packaging House
Okanagan	Dairy Farm
Okanagan	Beef Feedlot
Vancouver Island	Garden Nursery
Vancouver Island	Dairy Farm

Confirmation of Weight of Various Packaging and Other Materials

A number of sites were visited to confirm the weight of various packaging and other materials.

2.4 Recycling Facility Visits

Five agricultural packaging waste recycling programs/facilities were visited. A summary was prepared for each program/facility.

2.5 Identify Stewards

During the desktop audit the various suppliers and potential stewards were identified. These included manufacturers, first importers and in some cases retailers. A scoped list was developed per waste type.

3.0 Results

3.1 Description of Waste Types

Table 3.1 presents an overview of the different types of packaging wastes generated by different farm types.

Possible waste generation has been broken into **inputs** required for farm production and **outputs** required to ship products to market.

Inputs will create wastes that need to be managed at the farms. Inputs are the key focus of this Study. It is important to note that many key farm inputs are sold primarily in bulk and therefore generate no packaging waste. When these inputs are packaged they generate wastes.

Outputs generate wastes that are managed by customers be they wholesalers, retailers or consumers. Outputs have been included when data required to make calculations has been readily available.

3.1.1 Seed

Seed is sold in bulk and in packages. When sold in packages, it is typically sold in unlined and lined kraft paper bags (20-25 kg of product) and larger woven polypropylene (PP) bags (<1,000 kg of product).

3.1.2 Feed

Feed is sold bulk and in packages. When it is sold in packages it is typically sold in lined kraft paper bags and woven polypropylene (PP) bags (20-25 kg of product).

3.1.3 Fertilizer

Fertilizer is sold bulk (solid and liquid) and in packages. When it is sold in packages it is typically sold in low density polyethylene (LDPE) plastic bags (25-40 kg of product). It can also be sold in woven PP bags and high density polyethylene (HDPE) pails.

3.1.4 Pesticides

Pesticide products are often sold in 1 litre, 4 litre, 10 litre, 20 litre, 110 litre or 205 litre HDPE jugs, pails or drums. They are also sold in lined paper bags.

Table 3.1: Packaging waste types by type of production

Location	Inputs	Waste Types	Output	Waste Types	Potential to Enter Residential Waste Stream
Farm Type					
Crops					
Field Crops and Seed Production	Seed	Woven plastic bags, paper bags	Harvested crops	Plastic packaging materials (e.g. bale wrap).	No
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
Fruit and Vegetable Production	Seed/Propagation	Plastic trays, film plastic bags, Woven plastic bags, packaging materials	Harvested crops	Paper packaging materials (e.g. cardboard), plastic packaging materials (e.g. LDPE, PET, PS).	Yes
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
Greenhouse Production	Seed	Film plastic bags, Woven plastic bags	Harvested crops	Paper packaging materials (e.g. cardboard), plastic packaging materials (e.g. pots)	Yes
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
	Other	Plastic twine and plant clips			
Nursery Production	Seed/Propagation	Plastic trays, film plastic bags, woven plastic bags, packaging materials	Harvested crops	Paper packaging materials (e.g. cardboard), plastic packaging materials (e.g. pots)	Yes
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
Sod Production	Seed	Film plastic bags, woven plastic bags	Harvested crops		No
	Fertilizer	Film plastic bags			
	Pesticides	Film plastic bags, paper bags, plastic jugs, plastic pails			
Livestock and Livestock products (e.g. milk and eggs)	Feed	Paper bags, film plastic bags, woven plastic bags, paper bags	Livestock Livestock products	Paper or plastic packaging materials (eggs)	Yes
	Supplements	Film plastic bags, woven plastic bags, paper bags, plastic jugs, plastic pails			
	Sanitation products	Plastic jugs, pails and drums			
Non-Farm Locations					
Veterinary clinics	na	na	Medicine Surgical Companion animal food products Companion animal sundry items (e.g. toys)	Paper, plastic and glass packaging, plastic, leftover medicine Sharps (needles, syringes, scalpels, lancets) Paper packaging materials (e.g. cardboard, boxboard), plastic packaging materials.	Yes No Yes

3.1.5 Agricultural Film

Agricultural film includes greenhouse film and mulch film. These products are manufactured from LDPE.

3.1.6 Silage Film and Bale Wrap

Silage film and bale wrap are used to contain hay, silage and straw. These products are typically manufactured from LDPE.

3.1.7 Twine and Net Wrap

Twine (PP) and net wrap (HDPE) are used to contain hay and straw. There are limited quantities of twine made from sisal (i.e plant based material).

Twine is also used in the greenhouse vegetable growing industry. These products are typically manufactured from PP.

3.1.8 Sanitation Products

Sanitation products, used primarily in dairy, hog and poultry production, are typically sold in 4 litre, 10 litre, 20 litre, 110 litre or 205 litre HDPE jugs, pails or drums. The sanitation products can come in liquid or solid forms.

3.1.9 Animal Health Products

Animal health products include various medicines used to treat livestock. The use of animal health products was considered by the Canadian Animal Health Institute (CAHI). The product packaging is manufactured from a number of materials including paper, plastics and glass which are then packaged in boxboard and cardboard for distribution to veterinary clinics and farms.

3.1.10 Sharps

Sharps include needles and syringes. They are used to administer medicines and undertake medical procedures on farm animals. These products are typically made from steel. Weight estimates also include packaging materials.

3.1.11 Engine and Hydraulic Oil

Oils are often sold in 1 litre, 4 litre or 20 litre HDPE jugs or pails. They are also sold in larger containers and in bulk.

3.1.12 Plant Pots, Trays, Liners and Flats

Potted plants and bedding plants produced as an output from greenhouses and the nursery sector are produced and shipped in a variety of Plastic Pots, Trays, Inserts and Flats. These items are typically made from PP, polystyrene (PS) and HDPE. They also generate some on-farm waste.

3.1.13 Plastic Packaging

A variety of farm outputs, including some fruit and vegetables, are shipped from the farm in plastic packaging such as clamshells (PET, PS) and plastic bags (LDPE).

3.1.14 Cardboard

Some of the inputs that arrive on farms arrive in cardboard (OCC) boxes (e.g. plant pots, trays, liners and flats, pesticides).

Fruit and vegetables are produced as an output from greenhouse and field production. A variety of OCC and waxed cardboard (OCCw) boxes are used to ship this produce to market. In some cases this also includes a paper liner. They also generate some on-farm waste. A large quantity of fruits and vegetables are shipped in reusable plastic and wood crates.

3.2 Estimate of Annual Tonnage of Various Packaging Materials

Packaging wastes have been divided into plastic and paper and other wastes. Each key waste type is discussed in the following sections. Discussion is divided between waste inputs (i.e. generated and managed on-farm) and outputs (packaging materials used on-farm to prepare products for market). Figure 1 presents an overview of how the various calculations were made. Background information on calculations is provided in Appendix 1.

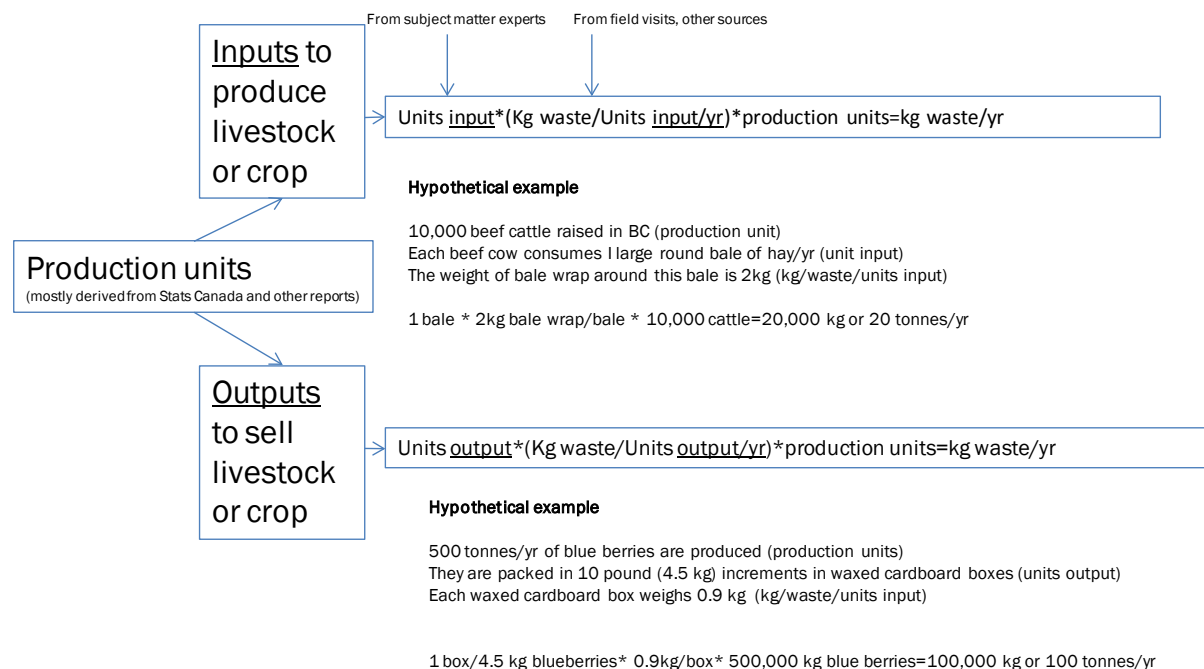


Figure 1. Overview of how Calculations were Developed

3.2.1 Plastic

3.2.1.1 Film Plastic

LDPE film is used primarily for the following:

- silage film;
- bale wrap;
- mulch film;
- packaging fertilizers;
- greenhouse film;
- grow bags used in the greenhouse vegetable growing industry; and
- packaging for fruit and vegetables.

It was estimated that 3.9 million m² (41.5 million ft²) of silage film and bale wrap is used annually. Unit weights were collected directly (i.e. weighed) or collected from suppliers. It was estimated that about 915 tonnes/year of film plastic are generated on BC farms.

Mulch film is used predominantly for some field cucumber, pepper, squash and zucchini production. Some floating mulch is used for early corn and early potatoes. It was estimated that about 260 tonnes/year of mulch film plastic are generated on BC farms.

A subject matter expert provided an estimate of the amount of fertilizers sold into the BC agricultural market annually. It is estimated that about 35,000 tonnes/year of fertilizer is sold in bags or includes a liner and that this results in about 100 tonnes/year of film plastic being generated on BC farms.

Supplier data and farm visits were used to calculate greenhouse film plastic used annually. This includes film plastic used as a cover for side walls and floor plastic. It was estimated that about 500 tonnes/year of this film plastic are generated on BC farms.

An estimate was developed of the annual amount of plastic film used in grow bags (Photo 1) for the production of greenhouse vegetables. It should be noted that grow bags are contaminated with growing media. They are not readily recyclable without considerable processing. It was estimated that about 60 tonnes/year of this film plastic are generated on BC farms.

Greenhouse soil mixtures are delivered to greenhouses in plastic film lined bales. An estimate of the annual number of bales was developed. It was estimated that about 280 tonnes/year of film plastic are generated on BC farms.



Photo 1 Grow Bag

It is estimated that close to 2,145 tonnes/year of film plastic waste are generated on BC farms. This film plastic waste is managed by the farmer.

LDPE (Input)

Sector	Estimated Weight
	Tonnes/year
Silage Film and Bale Wrap	915
Mulch Film	260
Fertilizer	100
Grow Bags (greenhouse vegetable production)	65
Greenhouse film	500
Greenhouse soil mixes	280
Film plastic packaging	25
Total	2,145

Film plastic packaging (from field to wholesaler) is used for fruit (sweet cherries, some cranberries) and some field and greenhouse vegetables (e.g. cucumbers, peppers, carrots and potatoes). A subject matter expert provided information on the amount of annual production that was packaged using film plastics and the weight of individual packages. It was estimated that about 540 tonnes/year of film plastic is shipped from BC farms. This film plastic waste is managed by the wholesaler, retailer and consumer.

It is estimated that about 5% or about 25 tonnes of this film plastic represents wastage that needs to be managed on the farm.

LDPE (Output)

Sector	Estimated Weight
	Tonnes/year
Fruit and Vegetable Packaging	125
Greenhouse Cucumbers and Peppers	415
Total	540

3.2.1.2 Woven Plastic Bags

In BC, woven PP plastic bags are typically used for packaging seeds and fertilizers.

Data provided by subject matter experts were used to develop estimates of the annual tonnage of woven PP bulk bags used for seeds and fertilizers. It is estimated that about 25 tonnes/year are generated on BC farms.

PP (Input)

Sector	Estimated Weight
	Tonnes/year
Seed (forage)	4
Fertilizer	21
Total	25

3.2.1.3 Twine and Netwrap

Twine (PP) is used to hold together bales of hay. It is estimated that about 370 tonnes/year of twine are generated on BC farms. Very little of this twine appeared to be made from sisal (i.e. non plastic).

Netwrap (HDPE) is used to help hold together bales of haylage. It is estimated that about 140 tonnes/year of net wrap are used for this purpose.

Twine is also used in greenhouse vegetable production. It is estimated that about 45 tonnes/year of twine are used for this purpose.

On the basis of these estimates about 415 tonnes/year of PP twine and 140 tonnes of HDPE net wrap are generated on BC farms.

PP (Input)

Sector	Estimated Weight
	Tonnes/year
Hay (baled)	370
Greenhouse vegetable production	45
Total	415

HDPE (Input)

Sector	Estimated Weight Tonnes/year
Haylage (net wrap)	140
Total	140

3.2.1.4 Greenhouse Plant Pots, Inserts, Flats, Liners and Nursery Pots

Polypropylene and PS pots, trays, inserts and liners (trays) are used in the greenhouse industry (Photo 2). High density polyethylene (HDPE) and PP pots are used in the nursery industry (Photo 3).



Pot



Tray



Insert



Flat

Photo 2 Pots, Trays, Inserts and Flats



Photo 3 Nursery Pots

An estimate of the amount of these pots, inserts, trays and flats was developed using the following information:

- Statistics Canada 2011 greenhouse and nursery production estimates;
- Weight based information provided by a manufacturer (from web site) and farm visits;
- Discussions with subject matter experts; and
- Farm visits.

The following assumptions were made for calculation purposes:

June 2012

CleanFARMS Inc.
British Columbia Agricultural Packaging Waste Stewardship Study
Final Report

13 of 68

- 50% of pots, trays, inserts and liners (trays) used in the greenhouse industry are made from PP and another 50% from PS;
- 100% of nursery pots are made from HDPE.

Greenhouse Ornamental and Bedding Plant Production

It is assumed that potted plants are grown in 1 litre, 2.4 litre, 11cm, 15cm, 30cm or hanging pots. Some potted plants are shipped in trays. For the purpose of these calculations it was assumed that all potted plants were grown in 15cm pots. Weight estimates consider total usage and apply a factor for on-site (i.e. greenhouse) waste generation. Most pots leave the greenhouse and enter the waste stream at a later time. A small percentage of pots used at a greenhouse become waste.

It was assumed that bedding plants are grown in inserts (40 plants/insert) and that 50% of these inserts were placed in a flat (also referred to as a tray) for transportation and marketing purposes. Weight estimates consider total usage and apply a factor for on-site (i.e. greenhouse) waste generation. Most inserts and flats leave the greenhouse and enter the waste stream at a later time. A small percentage of inserts and flats used at a greenhouse become waste.

Nursery Production

It is assumed that containers are made from HDPE. For the purposes of calculations it was assumed that all are made from HDPE. A small percentage of pots used at a nursery become waste.

It was estimated that a minimum of 620 tonnes/year of PP plant pots, inserts and trays are used on BC farms.

It was estimated that a minimum of 620 tonnes/year of PS plant pots, inserts and trays are used on BC farms.

It was estimated that a minimum of 200 tonnes/year of HDPE plant pots (nursery) are used on BC farms.

PP (Output)

Item	Estimated Weight
	Tonnes/year
Potted plants	580
Bedding plants- Inserts and Trays	40
Total	620

PS (Output)

Item	Estimated Weight
	Tonnes/year
Potted plants	580
Bedding plants- Inserts and Trays	40
Total	620

HDPE (Output)

Item	Estimated Weight
	Tonnes/year
Nursery Pots	200
Total	200

From farm visits, it was clear that only a small percentage of pots, inserts, trays and flats are broken during production. It is estimated that approximately 5% are broken and would constitute waste.

On the basis of these estimates about 70 tonnes/year of pots, trays, inserts and flats are generated on BC farms. These wastes are either disposed in a garbage bin or recycled.

PP, PS and HDPE (Input)

Item	Estimated Weight
	Tonnes/year
PS	30
PP	30
HDPE	10
Total	70

3.2.1.5 Potted Plant Sleeves

Most potted plants are fitted with a sleeve (Photo 4) prior to shipment. This is to protect the plant and for decoration. Plant sleeves appear to be largely made from PP as well as LDPE and PS. For calculation purposes, it was assumed that all potted plants left with a sleeve and that they are all made from PP. On the basis of these estimates about 155 tonnes/year of plant sleeves are used on BC farms.

Flowers are also packaged in a sleeve. It was estimated that 5 flowers were packaged in a sleeve. On the basis of these estimates about 75 tonnes/year of plant sleeves are used on BC farms.



Photo 4 Potted Plant Sleeves

Polypropylene (Output)

Item	Estimated Weight
	Tonnes/year
Potted plant sleeves	155
Flower sleeves	75
Total	230

It is estimated that approximately 5% of plant sleeves become waste that needs to be managed at the greenhouse. These wastes are typically disposed in a garbage bin.

On the basis of these estimates about 12 tonnes/year of plant sleeves are generated on BC farms.

Polypropylene (Input)

Item	Estimated Weight
	Tonnes/year
Potted plant sleeves	8
Flower packaging	4
Total	12

3.2.1.6 Plant Tags

Most potted plants and bedding plants come with a descriptive tag. Plant tags appear to be largely made from PP. For calculation purposes it was assumed that all potted plants left with a tag and that they are all made from PP. These tags leave the farm and enter the waste stream at a later time.

Polypropylene (Output)

Item	Estimated Weight
	Tonnes/year
Plant Tags	160
Total	160

It is estimated that approximately 5% of plant tags become waste that needs to be managed at the greenhouse. These wastes are typically disposed in a garbage bin.

On the basis of these estimates about 8 tonnes/year of plant tags are generated on BC farms.

Polypropylene (Input)

Item	Estimated Weight
	Tonnes/year
Plant Tags	8
Total	8

3.2.1.7 Plant Clips

Tomato plants produced in greenhouses use plastic clips (PP) to hold the plant in place. It was estimated that 85 tonnes/year are generated on BC farms.

Polypropylene (Input)

Item	Estimated Weight
	Tonnes/year
Plant Clips	85
Total	85

3.2.1.8 Clamshell Packaging

Clamshell packaging is used to hold fruit and some vegetables. In some cases this packaging takes place on farm. Clamshell packaging consists of PET and PS. For the purposes of calculation it was assumed that all clamshell packaging was made from PET.

The clamshell packaging for greenhouse production of tomatoes was estimated. It is estimated that this results in 980 tonnes/year of packaging waste.

The clamshell packaging for the production of blueberries, strawberries and raspberries (packaged on farm or at cooperatives) was estimated. It is estimated that this results in 4,020 tonnes/year of packaging waste.

PET (output)

Sector	Estimated Weight
	Tonnes/year
Greenhouse tomatoes	980
Fruit packaging	4,020
Total	5,000

It is estimated that approximately 5% of PET packaging becomes waste that needs to be managed at the greenhouse or farm. These wastes are typically disposed in a garbage bin. On the basis of these estimates about 250 tonnes/year of clamshells are generated on BC farms.

PET (Input)

Item	Estimated Weight
	Tonnes/year
Clamshells	250
Total	250

3.2.1.9 Plastic Jugs, Pails and Drums

HDPE plastic jugs, pails and drums of various sizes are used for the sale of various products including pesticides, sanitation products and oil (engine and hydraulic). Small amounts of fertilizers are also sold in plastic pails (not calculated).

CleanFARMS operates an “Empty Pesticide Recycling Program” across the country. In 2011, about 50 tonnes of plastic jugs and pails were collected in BC. It is estimated that about 130 tonnes of plastic jugs and pails were sold in British Columbia in 2010. About 40% of those jugs are currently captured in CleanFARMS recycling program.

Sanitation products are used in the dairy and poultry industries. It was challenging to obtain sufficient data to develop estimates. Ultimately estimates were developed from data collected from retailers and during farm visits and then extrapolated for British Columbia production. Based on available data, it was estimated that approximately 200 tonnes/year of jugs, pails and drums are generated on BC farms. There are some limited return programs for these wastes.

Oil and hydraulic oil is used at almost all farms across British Columbia. It was challenging to obtain industry wide data. The total weight of oil containers used in British Columbia was available. It was estimated that 7.5% of these came from the agricultural sector. On this basis an estimated 135 tonnes/year were generated on BC farms. There are return programs for these wastes.

On this basis it is estimated that about 465 tonnes/year of jugs, pails and drums are generated. While there are recycling programs available for some products, a

considerable amount of these jugs, pails and drums are either re-used or require disposal.

Sector	Estimated Weight
	Tonnes/year
Pesticides	130
Sanitation	
Sanitation products (Dairy)	195
Sanitation products (Poultry)	5
Oil	135
Total	465

3.2.1.10 Animal Health Products

Approximately 10 tonnes of plastic bottles are generated through animal health products. They consist of a variety of plastics.

3.2.2 Paper

3.2.2.1 Unlined Paper Bags

Some products such as feed are sold in unlined kraft paper bags.

It is estimated that 1 million tonnes of feed is sold in British Columbia annually. Of that, it is estimated that about 35,000 tonnes is sold in multi-walled kraft paper bags. On this basis it is estimated that about 300 tonnes/year of these bags are generated on BC farms.

Kraft paper bags (input)

Sector	Estimated Weight
	Tonnes/year
Feed	300
Total	300

3.2.2.2 Lined Paper Bags

Lined (plastic liner) paper bags are commonly used to sell seed products. It should be noted that much of these products are sold in bulk. It was estimated that 2 tonnes/year of waste was generated from these bags.

Kraft paper bags (unlined) (input)

Item	Estimated Weight
Sector	Tonnes/year
Corn Seed	2
Total	2

Waste bags from treated seed are incinerated or disposed.

3.2.2.3 Molded Pulp

Paper (i.e. molded pulp) is used in the packing of some fruits. For instance, for apples and cherries, a paper liner is used in packing boxes. Also, some raspberries and strawberries are sold in paper boxes. On this basis it is estimated that about 1,990 tonnes/year of paper liners and paper boxes are used at BC farms. This paper leaves the farm and enters the waste stream at a later time.

Molded Pulp (Output)

Item	Estimated Weight
Sector	Tonnes/year
Apples	1,900
Cherries	10
Raspberries	40
Strawberries	40
Total	1,990

It is estimated that approximately 5% of paper liners and paper boxes become waste that needs to be managed at the farm. On the basis of these estimates about 100 tonnes/year of paper liners and boxes are generated on BC farms.

Molded Pulp (Input)

Item	Estimated Weight
Sector	Tonnes/year
Apples	95
Cherries	0.5
Raspberries	2
Strawberries	2
Total	100

3.2.2.4 Animal Health Products

Approximately 0.2 tonnes of paper waste are generated through animal health products. They consist of a variety of papers.

3.2.2.5 Cardboard Boxes

Cardboard boxes are used primarily for the following:

- receipt of input materials including
 - plant pots;
 - pesticides;
 - sanitation products;
 - other supplies (e.g. twine, oil); and
- discharge of output products including:
 - packaging fruit, vegetables and flowers

The amount of OCC boxes generated from plant pots, trays, insert and liners was estimated based on the estimated number of the various items used annually in BC. It was challenging to unequivocally estimate this number because not all of these items are always received in cardboard boxes. Some are palletized and covered with both stretch wrap and cardboard inserts. On the basis of these estimates about 140 tonnes/year of OCC boxes are generated on BC farms.

The amount of OCC boxes received from the sale of pesticides was estimated. On the basis of these estimates about 45 tonnes/year of OCC boxes are generated on BC farms.

The amount of cardboard from other supplies delivered to farms was not calculated because there was insufficient data.

The amount of on-farm waste OCC from the packing of various products was estimated to be about 5% of the total used for packing.

On the basis of these estimates about 1,180 tonnes/year of OCC are generated on BC farms.

Cardboard Boxes (Input)

Item	Estimated Weight
	Tonnes/year
Plant Pots, Trays, Inserts and Flats (receipt) ¹	120
Potted Plants (on farm)	240
Pesticides (receipt)	45
Field Fruit and Vegetable Packing (on farm)	165
Greenhouse Vegetable Packing (on farm)	600
Flower Packing (on farm)	7
Animal Health	2
Total	1,180

¹ Includes greenhouse and nursery

Various field fruit, vegetable and flower crops are packed in OCC and transported from the field (not always) and then to market. It should be noted that these are not agricultural wastes *per se* as they are managed at the wholesaler, retailer or consumer level. It is estimated that about 20,200 tonnes/year is used on BC farms.

A portion of the OCC boxes used to pack fruit and vegetables on the farm become waste (e.g. breakage). From industry contacts and farm visits it is estimated that 5% of boxes end up as waste. This equals about 1,010 tonnes/year (and is noted in the Input table as “on farm”).

Cardboard Boxes (Output)

Item	Estimated Weight
	Tonnes/year
Fruit and Vegetable Packing	3,300
Greenhouse Vegetable Packing	12,000
Greenhouse Potted Plant Packaging	4,800
Greenhouse Flower Packing (boxes)	130
Total	20,230

3.2.2.6 Cardboard Boxes-waxed

Various field vegetable crops utilize waxed OCC boxes to transport product from the field (not always) and then to market. On the basis of these estimates about 2,580 tonnes/year of waxed OCC boxes are shipped from BC farms.

From discussions with industry contacts and farm visits it is estimated that 5% of waxed OCC boxes end up as waste. This equals about 130 tonnes/year. Much of this waxed OCC is managed at the wholesale and retail level. It is unknown how much is recycled.

Waxed Cardboard Boxes (Output)

Sector	Estimated Weight
	Tonnes/year
Vegetable Packing	2,580
Total	2,580

Waxed Cardboard Boxes (Input)

Sector	Estimated Weight
	Tonnes/year
Vegetable Packing	130
Total	130

3.2.3 Animal Health Products

Approximately 216 tonnes/year of glass and 2 tonnes of sharps (i.e. metal) are generated through animal health products on BC farms.

3.2.4 Summary

Table 3.2 presents a summary of non-organic wastes generated on BC farms. These are essentially all packaging materials. An estimated 5,500 tonnes/year of packaging wastes are generated on BC farms. About two thirds of this waste is plastic.

Table 3.2 Summary of Non-organic Waste Generated on British Columbia Farms

Plastic	tonnes/year	Comments
LDPE	2,136	Fertilizer bags, grow bags, greenhouse film, silage film, bale wrap, greenhouse soil
PP	580	Fertilizer and seed bags (woven), twine, greenhouse twine, plant tags and a portion of the following plant pots, inserts, flats, liners and pot sleeves
PS	31	Plant pots, inserts, flats, liners
PET	250	Clamshells
HDPE	612	Pesticide, sanitation products, oil jugs, pails, drums, net wrap
Other Plastic	11	Animal health products
Sub-total	3,620	
Paper		
Unlined Kraft Paper	298	Feed
Lined Kraft Paper	2	Seed (corn) bags
Molded Pulp	97	Portion of molded pulp paper packaging
Other Paper	0.2	Animal health products
Cardboard	1,180	Plant pots, inserts, flats, liners (receipt), pesticides (jugs packaged in boxes) and portion of fruit and vegetables packaging (does not include baskets)
Cardboard (waxed)	129	Waste packaging fruit and vegetables (does not include baskets)
Sub-total	1,706	
Glass		
Glass Bottles	216	Animal health products
Total	5,541	

Figure 3.2 provides an overview of the estimated waste composition of packaging wastes generated on BC farms.

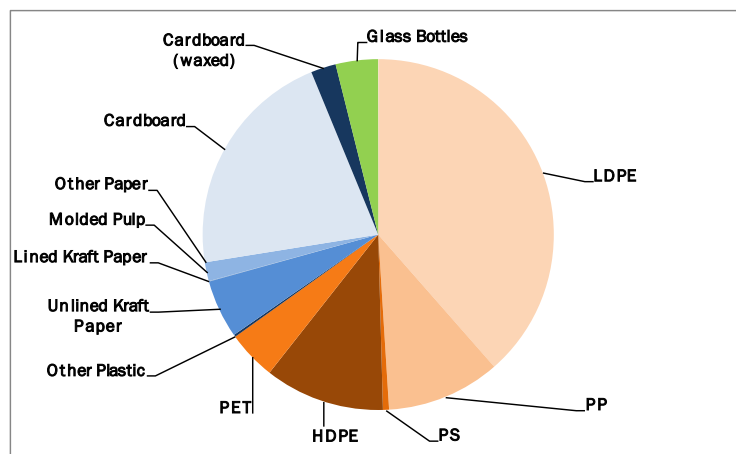


Figure 3.2 Estimated Waste Composition- Input

Table 3.3 presents a summary of the key waste producing packaging materials that are used to convey farm products to the marketplace. An estimated 32,000 tonnes/year of packaging wastes leave British Columbia farms. About three quarter of this waste is paper fibre.

Table 3.3 Summary of Key Waste Producing Packaging Materials used to Convey Farm Products to the Marketplace

Plastic	tonnes/year	Comments
LDPE	124	Fruit and vegetable packaging
PP	1,009	Plant pots, inserts, flats, liners , pot sleeves
PS	618	Plant pots, inserts, flats, liners
PET	4,995	Clamshells
HDPE	200	Nursery pots
Other		
Sub-total	6,945	
Paper		
Unlined Kraft Paper	0	
Lined Kraft Paper	0	
Molded Pulp	1,943	Packaging fruit
Cardboard	20,215	Packaging fruit, vegetables and flowers (does not include baskets); greenhouse potted plants
Cardboard (waxed)	2,577	Packaging fruit and vegetables (does not include baskets)
Sub-total	24,736	
Total	31,681	

Figure 3.3 provides an overview of the estimated waste composition of packaging wastes that leave BC farms.

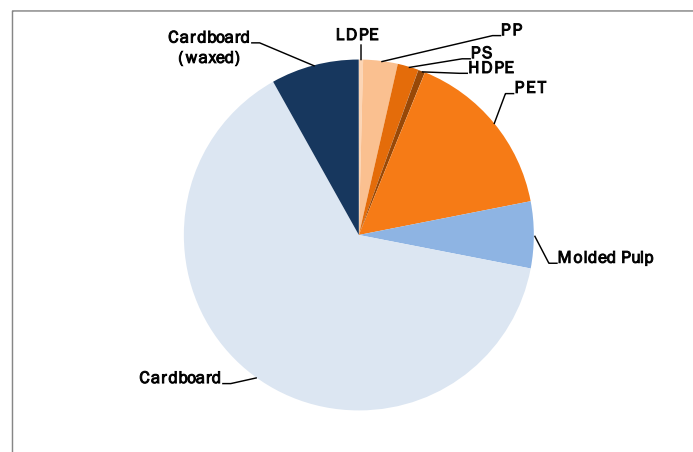


Figure 3.3 Estimated Waste Composition- Output

4.0 Farm Visits

Farm visits were undertaken to help gather information and develop a better understanding of the generation and management of non-organic wastes on the farm.

Table 4.1 presents an overview of the various farms visited. Fifteen farms were visited. The primary activity of each farm is noted. Many farms visited included at least one other activity (livestock and mixed crop). This is noted in the text of each farm visit summary.

Table 4.1 Overview of Farm Visits

Region	Farm Type (Primary operation)
Fraser Valley	Ornamental Nursery
Fraser Valley	Greenhouse, Cut Flower, Potted Plant and Cut Flower Packaging Farm

Fraser Valley	Tomato, Cucumber and Pepper Farm (Greenhouse)
Fraser Valley	Berry Farm
Fraser Valley	Vegetable
Fraser Valley	Blueberry Packing House
Fraser Valley	Dairy Farm
Fraser Valley	Poultry Farm (Broiler & Layer)
Okanagan	Apple Farm
Okanagan	Cherry Orchard and Packaging Plant
Okanagan	Apple Packaging House
Okanagan	Dairy Farm
Okanagan	Beef Feedlot
Vancouver Island	Garden Nursery
Vancouver Island	Dairy Farm

An overview of each farm visit is presented in the following sections, which are divided into the various primary farming operations. Most farms visited undertook additional farming activities over and above their primary farming operation.

4.1 Fraser Valley

1. Farm Type- Ornamental Nursery, Fraser Valley

Overview of Operations

A 10.8 ha (27 acre) nursery including 2 ha (5 acres) of greenhouses was visited. The nursery produces fruit trees, shrubs, trees, ground cover, vines, perennials, grasses, etc (Photo 5). They supply mostly retail garden centres, landscape contractors and other wholesale nurseries primarily within BC but also out of province. They have an Environmental Farm Plan.



Photo 5. Nursery Plants

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Fertilizers

About 240 LDPE plastic bags of fertilizer are used annually. This generates about 20kg of waste. This is placed in a LDPE recycling bin.

Pesticides

A variety of pesticides are used at this nursery. This includes approximately 25-10 L jugs, 5-20 L jugs and 10-1 L jugs/year. All containers used are rinsed and returned to the retailer for recycling.

Pots and Trays

Nursery stock is propagated in plastic pots of several sizes. It is estimated that approximately 13.4 tonnes of pots and 170kg of plastic propagation trays are reused at the nursery annually for transplanting/replanting.

Greenhouse Film

The farm operates 2 ha (5 acres) of greenhouses within which they propagate roots or cuttings to maturity. All of the cold frames and greenhouses are covered in LDPE plastic. This plastic is replaced every 1-4 years, depending on the building and thickness of plastic. It is estimated that 1,640 kg of plastic is sent for recycling annually.

Engine Oil/Hydraulic Oil

This nursery uses about 80 litres of oil per year. The oil is received in 4 L HDPE containers that are returned to the retailer as part of the provincial Used Oil Container Recycling Program.

Disinfectant

The nursery uses 4-200 L drums of disinfectant per year. These are plastic HDPE and once empty are returned to the retailer for reuse/refill. This is part of the bio security program.

Waste Disposal

The nursery contracts a recycler to collect cardboard and recyclable plastic on a regular basis.

Outputs

Pots and Trays

An estimated 112,000 pots are shipped out annually. This represents 20.1 tonnes going to the garden retailers/landscapers/other wholesalers. About 1,000 propagation trays are shipped out annually with a total weight of 170 kg.

Tags

All plants shipped out are tagged with picture tags, hang tags or stick tags. It is estimated that 400,000 tags are used each year of which approximately 90% being shipped off the farm. This represents approximately 792 kg of plastic.

Packaging Boxes

Various Shipping Materials

Various shipping materials are used as everything produced on the farm is shipped to other wholesalers, garden centres or landscapers. Approximately 30 rolls of stretch film (150 kg), 100 rolls of Sisal twine (227 kg), 70 rolls of nylon twine (158 kg), a number of rolls of foam packaging (6 kg), 20 rolls of mule tape (270 kg) and 6,000 jute squares (1,728 kg) are used annually.

Insights

A considerable quantity of greenhouse plastic, as well as smaller amounts of tags, pots and shipping materials are generated on this farm annually. Concern over soil borne diseases is a factor in limiting the reuse of any containers that have had plants in them both by the nursery and any of its customers.

2. Farm Type - Greenhouse, Cut Flower, Potted Plant and Cut Flower Packaging Farm, Fraser Valley, British Columbia

Overview of Operations

A 17 ha greenhouse (2 locations) that grows cut flowers and potted plants was visited (Photo 6). This farm also includes a large packaging facility. The farm receives, repackages (i.e. bouquets) and adds value (e.g. includes decorative vases etc.) to other local cut flowers. These bouquets and other products are sold to grocery store chains and other customers. About 40% of this farm's products are shipped out of the province (Western Canada and Pacific Northwest). The farm does have an Environmental Farm Plan. The farm has a number of recycling programs.



Photo 6. Greenhouse Flowers

Key Waste Generating Activities and Waste Management

The key waste generating activities included:

Inputs

Production of Cut Flowers/Potted Plants

Fertilizer

All fertilizers are received in 25kg bags. These generate approximately 187 kg of LDPE plastic waste per year. They are put in with the recyclable plastic.

Pesticides

Essentially no chemical pesticides are used. Most pest control is effected through various biological control agents.

Grow Media

Grow media above and beyond bulk compost and soil is purchased in large compressed 34 cu ft bales. The plastic waste from these bales is estimated to be approximately 1.7 tonnes per year. This is compacted and shipped to a collector for recycling.

Greenhouses

Greenhouses are mostly glass, but some are covered in 6 mm plastic. Approximately 3,700 m² of plastic film (LDPE) is used. The plastic is replaced every four years and generates about 130 kg of recyclable material per year.

Packaging area

Packing Boxes, Trays & Pots

A significant quantity of plastic cell trays (plant liners) and pots are received from imported plants for transplanting. This plastic is directed to an on-site plastic compactor. It is estimated that approximately 48 pallets of cell trays and 11 cages of 4.5" pots are shipped to a local collector for recycling. As well, a significant quantity of cardboard boxes and liners are received from the suppliers of pots and trays. Annually about 105 tonnes of cardboard is generated. The farm receives some revenue from this recycling.

Pails

Twenty litre pails are used to transport local cut flowers to the packaging facility (Photo 7). These originate from the BC Flower Auction in Burnaby. These high density polyethylene (HDPE) pails are reused for the same purpose on an ongoing basis. A deposit is paid on these, which includes a small amount for cleaning.



Photo 7. 20L Pails for Shipping Flowers

Waste

Waste consisting of mostly plastic packaging is generated in the packaging area. This includes plastic sleeves that all flowers are received in as well as plastic film and other wastes (Photo 8). This is directed to an on-site waste compactor.



Photo 8. Plastic Packaging Waste

Outputs

Production of Cut Flowers/Potted Plants

Pots and Trays

Potted plants are sent to market in the pots they were grown in. These pots are either polypropylene (PP) or polystyrene (PS). Pots are often inserted into trays. There are four pot sizes: 4 inch and 6 inch pots and 8 inch and 10 inch hanging baskets. In total over 6.9 million containers are used each year. It is estimated this generates approximately 149 tonnes of plastic waste per year.

Cut Flowers are shipped out in re-usable 10 L containers, which get returned for refilling.

Plant Tags

Each pot is tagged. Tags weigh about 2.2 gm each, resulting in approximately 12 tonnes of waste per year.

Packaging Boxes

Potted plants can also be packed in cardboard boxes. These weigh 199 gm each. Approximately 159 tonnes of cardboard is used, ending up in the waste and/or recycling stream of retailers, chain stores and garden centres.

Packaging area

Packaging sleeves

Each bouquet of flowers is packaged in a plastic film sleeve (Photo 9). Each sleeve weighs about 4 gm. Approximately 2.4 million sleeves are used annually. Cut flowers are also placed in shipping boxes.



Photo 9. Plastic Sleeves

Packaging Boxes

All products shipped out of province are packaged in cardboard boxes (various sizes) and wrapped in shrink wrap. For local deliveries, trucks are equipped with special racks to hold the pots and trays.

Insights

The cut flower and potted plant parts of the farming operation are similar to other facilities visited in terms of production techniques, inputs and outputs.

The packaging facility was unique. It generates considerable wastes from a) the suppliers of plants that need to be transplanted and b) the repackaging and distribution of cut flowers. Cardboard is fully recycled. Various plastic packaging and other waste is compacted and shipped to a collector for recycling. Soiled containers are washed for re-use and/or recycling.

3. Farm Type- Tomato, Cucumber and Pepper Farm (Greenhouse), Fraser Valley Delta

Overview of Operations

A 26.5 ha (66 acre) greenhouse farm was visited (Photo 10). They grow approximately 12 ha (30 acres) of tomatoes, 5.2 ha (13 acres) of cucumbers and 9.2 ha (23 acres) of peppers. Up to 70% of produce is shipped out of province. The farm has an Environmental Farm Plan.



Photo 10. Pepper Plants in Greenhouse

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Fertilizer

Some liquid fertilizer is received in bulk returnable re-useable totes. About 10,000 bags of fertilizers are used each year producing an estimated 850 kg of waste. These bags are disposed of in the garbage.

Plants are grown hydroponically and fertilizer in solution is directed using irrigation hoses (ca. 4-6mm in diameter). Approximately 114,250 m/ha are used. These plastic hoses are replaced every 8-10 years.

Pesticides

The pesticides used come in a variety of sized containers (up to 10 litre). They are mostly triple rinsed and taken back to the retailer for recycling. Biological control agents are used for much of their pest control. They generate little waste.

Acids and Cleaners

Large (205 litre) drums of acids and cleaners are used on the farm. They include a deposit and are returned to the retailer.

Sanitizers

Approximately 100 twenty L pails/year of sanitizer are used to sanitize the greenhouse. These pails are rinsed out and returned to the retailer or re-used on-site.

Ground Cover

The soil is covered with LDPE film annually. This film is removed each year and disposed. This is estimated to produce 37 tonnes of waste annually.

Grow Bags

Coco filled grow bags are used to grow tomatoes, cucumbers and peppers. Growing blocks (rockwool) are placed on top of these grow bags so that the bottom of the growing block is in contact with the coco media. This generates an estimated 45 tonnes/ha (i.e. plastic grow bags and growing media) of waste. This is collected and recycled once per year.

Twine

Tomatoes, cucumbers and peppers are each held in place with a 15 m piece of PP twine (375,000 m/ha). At this farm, about 9.9 tonnes of twine waste is generated annually. This is collected (with vines attached) and recycled with some being ground up as part of the compost once per year by a local composting company.

Clips and Strut Supports

Plastic clips and HDPE strut supports are used to hold the tomato plants in place and support the plant. About 750,000 clips/ha are used for tomato plants. Each clip weighs about 1 gram. About 750 kg/ha of clips are generated (metal clips are being tried as they have a longer life span.) Clips are collected (with vines attached) and recycled once per year.

Outputs

Packing boxes

An estimated 2.38 million cardboard boxes are used annually to ship all three crops (i.e. tomatoes 5kg/box, peppers 4.6 kg/box and cucumbers 24 per box) (Photo 11).

Each box weighs 0.62 kg which generates about 1,490 tonnes of off-farm waste per year.

An unknown quantity of damaged packaging boxes are recycled annually. A third party waste contactor collects cardboard for recycling. A few of the large grocery chains are being supplied with RPC (Rigid Plastic Containers) which are reused. These need to be cleaned before they are returned to the greenhouse for re-use as they could be a vector for disease.

Plastic Bags, Stretch Film and Clamshells

The peppers are bagged mostly 6 per 11 gram LDPE bag, generating about 21 tonnes of waste. The cucumbers are individually wrapped in stretch film (3

grams/cucumber) (Photo 12) generating approximately 22 tonnes of waste. The tomatoes are packed 3 per clamshell (18 gram each) generating an estimated 340 tonnes of waste.



Photo 11 OCC Shipping Boxes



Photo 12. Shrink-wrapped Cucumbers

Insights

Some of the inputs used at this farm come in bulk and generate no wastes. Some inputs such as pesticides have return to retailer recycling programs. The shipping of tomatoes, cucumbers and peppers to market results in the generation of a considerable amount of packaging waste (cardboard). Most cardboard is recyclable.

There are recycling and composting programs in place to deal with many of the other non-packaging and organic wastes generated at this farm.

It is estimated that 65-70% of these crops (and hence packaging) are exported out of province. Consequently approximately 30-35% of the waste packaging for shipping stays in BC.

4. Farm Type - Berry Farm, Central Fraser Valley

Overview of Operations

A 65 ha berry farm was visited. This is a mixed fruit farm comprised of 26 ha blueberries, 11 ha strawberries, 9 ha raspberries and 2 ha split into blackberries, currants and haskaps.

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Seeds

Fall rye is used as a cover crop between rows. It comes semi-bulk in approximately 15 PP totes per year, generating approximately 21 kg of PP plastic. These can be returned to the supplier and re-used.

Pesticides

Pesticides used come in 1 L, 5 L and 10 L containers. Approximately 250 containers are used annually and are triple rinsed and taken back to the retailer for recycling. Containers are shipped in cardboard boxes generating approximately 75 kg of OCC. Most of this cardboard is picked up by a contracted waste collector.

Fertilizers

Essentially all fertilizers come in bulk and no waste is generated.

Oil

Hydraulic oil and engine oil comes in 5 gallon pails. These are re-used on the farm and eventually recycled. Used oil is being returned to the equipment dealer for recycling. Used oil containers can be re-used and/or returned to the supplier, along with oil filters, as part of the provincial stewardship program.

Drip Tape

Watering of the plants is accomplished by an overhead drip (Photo 13) for all but the June bearing strawberries. These HDPE lines are repaired as needed and have a life span of 15-20 years, hence generating little or no waste.



Photo 13. Overhead Drip Watering on Raspberry Plants

Plastic Field Mulch

This is used for weed control for approximately 2.8 ha of strawberries and is placed in the space between rows (1.5 m). Mulch film (LDPE) has a 2 year life span and is then picked up by a waste collector for recycling. Approximately 5,800 m² per hectare is used, generating approximately 1,151 kg of LDPE waste per year.

Sisal Twine

An unspecified quantity of sisal twine is used each year for tying the raspberry canes, after pruning. This ends up in the pruning mulch at the end of the growing season, with no waste generated.

Treated Posts & Steel Wire

Posts are used for 10-15 years and wire & steel spreaders last over 20. They can be re-used, eventually going as scrap metal. These are used on all but strawberries.

Outputs

Flats, Lugs and Totes

Various sized plastic re-useable containers (HDPE) are used to convey picked fruit (strawberries, raspberries, blueberries etc.) to the packing house for re-packaging into consumer sized fibre or foam baskets. These containers are: 'flats,' which hold 8-9 kg (18-20 lbs) of fruit, 'lugs,' which hold 17-18 kg (38-40 lbs) of fruit and 'totes' (primarily used for blueberries) which hold 218-227 kg (480-500 lbs) of fruit. Approximately 200 flats and lugs are disposed of each year, from normal wear and tear. This generates 200 to 400 kg of plastic waste each year. These end up in the container provided by the local recycling collector company.

Fruit Baskets

Two types of fruit baskets are used. Paper (molded pulp) baskets (Photo 14) hold 1.13 kg (2.5 lbs) of fruit and weigh 21 grams each. Six of these are packed in a master case. Approximately 40,000 are used per year, resulting in approximately 840 kg of paper that is potentially recyclable. Foam baskets (PS) hold 0.38 kg (0.83 lbs) of fruit and weigh 17 grams each. Twelve of these are packed in a master case. Approximately 120,000 are used per year, generating 2,040 kg of PS waste.

An undetermined quantity of cardboard (OCC) and plastic bag (LDPE) waste is generated from the receipt of these fruit baskets from the manufacturer.



Photo 14. Fruit Baskets

Boxes, Master Cases

Master cases are waxed cardboard and are used to package the individual baskets of fruit. The fruit is picked and packed in baskets and master cases and sold at the fruit store to various wholesalers and the public. Approximately 20,000 master boxes (0.73 kg each) are used each year, generating about 14,580 kg of waste. These are re-used by the farm but eventually end up as landfill waste.

Plastic Pails

Plastic pails are sold as part of the "U" pick program for consumers. They are HDPE plastic weighing 0.7 kg each and hold about 2.26 kg each (5 lbs.) Approximately 2,000 are used each year. There is very high re-use of these pails by the consumers.

Stretch Netting

Cases of picked fruit are fastened to wood pallets for transport from the field to the on-farm fruit store by stretch netting (PP). Approximately one roll (15,000 ft by 20 inches) is used each year. About 15 kg of waste is generated annually.

Insights

A considerable quantity of re-usable plastic 'field to packing house/fruit store' containers and 'U pick' pails are used. Most of the waste that is recyclable is generated from the plastic mulch film, the fruit baskets and master waxed cardboard boxes used. The PS foam fruit basket is being re-evaluated with the hopes of finding an acceptable bio-degradable alternative that is leak proof.

5. Farm Type - Vegetable, Fraser Valley

Overview of Operations

A 48 ha (120 acre) vegetable farm was visited. Crops grown include: zucchini, lettuce, carrots, beets, parsnips, rutabagas, potatoes, peppers, corn, peas, beans, pumpkins and onions. The farm has an Environmental Farm Plan but it has not been updated in some years. Essentially all produce is sold either through the BC Vegetable Marketing Commission and or to local markets.

Key Waste Generating Activities and Waste Management

The key waste generating activities included:

Inputs

Seeds/Cuttings

Carrot, parsnip, beet and rutabaga seeds come in 5 gallon pails. Approximately 40 pails are used annually. Each pail weighs about 1.5 kg and therefore about 60 kg are generated annually. These pails are reused on the farm.

Seed potatoes are received in jute sacks or mini totes. Approximately 100 jute sacks and 4 mini tote bags of seed are used annually. The sacks can be reused or disposed of in the garbage.

Greenhouse Film

The farm has a 278 m² greenhouse. It is covered with a double layer of 6 mm LDPE film which is replaced every five years. Therefore 55 square metres of waste LDPE plastic is generated each year weighing 16 kg.

Greenhouse Propagation Plug Trays

Approximately 200 trays per year are used and end up as waste. This generates approximately 34 kg of waste going to landfill.

Plastic mulch, row covers and floating mesh

Black plastic mulch film (LDPE) is used in the zucchini and pepper field for weed control. This is 1-2 mm thick and is replaced annually. Annual usage is estimated at three rolls of 1.2m x 1,220m film, producing 228 kg of waste. A floating row cover is used on the early potatoes and sweet corn. This is used for two years. Total usage per year is approximately 1,125 m² per year, averaging 58 kg of waste annually. A new experimental floating “wonder” mesh is used on the rutabagas for insect control. This product is reusable, lasting 10 years or longer, generating no waste.

Grower Mix and Fertilizers

Most fertilizers used come in returnable mini totes and no waste is generated. About 120-25kg bags of fertilizer are used. The plastic bags weigh 85 grams each for a total of 10 kg of waste. Approximately 40 bales (3.2 ft³ bales) of seedling grow mix are used annually, generating approximately 36 kg of waste which is disposed in the garbage.

Pesticides

A variety of pesticides are used for crop production. Approximately 10-20 L (HDPE) jugs are used annually. Rinsed out pesticide containers are placed in large plastic bags (supplied by retailers) and returned to the retailer (Terralink, Evergro).

Engine Oil/Hydraulic Oil

Oil is received in five gallon pails and 45 gallon drums. Approximately 40 of the former and 4 of the latter sizes are used. Used oil is taken to a facility for recycling. Empty containers are returned to the oil distributor for recycling as part of the provincial used oil container recycling program.

Oil Filters/Air Filters

About 15 oil filters and 20 air filters are generated annually. They are taken to a local retailer for recycling.

Waste Disposal

On average this farm places one bag with residential garbage at the curb for pick-up per week. A contracted recycler provides weekly pick up of a dumpster for cardboard and plastic film. Cardboard comes from boxes containing pesticide containers and oil filters.

Outputs

Shipping Containers

The beets, parsnips and rutabagas are stored and shipped off the farm in plastic multi use totes (1,400 in total used that hold 454 kg each) (Photo 15). The estimated life span of these totes is 20 years. Approximately 3,000 waxed cardboard cartons (hold 22.68 kg of produce) are used to ship produce each year. Weighing approximately 1.5 kg each, this equals 4.5 tonnes of waste. Approximately 1,200 cardboard boxes (hold 11.34 kg of produce) are used per year representing about 545 kg of OCC which may be recycled by the end user. In addition about 40 large cardboard totes at about 11.34 kg each are used to ship produce (squash & pumpkin) each year. These leave the farm and

are likely reused but eventually end up recycled or in the garbage (453 kg). A quantity of fruit is purchased from other growers and sold at the farm vegetable store. It is estimated that 20,000 cardboard trays are used for sale. At a weight of 0.63 kg each this is about 12.6 tonnes of OCC going to consumers.



Photo 15. Reusable Plastic Totes

Mesh Bags

These are used to package shallots (onions) and potatoes. Approximately 200 PP bags weighing 17 grams each and 6,000 PP bags weighing 34 grams each generate a total of 207 kg of waste each year.

Plastic Film Bags

The retail vegetable store at the farm packages vegetables in 2, 5 and 10 lb plastic film (LDPE) bags. It is estimated that approximately 545 kg of waste per year is generated from these bags. The store also repackages produce from other growers. Approximately 40,000 LDPE T-shirt bags weighing 8 grams each produce 320 kg of waste. Approximately 50,000 five inch 'bar ties' are used weighing 1 gram each, generating approximately 50 kg of waste.

Insights

A moderate quantity of packaging waste is generated on the site annually. Most of these wastes are reused by others, recycled at local recycling facilities and/or returned to retailer. There appear to be recycling opportunities for most packaging wastes generated on the farm.

6. Farm Type - Blueberry Packing House, Fraser Valley

Overview of Operations

A Fraser Valley blueberry packing plant was visited. Blueberries are received during the July and August harvest from local farms. Fruit is cleaned, sorted and packaged for re-sale to various wholesale and retail customers. Nearby cold storage is used to extend the life of the crop.

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Blueberries are mostly machine harvested into re-usable plastic 'totes' and 'lugs' (Photo 16). These are used to convey the fruit to the packing house. The 'lugs' hold 17-18 kg of blueberries. Each 'totes' holds 218-227 kg of blueberries. Approximately 200 of these are damaged from normal wear and tear each year and are disposed of in the recycling dumpster. This generates approximately 1,000 kg of recyclable HDPE per year. Normally the lifespan of these containers is 15-20 years.



Photo 16. Plastic Totes

Cardboard

An undetermined quantity of cardboard and some film plastic (LDPE) is received at the plant from the various packaging suppliers. These cardboard boxes and plastic bags contain empty clamshells that the blueberries are packaged into.

Adhesive

The various cardboard master cases are partially held together by a hot melt adhesive. This comes in the form of a 'chicklet' which, when heated, melts and glues the cardboard together. Approximately 12-20 kg boxes of chicklets are used each year. The adhesive becomes an integral part of the cardboard master cases and ends up in the waste stream of re-used or recycled boxes.

Outputs

Cardboard Boxes

Cardboard (non-waxed and waxed) master cases are used to package the various sizes of clam shells which hold the fruit (Photo 17). Approximately 495,000 non-waxed master cases are used each year. Weighing 0.75 kg each, this generates about 371 tonnes of waste. These are shipped out to wholesalers and retailers and end up being either re-used and/or recycled. Approximately 37,400 waxed cardboard master cases are used each year. This generates about 28 tonnes of waste. These end up being re-used and/or in the waste stream of the food chains/wholesalers.



Photo 17. OCC Packaging Boxes

Stretch Netting

Stretch netting (PP) is used to hold the master cases of fruit onto pallets for transport. The plant uses approximately 16 rolls per year (20" wide x 15,000' long), generating 240 kg of waste that is sent for recycling.

Clamshells

Fruit is packed into food grade plastic (PET or PS) clamshells (Photo 18). These are subsequently packed into the cardboard master cases for shipping. Six different sizes are used (14 gram, 15 gram, 24 gram, 53 gram, 63 gram and 69 gram). All of the clamshells come 'pre labelled' from the supplier. Approximately 4 million clamshells are currently being used per year. About half of these are of the 15 gram size which holds about 551 ml (one pint) of fruit. These are packed 12 per master cardboard case. The total weight of all clamshells used is approximately 101 tonnes of plastic. This material likely ends up in the waste stream of the consumer (recyclable where facilities exist). A portion of these containers of fruit would be shipped out of province.



Photo 18. Clamshells

Pallets

"Chep" re-usable pallet boards are used, generating no waste.

Organic Waste

Damaged berries and culls from the packing house are composted and subsequently returned to the soil.

Insights

The key waste products generated include cardboard from outer cases and plastic clamshells. Most of the cardboard is recyclable through the local recycling collector and/or the various food chains. Clamshells likely end up in the curbside waste/recycling streams.

7. Farm Type - Dairy Farm, Fraser Valley Regional District

Overview of Operations

A 450 head (of which 200 are milked) dairy farm was visited (Photo 19). In addition this farm has about 300 acres of cropland in production, 150 acres produce silage corn and the other 150 acres grow grass forage. The farm maintains an Environmental Farm Plan. In addition this farm has been participating in a voluntary pilot farm plastic recycling collection program (free to farmer) in their District. This program, which has been operating for one year, is available for two days every four months. Previously these wastes would have been disposed in landfill, as they will after the conclusion of the pilot program.



Photo 19. Dairy Farm

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Feed additives and minerals

Minerals, which are added to feed, come in PP woven plastic bags. Approximately 400 bags are used at this farm annually. This generates about 34 kg of waste. These bags are disposed of in regular garbage.

Haylage

There are three large bunkers where hay grown on the farm is ensiled. They measure 9*24m (30*80 ft) for a total of 752 m². The haylage is covered with two separate layers of plastic. The bottom layer is a clear LDPE plastic film (3mm) called 'Silo Stop.' The top layer is a heavy gauge black/white LDPE plastic film (6mm) (white side facing down and black side facing up). The covers are only used for one season. This generates about 130 kg of waste. This plastic film is being sent to the pilot farm plastic recycling collection program.

Hay

Hay comes in bale wrap, net wrap or twine. Approximately 200 round straw bales (bale wrap and net wrap), 220 round hay bales (net wrap, bale wrap), 300 large square bales (synthetic twine) and 2,000 small square bales (synthetic twine) are used annually at this farm. This generates about 130kg of bale wrap, 24kg of net wrap and 225kg of twine. The net wrap is disposed in landfill. The bale wrap and twine is being sent to the pilot farm plastic recycling collection program.

Corn Silage

All corn is harvested and then stored in one of six horizontal bunker silos. The silage is covered with black/white LDPE plastic film bunker silage covers which are used for one season. This generates about 245 kg of waste. These covers are being sent to the pilot farm plastic recycling collection program.

Fertilizer

Fertilizer is purchased in one tonne tote bags. On this farm about 24 bags are used annually. The bags are made from woven PP and lined with LDPE plastic film. This generates about 34 kg of PP waste and 22kg of LDPE waste. The bags and plastic film are being sent to the pilot farm plastic recycling collection program.

Seed bags

Corn seed comes in paper bags (lined). On this farm about 5 bags are used annually. The bags are made from kraft paper. This generates about 4 kg of waste per year. These bags are disposed in the garbage.

Grass seed comes in plastic bags. On this farm about 10 bags are used annually. The bags are made from woven PP paper. This generates about 4 kg of waste per year. These bags are disposed of in the garbage.

Pesticides

Pesticides come in 10 L HDPE containers and applied by a local custom applicator who returns them as part of the pesticide container recycling program at the retailer. On this farm about 30 pails are used annually.

Sanitation

A number of sanitation products are used at this dairy farm. Approximately 4-205 L plastic drums of teat dip, 20-205 L plastic drums of soap, and 2-205 L plastic drums

of foot bath are used annually. The drums are made from HDPE. Approximately 30-55 L plastic drums of chlorine and 25-55 L drums of acid are used annually. The drums are made from HDPE. All of these products are purchased with a deposit and returned to the dairy supply company where they are refilled and brought back to the farm (all delivery and return done by the supplier).

Floor drying

Hydrated lime, which is used as a floor drying compound, comes in lined paper bags. Approximately 100 bags are used at this farm annually. This generates about 9 kg of waste. These bags are taken to the local landfill as mixed paper.

Tank washing

Water conditioner, which is used to correct high magnesium in wash-up water, comes in LDPE plastic bags. Approximately 50 bags are used at this farm annually. This generates about 4 kg of waste. These bags are taken to the local landfill.

Other Packaging Materials

LDPE plastic (stretch) film is generated from incoming shipments. This generates about 2kg of waste/year. OCC is generated from incoming shipments of materials. This generates about 90kg of waste per year, which is sent for recycling.

Used Oil

Approximately 20-20 L pails of oil and hydraulic oil are used annually. It is estimated that 16 of these are washed and used around the farm. Otherwise these and the 1-205L oil drum used per year are returned to the supplier for subsequent recycling (part of the provincial stewardship program for used oil containers).

Animal Health Waste/Sharps

Some animal health products are used on-site. Vets take back their own sharps. Glass bottles have any metal and caps removed and are cleaned and put in with the local recycling. Some containers go back to the supplier. A small amount ends up in the garbage.

Outputs

No outputs are generated from the sale of milk.

Insights

A considerable quantity of bunker silo covers, bale wrap, net wrap and twine are generated on this farm annually. They are currently being sorted at the farm and shipped every four months to the voluntary pilot farm plastic recycling collection program (free to farmer) in their District, which supplies a large container to deposit the returns and subsequently ships them to a recycler in the City.

All of the sanitation products are purchased in large containers which have a deposit and are returned to the supplier for refilling.

8. Farm Type - Poultry Farm (Broiler & Layer), Eastern Fraser Valley

Overview of Operations

A 70,000 bird per year poultry (broiler) farm was visited. The production cycle is 10,800 birds every 6.5 weeks. At any one time there are 10,800 chickens on-site. Chickens roam loose in the barn (6,000 m²). In addition, the farm has 14,500 layer birds. They are housed 4 to 5 birds per cage in a 743 m² building. This farm also rents out 13 ha of cropland. The farm has an Environmental Farm Plan.

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Feed and Supplements

Virtually all feed and supplements are premixed and blown into the barn by contracted services. No waste is generated from this activity. A quantity of bagged feed is used each year as some feed testing trials are being conducted in conjunction with a local feed company. Approximately 500-20 kg multi-layer paper bags are used annually. A contracted waste disposal dumpster is on site for paper waste disposal.

Sanitation

After each production cycle, the barn is steam cleaned by contracted services. As part of the industry wide bio-security protocols, access to the inside of the barn is limited to specialized services. Approximately 5-5 gal pails of mouse bait are used per year. These pails are cleaned and re-used on the farm. Approximately 3-4 20 L pails of sanitation products are used annually. Pails are rinsed and disposed of in curbside waste.

Animal Health Products

Any vaccines and animal health products are administered by contracted veterinary services off site or prior to delivery of a new flock.

Outputs

No wastes are generated from the sale of livestock. Eggs are gathered automatically and are placed into re-usable plastic trays. Eggs are packed 30 per tray. Trays are stacked on pallets (15 dozen per layer, 30 layers high). They are kept in a cooler room and are picked up regularly by Golden Valley Foods. The plastic trays are washed and sanitized and returned to the farm for re-use.

Insights

A relatively small quantity of packaging waste is generated on the site annually. Waste is removed by contracted services and curbside collection.

4.2 Okanagan

1. Farm Type - Apple Farm, Central Okanagan

Overview of Operations

A 9 ha apple farm was visited. Currently 3.25 ha are in production (Photo 20).

Apples are taken to a local co-operative for storage and final marketing. Approximately 80% of apple production in the Okanagan is exported out of province.



Photo 20. Apple Orchard

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Plantings

Essentially all plantings come in bulk and no waste is created.

Fertilizers

Relatively little fertilizer is used at apple farms. About 50-25 kg LDPE bags are used annually. This generates about 4kg of packaging waste which is disposed in the garbage. Some foliar nutrients are used. These come in 10 L size (HDPE) containers. About 4 plastic containers are used annually, triple rinsed and returned to the retailer.

Pesticides

A variety of pesticides are used for apple production. Approximately 1-170 L drum of Dormant Oil Spray is used. The drum is returned to the retailer.

Fungicides are typically sold in paper bags. Approximately 3 bags are used annually. They are disposed in the garbage. Approximately 2 bags of rodenticide are used. These are disposed in the garbage.

Insecticides and herbicides come in plastic containers (1, 5 and 10L sizes). Approximately 6 containers are used annually, triple rinsed and returned to retailer.

Engine Oil/Hydraulic Oil

About 2 -20 L containers are used per year. These and the used oil are disposed of at the retailer as part of the provincial used oil/container stewardship program.

Oil Filters/Air Filters

The farm takes used oil and oil filters to the local retailer for disposal.

Overhead Irrigation Tubing

Trees are currently being irrigated via an overhead watering system employing plastic PVC piping and sprinkler heads. Average life span is 12 years. It can be repaired, recycled and/or reused. Recycling requires removal of glue and metal fittings otherwise it must go into the landfill garbage.

Outputs

Cardboard Boxes

The farm delivers approximately 127 tonnes of apples to the local co-operative for packing. This is done in re-useable wooden and/or plastic tote boxes that hold about 454 kg (1,000 lbs) each. At the co-operative, the apples are packaged in cardboard boxes. Each box can hold 18 kg (40 lbs) of apples so approximately 7,000 boxes are used annually.

Each box weighs about 425 grams and therefore about 3 tonnes/year of cardboard is used to package apples produced at this farm.

Insights

A moderate quantity of packaging waste is generated on the site annually. Most of these wastes are reused by others or recycled at local recycling facilities and/or returned to retailer.

2. Farm Type - Cherry Orchard and Packaging Plant, Central Okanagan

Overview of Operations

A cherry orchard was visited. The farm grows 13.4 ha of cherries. The farm has an Environmental Farm Plan.

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Pesticides

Pesticides come in 1, 2 and 10 L containers (HDPE). They are triple rinsed and taken back to the retailer for recycling. Containers are shipped in cardboard boxes. Most of this cardboard is recycled. Approximately 0.5 kg of waste plastic is from plastic pesticides in 20 kg plastic film bags which are landfilled.

Fertilizers

Fertilizers come in 25 kg plastic bags (LDPE) which end up in the garbage. Foliar Nutrients come in 10 L HDPE containers, are triple rinsed and included in the return to retailer for recycling program.

Every 2-3 years, agricultural lime is applied to the soil. A rate of 5-7.5 tons per ha is required to maintain the soil pH at around 6.5. This generates approximately 6 empty (PP) tote bags per year weighing a total of 8.5 kg for reuse or disposal in landfill.

Oil

Hydraulic oil and engine oil comes in 5 gallon pails. These are reused on the farm and eventually assumed to be returned to the retailer. Used oil is being returned to the equipment dealer for recycling. Oil filters are returned to the retailer. All of this is part of the provincial used oil management program.

Drip Lines

One inch diameter plastic tubing with emitters are strung along the rows of trees for watering. Larger size plastic piping runs underground. Between 600 and 900 m/ha (2,000 and 3,000 feet/acre) of tubing runs above ground. Tubing does get repaired but lasts 20 years or more.

Plastic Mulch

A plastic film (LDPE) ground cover material called 'extenday' is put on the ground at blossom time to reflect light and improve colour of some varieties of cherries. This can be re-used for up to eight years before it has to be disposed. Approximately 3,065 m² is re-used every year.

Cleaners

Approximately 3-4 L jugs of bleach are used for disinfecting the work surfaces in the packing house per season. They are rinsed and disposed of in curbside garbage.

Picking Containers

Reusable metal and plastic containers holding 6.8kg (15 lbs) of fruit, as well as wooden and plastic tote boxes (reusable) are employed to convey the cherries from the trees to the packing house.

Outputs

At the packing house, sorted and washed fruit is packed in cardboard boxes with a paper insert and plastic bag in each box (Photo 21). Two sizes of boxes are used: 9.07kg and 4.54 kg. With an average yield of 7.26 tonnes per acre and assuming half of the harvest is packed in each size of box, approximately 14.95 tonnes of cardboard, 277 kg of paper inserts and 1.6 tonnes of plastic (LDPE) waste is generated. Packaging would enter the waste/recycling stream through food wholesalers, grocery stores and customers placing waste at the curbside.



Photo 21. Cherry Packaging

Insights

A moderate amount of packaging waste is generated on the site annually. Most of this waste is recycled (cardboard), returned to the retailer for recycling or landfilled. Picking and storage containers are returned to the farm and reused. Over 95% of the crop is exported out of province.

3. Farm Type - Dairy Farm, North Okanagan

Overview of Operations

A 320 head dairy farm (150 head milking) was visited. In addition this farm has 83 ha of cropland in production on which corn silage (33 ha), grass hay and alfalfa are grown. The crops are primarily used to feed the livestock throughout the year. The farm does not have an Environmental Farm Plan.

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Feed additives

Mineral supplements are mixed into the feed. Approximately 240 bags per year result in about 20 kg of plastic waste which is disposed in the contracted dumpster on site.

Lime

Lime is used as a floor dry. Approximately 300 plastic lined paper bags are disposed of each year in the garbage.

Water Treatment

There are about 72 LDPE plastic bags disposed of each year.

Hay

Hay comes covered in bale wrap, net wrap or twine. Approximately 200 round bales (net and bale wrap), 40 wet silage bales (bale wrap) and 1,000 small square bales (twine) are used annually at this farm. The bale wrap, net wrap and twine are disposed. There are limited recycling opportunities for bale wrap.

Haylage is also stored in horizontal bunkers, covered with 6 mm white plastic. The two bunkers are approximately 1,400 m². Approximately 197 kg of waste is disposed each year.

Corn Silage

Four bunkers have an area of approximately 2,100 m², resulting in about 300 kg of plastic waste each year from the bunker covers (Photo 22).



Photo 22. Bunker Cover

Sanitation

A number of sanitation products are used at this dairy farm. Approximately 6-55 L plastic drums of teat dip (Photo 23), 6-55 L plastic drums of soap, and 3-205 litre plastic drums of acid are used annually. The drums are made from HDPE. Approximately 6-55 litre plastic drums of Chlorine are used annually. The drums are made from HDPE. Approximately 300 kg of waste (HDPE) is generated annually at this farm. The plastic pails for the teat dip are currently not recyclable and are a disposal issue. Some are rinsed and re-used.



Photo 23. Teat Dip Drum

Engine Oil and Hydraulic Oil

Engine oil and hydraulic oil is used for various pieces of equipment. About 10-20 L pails are used annually. About 3-205L drums are used each year. The pails are made from HDPE. There is a provincial recycling program for these pails. Many pails are re-used on the farm.

Animal Health Products

Some animal health products are used on-site. Vets take back their own sharps and medical waste. There is a storage area for medicines at the farm. Some containers go back to the supplier. A small amount ends up in the garbage.

Outputs

No wastes are generated from the sale of milk.

Insights

A considerable quantity of packaging waste, primarily plastic, is generated on the farm annually. This consists of 55 L HDPE drums. There are no obvious recycling programs for all of these drums. The farmer considered this a major waste management issue.

A considerable quantity of bale wrap, net wrap and twine are also generated on this farm annually with limited recycling opportunities.

4. Farm Type - Beef Feedlot, North Okanagan

Overview of Operations

A 400 head beef feedlot was visited (Black Angus, Hereford, Charlois and Charcross) (Photo 24). Feeders are purchased weighing 364 kg and finish at 636 kg per animal. Average weight gain is 1.4 to 1.6 kg per head per day over 5 months until they reach shipping weight. Total annual throughput is approximately 800 head of cattle. In addition,

162 ha of crops are grown (41 ha of corn silage and 121 ha of hay (alfalfa mostly for re-sale) and silage and round bales for feed). Crops are grown with the aid of a pivot irrigation system.



Photo 24. Beef Feedlot

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Fertilizers

All crop fertilizers are purchased in bulk generating no packaging waste.

Pesticides

All pesticides (herbicides) are purchased by a custom spray operator, and sold to the farmer, applied to the land. Empty containers are triple rinsed and returned to the retailer. There is no waste generated by the farmer.

Hay

454 kg (1,000 lb) bales are netted and stored under cover. For 200 bales, approximately 4.4 kg of plastic netting waste is generated. It is disposed in the garbage.

An undisclosed quantity of 364 kg (800 lb) bales are tied with twine and sold for revenue. Each bale uses approximately 361 grams of plastic PP twine.

There are two haylage bunkers measuring 24 ft by 100 ft. They are covered with a 6 mm white opaque LDPE film, generating approximately 63 kg of waste plastic per year.

Corn

Corn is ensiled and stored in a 50 ft x 100 ft bunker silo. It is covered with black and white plastic bunker covers. The covers are usable for one year. It is estimated that 65 kg of waste plastic is generated per year.

Approximately 40 multi-layer paper bags of corn seed are used annually to plant the 41 ha of corn. This generates about 4 kg of waste which is disposed in the on-site dumpster.

Medicated Beef Supplement

This supplement is fed as required to some animals in the form of a coarse mash. It is used to prevent coccidiosis in cattle as well as to reduce the incidence of liver abscesses and fusobacterium necrophorum in beef cattle fed in confinement for slaughter. Approximately 1.4 tonnes is used per year. This supplement comes in a PP woven mini bulk bag, which is stored on the farm and eventually disposed of in the garbage dumpster.

Engine Oil and Hydraulic Oil

Approximately 10-20 L pails are used annually. The pails are made from HDPE. Approximately 2-205 L plastic HDPE drums of oil and 1-208 L steel drums are used. These appear to be re-used on the farm. An unspecified quantity of used oil filters are being stored in a shed for disposal.

Animal Health Products

An undisclosed quantity of animal health product is administered, with sharps being taken back by the vet and glass bottles disposed of in the garbage.

Outputs

No wastes are generated from the sale of live animals for beef.

Insights

A moderate amount of plastic waste is generated from bale netting and bunker covers. A contracted waste collector has a dumpster on site, for netting and garbage. The plastic covers are being landfilled at present as there is no formal collecting/recycling program in place. Used oil containers appear to remain on the farm for re-use.

4.3 Vancouver Island

1. Farm Type- Garden Nursery, Vancouver Island BC

Overview of Operations

A 3.2 ha (8 acre) garden nursery was visited. This site includes a greenhouse operation and tree nursery (Photo 25). A retail store is also located on-site but waste data associated with this part of the nursery is not included here. The nursery has an Environmental Farm Plan.



Photo 25. Nursery

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Greenhouse

In addition to starting plants from seeds, the greenhouse receives seedlings and grows them for retail sale. Additionally, value-added products such as mixed planters are prepared in the greenhouse.

Approximately 600 plastic plug trays are used annually (Photo 26). Roughly 25% of these are reused and 75% are landfilled. Each tray weighs 15 g, generating 6.8 kg of waste landfilled.

Approximately 3,200 2" plastic inserts are used annually and landfilled.

A small number of cardboard boxes are generated annually and recycled.



Photo 26. Plastic Plug Tray

Nursery

Approximately 150 plastic fertilizer bags (14.4 kg), 20 paper bags of lime (6.6 kg), 20 mini totes of planting medium and 6 rolls of baling twine (800 yards/roll) are landfilled annually.

Approximately 500 wooden pallets are returned to the supplier or sent to a refurbisher.

Outputs

Approximately 3,000 flats of plants grown on site are sold to customers, along with 50,000 plant pots of nursery stock. Pots generate approximately 2.2 tonnes of waste that could be recycled or disposed by consumers or returned to the nursery for re-use.

Insights

The nursery reuses as much incoming materials as possible for their own operation, including trays, inserts and pots. They also encourage customers to return their plastic containers so that they can be used again (Photos 27 and 28). A store credit is offered if nursery pots are returned.

Frequently, they receive plastic containers that were not sold by the nursery (typically, the plant was bought at one of the large retailers in the area such as Canadian Tire). These containers are set aside in a “free” area so that members of the public can access them for their own use. This free area is also stocked when there is an excess of used containers on-site.



Photo 27. Used trays & inserts (returned by customers)



Photo 28. Used plant pots (returned by customers)

Reuse is made more difficult due to the high variation in sizes of trays and inserts. Staff felt that standardization would make reuse of packaging much easier. Similarly, the wide variety of plastic resins used in pots and trays and the lack of consistent labeling makes recycling difficult, if not impossible. Staff felt that if there was one type of hard plastic used, there would be more opportunities to identify recycling markets.

2. Farm Type - Dairy Farm, Vancouver Island

Overview of Operations

A 330 head dairy farm was visited (Photo 29). Roughly 140 cows are used in milk production. The farm generates 1,440,000 litres of milk per year.

The farm has 120 ha of land, of which 80 ha is used for cropland (hay production). An additional 4 ha is used for pasture. The farm has an Environmental Farm Plan.



Photo 29. Dairy Farm

Key Waste Generating Activities and Waste Management

The key waste generating activities include:

Inputs

Feeding

Most feed is received in bulk, so minimal waste is generated.

Some wastes that are generated from feed include: twine from alfalfa and hay bales – one mini-bag full per year is sent to landfill (Photo 30) (twine weighs 1.6 g per foot); paper bags from feed for animals other than cows (i.e. dogs, cats, goat, llamas) – 24 - 20 kg bags of food (e.g. dog food bags) per year, generating approximately 3.6 kg of waste that is recycled through municipal curbside collection; bale wrap and net wrap from silage bales – the farm consumes 600 round bales per year (Photo 31). Bale wrap is thin plastic, like pallet wrap and 6-8 layers are wrapped around each bale. One layer of net wrap goes around the bale before it is packaged in the bale wrap (one square foot of bale wrap weighs 5 g and one square foot of net wrap weighs 4 g). Both the bale wrap and net wrap are landfilled (Photo 32).

The farm uses hydrated lime as a drying agent in the animal stalls. These bags are recycled through the municipal recycling program.



Photo 30. Mini-bag with Waste Twine



Photo 31. Hay Bales



Photo 32. Bale Wrap and Net Wrap

Feed Production

Approximately 40-1,000 kg mini bags of fertilizer are used for growing hay. They are made of woven PP plastic with an LDPE liner (Photo 33). These bags are reused on site or landfilled.

Approximately 12 ag bags (Photo 34) (10" x 200" in size) are used annually to make silage. These bags are landfilled after use, producing 288 kg of waste. Each ag bag comes in a cardboard box which is recycled through the curbside recycling program.

Approximately 42 plastic bottles of inoculants, weighing 1.7 kg are recycled through the curbside recycling program.

Approximately 54 - 20 kg woven plastic bags containing mineral topdress for heifers (Photo 35) are used annually, producing 5.4 kg of waste going to landfill.



Photo 33. Ag bag Plastic



Photo 34. Ag bags



Photo 35. Mineral Bag

Hay Production

Approximately 40 seed bags (20-25kg) made of woven PP plastic or paper are used annually. Paper bags are recycled, plastic bags are landfilled.

Herbicides are applied to hay fields. Approximately 15-18 10L plastic jugs are used annually, triple rinsed and recycled through the curbside recycling program. The cardboard boxes containing the herbicide jugs are also recycled.

Milk Production

Waste generated as part of the milking process is generally associated with maintaining a sterile environment for milk storage. Most of the cleaning products come in refillable jugs that range in size from 60 to 205 litres.

Cleaning Products

Twenty-four 60 L plastic jugs of teat dip are used annually. Jugs are reused or stored on site for future use (Photo 36).

Three 205 L plastic containers of formaldehyde are used annually. They are reused or stored on site for future use.

Two and a half laundry detergent barrels (boxboard barrel with metal bands on ends, plastic bag inside) (Photo 36) are used annually and landfilled.



Photo 36. 60 L Jugs being Reused



Photo 37. Laundry Detergent Packaging

Approximately 730 milk filers (disposable fibre tubes) (Photo 38) are landfilled each year. This produces 5.1 kg of waste.



Photo 38. Milk Filer

A minimal quantity of rubber gaskets are landfilled

Approximately 3,650 pairs of latex gloves are landfilled annually, weighing 43.8 kg.

Engine Oil and Hydraulic Oil

An unknown quantity of 20 litre pails are used annually. The pails are made from HDPE. These pails are cleaned, used on farm for feeding and other purposes. Once they are broken they are put in the curbside recycling program.

Animal Health Products

Animal health products are generated on the farm by the farm owner and visiting vets.

Vaccines are the primary waste generating products and are used primarily on calves and milk-producing cows. Three 250mL plastic penicillin bottles and 72-500mL plastic calcium bottles are recycled through the curbside recycling program annually.

Twelve 50mL glass bottles, 14-100mL glass bottles, 2-500mL glass bottles and 100-2cc glass bottles are recycled through the municipal recycling depot annually.

Outputs

No wastes are generated from the sale of milk.

Insights

Minimizing the amount of waste sent to landfill appears to be a significant driver in how waste is managed on this farm. Waste packaging is refillable or re-purposed on the farm to the greatest extent possible. Some packaging is stored on-site if there is a perceived value to the packaging for a future reuse (e.g. the storage of plastic barrels, as shown in Photo 39 below).



Photo 39. Storage of Plastic Barrels

Access to recycling through the residential curbside collection program makes recycling of many types of packaging very convenient (cardboard, paper bags, plastic bottles).

Problematic waste materials are soft plastics (ag bag plastic, bale and net wrap, twine, woven bags and mini-bags), much of which is dirty when it is disposed.

4.4 Summary

Table 4.2 presents an overview of how various non-organic waste streams are managed on different farm types.

A mixture of landfilling, recycling, re-use, and burning are used to manage wastes. There were a number of examples of recycling programs. It is clear that both farmers and retailers are making efforts to avoid the landfilling of wastes

Key findings include:

- The key input Feed is largely sold in bulk, not generating any packaging waste at the farm.
- The key inputs Fertilizers and Seed, are also sold in bulk, however, a larger portion is sold in bags, pails, or mini totes creating a packaging waste issue for the farmer.
- Some farm types generate significantly more packaging waste than others e.g. Dairy, Beef, Greenhouse and Nursery.
- Many farms visited had an Environmental Farm Plan;
- Efforts and cost to collect and transport waste to a recycler are negatively impacted by geographical distances in the province;
- There were a number of examples of return to retail programs for some waste streams (e.g. jugs, pails, drums);
- Return to retail programs were inconsistent and not available across the Province; and
- There were essentially no recycling programs and limited recycling opportunities for LDPE bags and unlined and lined paper bags.

Some of the data collected was used to help calculate total wastes generated in the Province.

Table 4.2 Management of various input waste streams by farm type

	Grain and Oilseed	Livestock	Greenhouse Vegetable, Potted Plants, Bedding Plants	Field Vegetable	Fruit and Tender Fruit	Nursery
Low density polyethylene (LDPE) bags and other film	Landfill	Landfill Some recycling of bale and silage wrap	Landfill Some recycling of greenhouse floor & inside wall film	Landfill Some re-use of ground cover & mulch film then recycling	Landfill Some re-use of ground cover & netting then recycling	Landfill Some recycling of film
Woven polypropylene (PP) bags	Landfill Limited take back programs	Landfill Limited take back programs	na	na	na	na
Twine (PP)	Landfill	Landfill Some recycling	Landfill	na	na	Landfill
Pots, trays, inserts and flats (PP, PS, HDPE)	na	na	Landfill Collection for Recycling programs Some reuse of plug trays & pots	na	na	na
High density polyethylene (HDPE) jugs, pails, drums, flats, lugs & totes	Take back to retail programs (pesticides, some oil products) Re-use (oil)	Take back to retail programs (pesticides, some sanitation and oil products) Re-use (oil, sanitation)	Take back to retail programs (pesticides, some oil products and antifreeze) Re-use (oil) Re use RPC trays	Take back to retail programs (pesticides, some oil products and antifreeze) Re-use (oil) Re-use totes	Take back to retail programs (pesticides, some oil products and antifreeze) Re-use (oil) Re-use, pails, flats, lugs & totes))	Take back to retail programs (pesticides, some oil products and antifreeze) Re-use (oil)

	Grain and Oilseed	Livestock	Greenhouse Vegetable, Potted Plants, Bedding Plants	Field Vegetable	Fruit and Tender Fruit	Nursery
Unlined and lined paper bags	Landfilled Recycled	Landfilled Recycled	Landfilled Recycled	Landfilled Recycled	Landfilled Recycled	Landfilled Recycled
Cardboard	Recycled	Recycled	Recycled	Recycled	Recycled	Na
Animal Health Waste	na	Removed from the farm by vets Cardboard recycled Glass ampoules recycled or disposed	na	na	na	na
Animal Health Waste-sharps	na	Removed from the farm by vets Take back programs Landfill	na	na	na	na

5.0 Agricultural Plastics Processors

1. Processor of Recyclable Materials - Greater Vancouver Regional District

Westcoast Plastics Recycling Inc., www.westcoastplasticrecycling.com

Unit 3-2480 Shell Rd., Richmond BC V6X 2P1

Peter Bissada, Sales & Marketing Manager

Tel: 604-247-1664, sales@westcoastplasticrecycling.com

A processor of recyclable materials located in the GVRD was visited. They handle shrink wrap, bulk bags, pails, pots and trays. They do not process paper or OCC.

The processor has their own trucks and they operate primarily within the Lower Mainland. Material is collected, sorted and separated, compressed and baled and then shipped to different markets. Less than 1 % of the material is landfilled. Virtually all materials are sold and shipped in containers to overseas markets for recycling.

On the agricultural side, they have been handling dairy farm waste including plastic twine, bale wrap, bunker silo covers, ag bags, stretch film and mini tote bulk fertilizer

bags. They have also been successful in collecting nursery/greenhouse materials including PS, PP pots and trays, LDPE greenhouse film, LDPE drip tape and PP flower tags.

In 2011 they diverted an estimated 350 tonnes of the above materials.

Insight

Material volume has been steadily increasing over the past three years. The plant is well situated and has additional capacity available.

2. Processor of Recyclable Materials - Fraser Valley Regional District

Fraser Valley Regional District, 45950 Cheam Ave., Chilliwack BC V2P 1N6

Stacey Barker, Engineering & Environmental Services Co ordinator

Tel: 604-702-5000

www.fvrd.bc.ca

sbarker@fvrd.bc.ca

A pilot project with the local dairy farmers was visited in this District. It is localized to this area of the Fraser Valley with about 70% participation rate. Participating farmers are required to separate and store their plastic twine, silage bale wrap, ag bags, bunker silo covers, clear stretch wrap and mini tote bulk fertilizer bags on the farm. They are encouraged to shake, roll, stuff and tie like materials into their own mini-bulk tote bags from the farm. Bale netting is not accepted. The pilot is free of charge to dairy farmers. Approximately every four months, the farmers are notified of a two day window within which they may drop off their agricultural plastics for recycling at the pilot depot (Photo 39). All material is packed into open top dumpsters that hold approximately four to five tonnes and hauled to a recycling company in the city. Two dumpsters are shipped each collection day for a total of approximately eight to ten tonnes per day.

Insight

The District has partnered with various levels of government to fund this project for the past year. It is unclear how this waste will be dealt with once the pilot project is concluded. It could end up going back into the local landfill as before.



Photo 39. Farm Plastic being taken to Depot

3. Processor of Recyclable Materials - Delta BC

Merlin Plastics Supply Inc., Kevin Andrews

109-917 Cliveden Ave., Delta BC V3M 5R6

A processor of recyclable materials located in the Delta was visited. Materials recycled include: LDPE film scrap (printed and non-printed), post-consumer blow moulding, high density polyethylene (HDPE), as well as PET (soft drink containers) and some industrial scrap from commodity resin to engineering grade. Production capacity is 38,600 tonnes (85 million pounds) a year.

Services they offer include sorting and bailing; grinding; decontamination through use of air separation, electrical current, or hydrocyclones; washing to remove glue, labels and other contaminants by using heat, friction and chemicals; pelletizing by melting, filtering and extruding; blending; packaging and lab analysis.

The empty agricultural pesticide containers returned in BC for CleanFARMS are handled here.

Insight

Material volume has been steadily increasing over the past three years. The plant is well situated and has additional capacity available. They have also expanded operations into Alberta.

4. Processor of Recyclable Materials - Regional District of Okanagan - Similkameen

Don Hamilton, Solid Waste Facilities Coordinator

101 Martin St., Penticton BC V2A 5J9

Tel: 205-492-2913, www.rdos.bc.ca, dhamilton@rdos.bc.ca

The Solid Waste Facilities Coordinator for this District was interviewed. In addition, a report from the past Air Quality Co-ordinator for the RDOS was obtained and reviewed.

The RDOS agricultural plastics recycling program originated for the primary purpose of improving air quality by eliminating the burning of agricultural (mostly orchards and vineyards) plastics. The secondary purpose was to reduce landfill volumes. In 2012 they received funding from ARDCORP for research in developing markets for ag plastic. Other funding has come from a regional solid waste program paid for by all Electoral Areas and Municipalities within the RDOS.

The program currently consists of plastics drop off at four stations: Oliver, Okanagan Falls, Penticton and Keremeos.

Plastics collected and processed included bale twine, silage wrap, bale netting, irrigation tubing, ground cover plastic, PVC pipe, plant pots, plant trays, seedling trays and film plastics. Plastics are separated by product and are dropped off by farmers in large tote bags or bundled (irrigation lines). Some wine bladders are also being collected.

The Regional District which runs the collection program is working with a local person who has a baler. In 2011 the RDOS collected approximately 150 tonnes of

agricultural plastic. The RDOS has been working with Merlin Plastics in Calgary to market the recycled materials.

Insight

Originating as a pilot project, the project was expanded to seven sites but had to be reduced to four sites due to lack of funding. It is hoped that the four sites can be maintained in the future.

5. Processor of Recyclable Materials - Surrey BC

Ryan Anderson, Polymere Agri Plastics Recycling Co.
8625-130 St., Surrey BC
Tel: 604-240-2597, ryan@pacificequipment.com

A processor of recyclable materials located in Surrey was visited. This processor collects plastic and cardboard from businesses, farms and private individuals in the lower mainland. They sort and compact the different materials in Surrey which are then sent to the next processor, typically outside of the province.

The processor has its own trucks and operates primarily within the Lower Mainland. They are currently handling paper/cardboard, PP bags, stretch wrap, LDPE bags, balewrap, PP tote bags, plastic twine etc. Other materials include LDPE bags that have held fish feed, from fish farms along the coast. Twine is exported to Oregon and plastic is exported overseas.

Currently, from the ag recycling, one load every two weeks is processed weighing approximately 6.8 tonnes (15,000 lbs) or 163.6 tonnes (360,000 lbs) per year. The processor has an active bi-weekly free pickup and ag recycling service for the lower mainland, with two compactor trucks and other collection vehicles.

Insight

Material volume has been steadily increasing. The processor also processes approximately 9 plastic loads a week from local manufacturing companies.

6. Processor of Recyclable Materials - Victoria

Syntal Products (Victoria) Ltd.,
6722 Bertram Place, Victoria BC V8M 1Z6
Tel: 250-544-1676 info@syntalproducts.com

A processor of recyclable materials located in Victoria was visited. This company recycles mixed and commingled plastic waste into marketable premier quality building material. They maintain an active public plastics recycling program at its facility. Individuals and organizations are encouraged to drop off their recyclable plastic in the bins at the entrance to the property. The finished product is promoted as a superior alternative to wood, concrete and metal. It does not warp, split, check or splinter, is impervious to weather, insects and disease and resists breakage.

The synthetic lumber is marketed through a network of retail distributors. They plan on adding additional lumber sizes as well as introducing a line of outdoor building projects in kit form. They have been testing in the area of PVC and PS processing which would enable the recycling of these plastics.

Other agricultural plastics recyclers include:

- 1) **Poly Profiles Ltd.**, Richmond BC
Works on projects to re-use plastic. They make stands to hold sprinklers in cranberries.etc.
- 2) **Mansonville Plastics (BC) Ltd.**, Surrey BC
Handle strictly PS, from fish boxes and some nursery trays. Require material to be delivered to their facility. Remake this material into landscaping filler.
- 3) **ABC Plastic Fence Post Ltd.**, Surrey BC.
This company is specialized in the production and distribution of plastic fence posts for the agricultural industry using 100% Blue Box #3-#7 recycled plastic. They use an extrusion mold system to produce fence posts. They can produce any size, shape and length of post as long as quantity warrants. They have produced several thousand posts using silage wrap mixed with post-consumer blue box, #3 to #7 material. They are currently consuming approximately 400,000 lbs of post-consumer plastic per month.
- 4) **Command Recycling**, Vernon Ca USA
A recycler of agricultural plastic.

6.0 References and Bibliography

BC Ministry of Environment, 2011. Fast Stats 2010. Agriculture, Aquaculture and Food.

BC Ministry of Environment, 2011. Packaging and Printed Paper Extended Producer Responsibility. Presentation by Teresa Conner at the Coast Waste Management Association October 2011 Conference. Accessed at www.cwma.bc.ca/events/2011/conference/presentations/BC%20MoE%20-Teresa%20Conner.pdf on November 28, 2011.

BC Ministry of Environment (no date) Product Stewardship website (<http://www.env.gov.bc.ca/epd/recycling/>)

BC Ministry of Environment. 2006. Recycling Regulation Guide Accessed at http://www.env.gov.bc.ca/epd/recycling/guide/pdf/recycling_regulation_guide.pdf on Dec. 1, 2011.

Province of BC (2004, last amended 2011). Recycling Regulation. http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/449_2004

Clean FARMS 2011. Final Report Ontario Agricultural Waste Study- Waste Characterization

Clean FARMS 2011. British Columbia Regional District Agricultural Plastics Collection

CleanFARMS. 2011. British Columbia Packaging Regulation 101. What Producers Need to Know.

Statistics Canada, 2012. Cansim Table 011-100.

Statistics Canada, 2011. Service Bulletin-Fertilizers Shipment Survey. Catalogue no. 21-022-X

Statistics Canada ,2011. Cattle Statistics 2011. Catalogue no. 23-012-X

Statistics Canada, 2011c. Hog Statistics. Catalogue no. 23-010-X

Statistics Canada, 2011. Sheep Statistics 2011. Catalogue no. 23-011-X

Statistics Canada 2011. Poultry and Egg Statistics- Catalogue no. 23-015-X

Statistics Canada 2011. Greenhouse, Sod and Nursery Industries- 2011. Catalogue no. 22-202-X

Statistics Canada 2011. Field Crop Reporting Series- 2011. Catalogue no. 22-002-X

Statistics Canada 2011. Fruit and Vegetable Production. Catalogue no. 22-003-X

Statistics Canada, 2002. Livestock Feed Requirements Study. 1999-2000. Catalogue no. 23-501-XIE

Appendix 1

Background Information on Calculations

Background information on calculations

Notes:

1. Numbers are rounded in the text of the report.
2. A five-percent factor of output packaging materials (i.e. for distribution of farm products) has been calculated as inputs (i.e. wastage from packaging process) and included in the text of the report.

Plastics

Low Density Polyethylene (LDPE) Plastic Film

Silage Film and Bale Wrap (input)

Type	Estimated Production ¹	Silage/Bale Wrap Usage	Unit Weights ²	Weight	Annual Tonnage
	tonnes	ft ² /yr	kg/ft ²	kg	tonnes
Silage (hay)	358,000	36,790,000	0.01134	417,199	417
Haylage	519,000	744,000	0.58	431,520	432
Silage (corn) (bunker)	390,000	3,958,400	0.01134	44,888	45
Silage (corn) (Ag bag)		39,000	0.58	22,620	23
Total		41,531,400		916,227	916
Comments:					
1 Estimated production data from Cansim Table 001-0010 (Statistics Canada).					
2 Unit weights gathered from retailers and from farm visits.					

Mulch Film

	Annual Production (Area)	Annual Production (Covered area)	Unit Weight	Weight of Mulch Film
	ha	m ²	kg/m ²	tonnes/year
Plastic mulch				
Squash and Zucchini	311	3,110,000	0.02	62
Cucumbers	64	640,000	0.02	13
Peppers	101	1,010,000	0.02	20
Strawberries	404	4,040,000	0.02	81
Floating Mulch				
Early corn	275	2,750,000	0.017	47
Early Potatoes	200	2,000,000	0.017	34
Total				257

1 Production data from Fruit and Vegetable Production Catalogue no. 22-003-X (Statistics Canada) and subject matter experts.

2 Unit weights gathered from retailers.

Fertilizer (input)

Type	Estimated Use ¹	Bag/Liner Use	Unit Weights ³	Annual Tonnage
	tonnes	#/yr	kg	
Mini Bulk liners ²	15,000	15,000	0.919	14
Bags: 25 kg	10,000	400,000	0.085	34
Bags: 20 kg	5,000	250,000	0.075	19
Bags: 10 & 15 kg	5,000	500,000	0.06	30
Total	35,000			97
Comments:				
1 Estimated use data from subject matter expert.				
2. LDPE liners included inside Mini Bulk PP totes.				
3 Unit weights gathered from farm visits.				

Grow Bags (input)

	Production ¹	Annual Production (Area)	Plants Per Grow Bag	Number of Grow Bags	Weight of Grow Bag ²	Weight of Grow Bags
	plants/ha	ha	#	#	kg	tonnes/year
Greenhouse Tomatoes (kg/m ²)	25,000	116	4.5	644,444	0.04	26
Greenhouse Cucumbers (units/m ²)	25,000	41	3	341,667	0.04	14
Greenhouse Peppers (kg/m ²)	15,000	122	3	610,000	0.04	24
						64
Comments:						
1 Estimated production data from Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada) and subject matter experts.						
2 Weight of an empty grow bag.						

Greenhouse Film (input)

Type	Estimated Use ¹	Change Out	Unit Weights ³	Weight	Annual Tonnage
	m ² /yr	yr	kg/m ²	kg	tonnes
Greenhouse Film-Roof ¹	1,083,295	4	0.14	38,410	38
	ha/yr		kg/ha		
Greenhouse Film- Floor ²	280	1	1560	436,800	437
Greenhouse Film-Sidewalls ²	280	1	80	22,400	22
Total				497,610	498
Comments:					
1 Estimated use data from Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada) and subject matter experts.					
2 Estimated from subject matter experts.					
3 Unit weight from supplier or calculated from available data.					

Greenhouse Soil Mixes (input)

Type	Estimated Bales ¹	Unit Weights ²	Weight	Annual Tonnage
	#/yr	kg/bale	kg	tonnes
Greenhouse Soil Mixes	1,188,000	0.234	277,992	278
Total			277,992	278
Comments:				
1 Estimated usage data gathered from subject matter experts.				
2 Unit weight gathered from retailers and from farm visits.				

Polypropylene (PP)

Woven Bags (input)

	Estimated Use ¹	Unit Weights ²	Weight of Bags
	bags/year	kg	tonnes/year
Seed	38,000	0.1	4
Fertilizer	15,000	1.49	22
			26

Comments:

1 Estimated usage data from subject matter experts.

2 Unit weight from supplier or calculated from available data.

Twine (Hay) (input)

	Production ¹	Unit Weight ²	Weight of Twine
	bales/year	kg/bale	tonnes/year
Large bales (800 pound)	1,610,000	0.158	254
Small bales (60 pound)	6,770,000	0.017	115
			369

Comments:

1 Estimated usage data from subject matter experts.

2 Unit weight gathered during a farm visit.

Greenhouse Twine (input)

	Production	Annual Production (Area) ¹	Twine per plant	Total twine used	Weight of twine ²	Weight of Twine
	plants/ha	ha	feet	feet	g/foot	tonnes/year
Greenhouse Tomatoes (kg/m ²)	25,000	116	30	87,000,000	0.4	35
Greenhouse Cucumbers (units/m ²)	25,000	41	12	12,300,000	0.4	5
Greenhouse Peppers (kg/m ²)	13,000	122	8	12,688,000	0.4	5
						45
Comments:						
1. From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada).						
2. Gathered from farm visits.						

Plant Pots (output)

Pot Type	Potted Plants ¹	Weight of a Pot ²	Weight of Pots	Per-Cent Polypropylene ³	Weight of Pots (Polypropylene)
	#	g/pot	tonnes/year	%	tonnes/year
15 cm	38,569,225	30	1,157	50	579
	38,569,225		1,157		579
Comments:					
1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada)					
2. Calculated					

Bedding Plants Inserts and Trays (output)

Container Type	Bedding Plants ¹	Weight of Inserts and Trays ²	Plants/Insert and Tray	Per-cent of Bedding Plants Grown in a Particular Container ³	Weight of Containers	Per-Cent Polypropylene	Weight of Pots (Polypropylene)
	#	g/tray	#		tonnes/year	%	tonnes/year
Inserts	41,022,945	66	36	100	75	50	38
Trays	1,139,526	147	36	50	5	50	2
					80		40

Comments:

1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada g) and OMAFRA subject matter experts

2. Weighed

Plant Tags (output)

Pot Type	Number of Plants ¹	Weight of a Tag ²	Plants/Insert and Tray	Per-cent of	Weight of Tags		
	#	g/pot	#		tonnes/year		
Potted Plants	39,000,000	2	1	100	78		
Bedding Plants	41,000,000	2	1	100	82		
					160		

Comments:

1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada). Assumed that 40% of potted plants in production enter the marketplace annually.

2. Weight gathered during farm visits

Plant Clips (input)

	Production	Annual Production (Area) ¹	Clips per plant	Total twine used	Weight of clips ²	Weight of Clips
	plants/ha	ha	#	feet	g/clip	tonnes/year
Greenhouse Tomatoes (kg/m ²)	25,000	116	30	87,000,000	0.001	87
						87
Comments:						
1. From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada).						
2. Gathered from farm visits.						

Plant Sleeves - Cut Flowers (output)

	Production ¹	Stems	Packaged with sleeves ²	Unit Weight ²	Weight of Sleeves
	stems/yr	stems/package	%	kg/sleeves	tonnes/year
Cut flowers	95,000,000	5	100	0.004	76
					76
Comments:					
2 Production data from Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada).					
2 Weighed.					

Plant Sleeves – Potted Plants (output)

Pot Type	Potted Plants ¹	Proportion Shipped with Sleeve ²	Weight of a Sleeve ³	Weight of Sleeves
	#	%	g	tonnes/year
15 cm	38,569,225	100	4	154
	38,569,225			154

Comments:

1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada)

2. Calculated

Polystyrene (PS)

Plant Pots (output)

Pot Type	Potted Plants ¹	Weight of a Pot ²	Weight of Pots	Per-Cent Polystyrene ³	Weight of Pots (Polystyrene)
	#	g/pot	tonnes/year	%	tonnes/year
15 cm	38,569,225	30	1,157	50	579
	38,569,225		1,157		579

Comments:

1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada g) and OMAFRA subject matter experts

2. Weighed

Bedding Plants Inserts and Trays (output)

Container Type	Bedding Plants ¹	Weight of Inserts and Trays ²	Plants/Insert and Tray	Per-cent of Bedding Plants Grown in a Particular Container ³	Weight of Containers	Per-Cent Polypropylene	Weight of Pots (Polypropylene)
	#	g/tray	#		tonnes/year	%	tonnes/year
Inserts	41,022,945	66	36	100	75	50	38
Trays	1,139,526	147	36	50	5	50	2
					80		40

Comments:

1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada) and OMAFRA subject matter experts

2. Weighed

Polyethylene terephthalate (PET)

Clamshells (Output)

	Production ¹	Packaged in PET	Packaged Weight	Unit Weight ²	Weight of Clamshells
	tonnes/yr	%	kg/clamshell	kg/clamshell	tonnes/year
Blueberries ¹	38,745	50	0.125	0.026	3,952
Raspberries ¹	7,632	2.5	0.103	0.021	39
Cherries (sweet and sour)	9,195	5	0.914	0.053	27
					4,018

Comments:

1 Production data from Fruit and Vegetable Production Catalogue no. 22-003-X (Statistics Canada) and subject matter experts.

2. Weighed

High Density Polyethylene (HDPE)

Net Wrap (Input)

	Production ¹	Unit Weight ²	Weight of Twine Netting
	bags/year	kg	tonnes/year
Large (800 pound)	1,140,000	0.122	139
			139
Comments:			
1 Estimated usage data from subject matter experts.			
2 Unit weight gathered during a farm visit.			

Plastic Jugs, Pails and Drums

Pesticides (Input)

	Weight ¹	Weight of Pesticide Containers
	kg/year	tonnes/year
Pesticide Containers	128,000	128
Comments:		
1 Estimated usage data from subject matter experts.		

Sanitation Products

Dairy (Input)

From Farm Visits		Dairy cows	Sanitation		20 litre pails	110 litre drums	205 litre drums	
	litres/year/cow ¹	000s ²	litres/year		tonnes/year			
Teat Dip	11	71	781,000	Teat Dip	18	17	19	54
Chorine	11	71	781,000	Chorine	18	17	19	54
Soap	11	71	781,000	Soap	18	17	19	54
Acid	6	71	426,000	Acid	10	9	10	29
Foot Bath	1	71	71,000	Foot Bath	2	2	2	5
				Total	64	62	69	195
Comments:								
1 From previous farm visits and subject matter experts.								
2 Data from Cattle Statistics 2011 Catalogue no. 23-012-X (Statistics Canada)								
2. Weighed								

Hog (Input)

Using Industry Data ²	Value	Units
Hog production ¹	116,000	#/year
Space used	10	sq foot
Cycles	2.5	turnover/year
Total space used	1,160,000	sq feet/year
Ratio of Floor Space to total Barn Space	2.9	
Total barn space	3,364,000.0	sq feet/year
Undiluted Sanitation product used	0.75	ml/square foot
Undiluted Sanitation product used	2,523	litres/year
20 litre containers (HDPE)	126	#/year
Weight of containers	1.5	kg
Weight of all empty containers	0.19	tonnes/year
Comments:		
1 Production data gathered from Hog Statistics. Catalogue no. 23-010-X (Statistics Canada, 2011).		
2 Other data collected from subject matter experts.		

Poultry-Broilers (Input)

Using Industry Data	Value	Units
Poultry production ¹	99,842,000	#/year
Space used ²	0.75	sq foot
Cycles	6.5	turnover/year
Total space used	74,881,500	sq feet/year
Ratio of Floor Space to total Barn Space	2.7	
Total barn space	202,180,050.0	sq feet/year
Undiluted Sanitation product used	0.31	ml/square foot
Undiluted Sanitation product used	62,676	litres/year
20 litre containers (HDPE)	3,134	#/year
Weight of containers	1.5	kg
Weight of all empty containers	5	tonnes/year
Comments:		
1 Production data gathered from Poultry and Egg Statistics Catalogue no. 23-015-X (Statistics Canada 2011)		
2 Other data collected from subject matter experts.		

Poultry-Layers (Input)

Using Industry Data	Value	Units
Poultry production	3,378,000	#/year
Space used	0.75	sq foot
Cycles	6.5	turnover/year
Total space used	2,533,500	sq feet/year
Ratio of Floor Space to total Barn Space	2.7	
Total barn space	6,840,450.0	sq feet/year
Undiluted Sanitation product used	0.75	ml/square foot
Undiluted Sanitation product used	5,130	litres/year
20 litre containers (HDPE)	257	#/year
Weight of containers	1.5	kg
Weight of all empty containers	0.4	tonnes/year
Comments:		
1 Production data gathered from Poultry and Egg Statistics Catalogue no. 23-015-X (Statistics Canada 2011)		
2 Other data collected from subject matter experts.		

Oil (Input)

	Weight	Farm Generated ¹	Weight of Oil Containers
	kg/year	%	tonnes/year
Oil Containers ¹	1,800,000	7.5	135
Comments:			
1 Estimated usage data from subject matter experts.			

Paper
Paper bags –unlined

Feed (Input)

	Weight	Weight	Unit Weight ²	Weight of Grow Bags
	tonnes/yr	kg/bag	kg	tonnes/year
Feed ¹	35,000	20	0.17	298
				298
Comments:				
1 Data from subject matter expert (i.e. feed mill)				
2. Weighed				

Paper bags-lined

Seed (Input)

	Acres	Acres Planted Per Bag	Bags	Unit Weight ²	Weight of Grow Bags
	acres/yr	bags/acre	#/yr	kg	tonnes/year
Corn Seed ¹	27,500	3	11000	0.17	2
					2
Comments:					
1 Data from subject matter expert (i.e. Large seed retailer)					
2. Weighed					

Molded Pulp (Output)

	Production ¹	Packaged with or in paper ²	Packaged Weight ²	Unit Weight ²	Weight of Paper Liners
	tonnes/yr	%	kg/box	kg/paper liner	tonnes/year
Apples	82,304	85	16	0.425	1,894
Cherries	9,091	95	6	0.007	10
Raspberries	7,632	2.5	0.1	0.019	39
Strawberries	1,871	50	0.7	0.029	39
					1,982
Comments:					
1 Production data from Fruit and Vegetable Production Catalogue no. 22-003-X (Statistics Canada) and subject matter experts.					
2 Data collected from farm visits.					

Cardboard (unwaxed)**Potted Plants (input)**

Pot Type	Potted Plants ¹	Weight of a Pot ²	Weight of Pots	Weight of Box ²	Number of Pots/Box	Weight of Boxes
	#	g/pot	tonnes/year	kg	#	tonnes/year
15 cm	38,569,225	30	1,157	1.2	540	86
	38,569,225		1,157			86
Comments:						
1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada)						
2. Calculated or weighed						

Potted Plants (output)

Pot Type	Potted Plants ¹	Weight of Shipping Box ²	Plants/shipping Box	Weight of Shipping Boxes
	#	kg/box	#	tonnes/year
15 cm	38,569,225	1	8	4,821
	38,569,225			4,821
Comments:				
1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada)				
2. Calculated or weighed				

Bedding Plants (input)

Container Type	Bedding Plants ¹	Weight of Box ²	Units/Box	Weight of Boxes
	#	kg	#	tonnes/year
Inserts	41,022,945	0.5	1,200	17
Trays	1,139,526	0.5	540	1
				18
Comments:				
1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada)				
2. Weighed				

Nursery Plants (input)

Pot Type	Potted Nursery Plants ¹	Weight of Box ²	Number of Pots/Box	Weight of Boxes
	#	kg	#	tonnes/year
1 gallon	1,500,000	0.4	75	8
2 gallon	1,500,000	0.4	50	12
				20
Comments:				
1 Production data from From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada).				
Assumed that 40% of potted plants in production enter the marketplace annually).				
2. Weighed				

Pesticides¹ (input)

Number of Containers Generated in British Columbia	Containers per Box	Estimated Number of Boxes	Weight of One Box	Total Weight of Cardboard Boxes Generated in 2010
#/year	#	#	kg	tonnes
182,000	4	45,500	1	46
Comments:				
1 Data obtained from Clean Farms				

Fruit and Vegetable Packing (output)

CARDBOARD	ha	1000s tonnes/year	Packaging Type	Packaging Weight	% Packaged	Average Weight ²	Tonnes/Year
				pounds		kg	
Fruit Production¹							
Apples	3,440	82,304	Cardboard Tray Packs	40	85	0.45	1,732
Apricots	80	514	Cardboard Multi Master (20 pound)	20	100	0.425	24
Cherries, sour	1,161	6,364	Cardboard Multi Master (20 pound)	20	0	1	0
Cherries, sweet	1,416	9,081	Cardboard Multi Master (20 pound)	20	95	0.425	403
Grapes (table)	60	259	Cardboard Multi Master (15 pound)	15	95	0.425	15
Nectarines	90	1,023	Cardboard Multi Master (20 pound)	20	100	0.425	48
Peaches	607	4,755	Cardboard Multi Master (20 pound)	20	100	0.425	222
Pears	202	4,426	Cardboard Multi Master (30 pound)	30	100	0.425	138
Plums and Prunes	121	926	Cardboard Multi Master (20 pound)	20	100	0.425	43
Subtotal							2,627
Berries Production¹							
Blueberries	8,094	38,745	Cardboard Multi Master (20 pound)	20	25	0.246	262
Raspberries	1,214	7,250	Cardboard Multi Master (3.5 pound)	4	5	0.163	37
Subtotal							299
Vegetable Production¹	ha	tonnes/year					
Pumpkin	302	8,620	Cardboard tote	800	100	11.34	269
Watermelon	14	241	Cardboard tote	800	100	11.34	8
Potatoes	2104	4,482	Cardboard Multi Master (50 pound)	50	50	0.8	79
Subtotal							355
GRAND TOTAL							2,933
Grand Total							3,281
Comments:							
1. From Fruit and Vegetable Production. Catalogue no. 22-003-X (Statistics Canada), BC Ministry of Agriculture Fast Stats 2010 and subject matter experts							
2. Calculated box weights							

Greenhouse Vegetables

	Production ¹	Annual Production (Area) ²	Annual Production (crop)	Weight or units per box	Number of boxes	Weight of box ³	Weight of boxes
	kg or unit/m ²	ha	kg or unit/year	kg or unit/box	#	kg	tonnes/year
Greenhouse Tomatoes (kg/m ²)	65	116	75,400,000	5	15,080,000	0.5	7,540
Greenhouse Cucumbers (units/m ²)	140	41	57,400,000	24	2,391,667	0.5	1,196
Greenhouse Peppers (kg/m ²)	25	122	30,500,000	4.7	6,489,362	0.5	3,245
							11,981
Comments:							
1 From subject matter experts							
2 From Greenhouse, Sod and Nursery Industries Catalogue no. 22-202-X (Statistics Canada).							
3 Estimated Box weights							

Cut Flowers (Output)

	Production	Stems	Packaged in boxes	Unit Weight	Weight of Boxes
	stems/yr	stems/box	%	kg/box	tonnes/year
Cut flowers	95,000,000	144	40	0.5	132
					132

Waxed Cardboard

Fruit and Vegetable Packing (output)

	ha	1000s tonnes/year	Packaging Type	Packaging Weight	% Packaged	Average Weight ²	Tonnes/Year
WAXED CARDBOARD				pounds		kg	
Vegetable Production¹							
Asparagus	83	180	Waxed Cardboard 25 Pound Carton	25	100	0.8	13
Beans	818	4,496	Waxed Cardboard 25 Pound Carton	25	100	0.8	317
Broccoli	252	1,133	Waxed Cardboard 25 Pound Carton	25	100	0.8	80
Brussel Sprouts	255	3,006	Waxed Cardboard 25 Pound Carton	25	100	0.8	212
Cabbage	266	1,867	Waxed Cardboard 50 Pound Carton	50	100	0.8	66
Cauliflower	46	324	Waxed Cardboard 25 Pound Carton	25	100	0.8	23
Celery	4	91	Waxed Cardboard 25 Pound Carton	25	100	0.8	6
Corn	925	5,184	Waxed Cardboard 25 Pound Carton	25	100	0.8	365
Cucumbers	64	592	Waxed Cardboard 25 Pound Carton	25	100	0.8	42
Garlic	38	64	Waxed Cardboard 25 Pound Carton	25	100	0.8	5
Leeks	22	233	Waxed Cardboard 25 Pound Carton	25	100	0.8	16
Lettuce	307	9,746	Waxed Cardboard 25 Pound Carton	25	100	0.8	686
Parsley	10	159	Waxed Cardboard 25 Pound Carton	25	100	0.8	11
Peas	440	1,975	Waxed Cardboard 25 Pound Carton	25	100	0.8	139
Radish	38	529	Waxed Cardboard 25 Pound Carton	25	100	0.8	37
Rhubarb	63	1,053	Waxed Cardboard 25 Pound Carton	25	100	0.8	74
Spinach	80	866	Waxed Cardboard 25 Pound Carton	25	100	0.8	61
Squashes and zucchinis	311	4,431	Waxed Cardboard 25 Pound Carton	25	100	0.8	312
Tomatoes	80	1,600	Waxed Cardboard 25 Pound Carton	25	100	0.8	113
Grand Total							2,577
Comments:							
1. From Fruit and Vegetable Production. Catalogue no. 22-003-X (Statistics Canada), BC Ministry of Agriculture Fast Stats 2010 and subject matter experts							
2. Calculated box weights							

Page left intentionally blank

Appendix 2
List of Subject Matter Experts and Industry Contacts
Interviewed

List of Subject Matter Experts and Industry Contacts Interviewed

	Name and Affiliation	Expertise Provided
Farm Level	Wayne Haddow , Regional Agrologist, BCMAF Cowichan Valley 250-746-1212 Wayne.Haddow@gov.bc.ca Jill Hatfield , Regional Agrologist, BCMAF, Comox Valley 250-356-2521 Jill.Hatfield@gov.bc.ca	General
Livestock Production		
	Don Low Ind Specialist: 250-402-6429 Don.Low@gov.bc.ca <i>B.C. Cattlemen's Association</i> , Kevin Boon General Manager 250-573-3611 bccattle@kamloops.net John Anderson , Kane Lake Ranch (cattle farmer) 250-936-8363	Beef production
	Cornelis Hertgers , BC Milk Marketing Board, Board Member chertgers@milk-bc.com 604-796-9235 <i>B.C. Milk Producers' Association</i> : Robin Smith , 604-294-3775 contactus@bcmilkproducers.ca Lorne Hunter charlotte@winspeedwireless.ca 250-546-6158 Chris Groendyke , Green Dyke Farms, chgroenendijk@shaw.ca	Dairy production
	Dr. William (Bill) Cox , Poultry Health Vet: 604-556-3150 william.Cox@gov.bc.ca Walter Dyck past board member BC Chicken Marketing Board Chair Chilliwack Agricultural Commission wmdyck@uniserve.com 604-795-5488	Poultry production
Crop Production		
	Mark Sweeney , Berry & Nut Industry Specialist Tel: 604-556-3056 Mark.Sweeney@gov.bc.ca Jim Campbell , Industry Specialist. Tree Fruit & Grapes. 250-498-5254 Jim.G.Campbell@gov.bc.ca Rhonda Driediger , Driediger Farms Ltd Rhonda@driedigerfarms.com 604-888-1685 Susan Smith , Industry Specialist, Field Vegetable & Organics: 604-556-3087 Susan.L.Smith@gov.bc.ca <i>B.C. Blueberry Council</i> : Debbie Etsell , Executive Director: Debbie@bcblueberry.com Cell 604-996-2701/604-864-2117, <i>B.C. Fruit Growers' Association</i> : Glen Lucas , 250-762-5226 glucas@bcfga.com Lynn Lashuk , Engage Agro, Technical Representative, lynnlashuk@engageagro.com	Field (tender) fruit and vegetable production

	Name and Affiliation	Expertise Provided
	<p>cell 250-469-2387</p> <p><i>B.C. Grape Growers' Association:</i> Connie Bielert, 1-877-762-4652 cbielert@nethop.net Manfred Freese, President BC Grape Growers Association freesem@eastlink.ca 250-495-4124</p> <p><i>B.C. Wine Grape Council:</i> Louise Corbeil, 250-767 2534 bcwgc@telus.net</p> <p>Okanagan Tree Fruit Co operative Leslie Collins 250-766-2527</p> <p><i>Okanagan Kootenay Cherry Growers' Association:</i> Dave Stirling, 250-861-6172 stirlingorchards@shaw.ca Christine Dendy Denby Orchards Christine@dendy.ca 250-860-3537</p> <p><i>Raspberry Industry Development Council:</i> Sharmin Gamiet, Executive Dir council@bcraspberries.com cell: 604-835-7572</p> <p><i>B.C. Potato & Vegetable Growers' Association :</i> Robert Butler, 604-940 2024 bebutler@telus.net</p> <p>Tom Demma General Manager, BC Vegetable Marketing Commission tom@bcveg.com 604-542-9734</p>	
	<p><i>Western Canada TurfGrass Association,</i> Jerry Rousseau, 604-869-9282 exec.director@wctaturf.com</p>	Sod production
	<p><i>BC Landscaping & Nursery Association:</i> Lesley Tannen, 604-574-7772 ltannen@bclna.com Hedy Dyck, Ind Dev. Manager hdyck@bclna.com 604-575-3505/Bill Hardy, CNLA, Environmental, bhardy@telus.net 604-435-4842 Len Smit Kato's Nursery (2007) Ltd. len@katosnursery.com 604-856-2470 Bernie Dinter, Dinter Nursery, 250-748-2023</p>	Nursery crop production
	<p>David Woodske, Industry Specialist, Ornamentals & Greenhouse Veg, 604-556-3044 David.Woodske@gov.bc.ca</p> <p><i>B.C. Greenhouse Growers' Association:</i> Linda Delli Santi, 604-531-5262 bcgga@bcgreenhouse.ca</p> <p>John & Susan Vanderende, Burnaby Lake Greenhouses Ltd john@burlake.com susan.vanderende@burlake.com 604-576-2088</p>	Greenhouse flower production

	Name and Affiliation	Expertise Provided
	<i>B.C. Greenhouse Growers' Association: Iris Bitterlich, 604-531-5262 bcgga@bcgreenhouse.ca</i> Ron Moes , Senior Grower Windset Farms ron@windset.com 604-940-7700 Suby Kaur, Q A Mgr skaur@windset.com 604-952-2762	Greenhouse vegetable production
	Fred Wickens District Manager SunGro Horticulture (retired) phredwick@hotmail.com 604-535-0723 Smithers Feed Store, Tom, Manager 250-847-9810 Vanderhoof Co op, Doreen, Sales 250-567-4464 Spruce Capital Feeds, Prince George, Greg Manager 250-564-6010	Other
Farm Inputs (generates wastes that are managed by farmer)		
	Ian Anderson , Feed Division Manager, Otter Co op feedmgr@otter-coop.com 604-607-6902	Feed production
	Erin Rutkowski , Territory Manager BC Vetoquinol erutkowski@vetoquinol.ca 604-312-2805 Bobby Smathers Customer Service 877-888-4530 www.vetoquinol.ca	Livestock sanitation products
	<i>Associated Veterinary Purchasing: Eric Stokvis, 604-856-2110 ericstok@avpbc.com & Director CAHI</i> Ms Tracey Firth , Programs Director (CAHI) Canadian Animal Health Institute 519-763-7777 cahi@icsa.ca	Animal health
	Bill Awmack , Sales Mgr Quality Seeds West bill@qualityseedswest.ca 604-574-7333 Leah Erickson , Sales Representative, Stokes Seeds Ltd. LErickson@stokeseeds.com 604-957-2359	Seed production
	Mr. Barry Friesen General Manager 416-622-9771x2230 CleanFARMS friesenb@cleanfarms.ca	Pesticides
	Stan Loewen , General Manager, Terralink Horticulture stanl@tlhort.com 604-864-9044	Fertilizer
	Black Sheep Reports Bruce Wisbey , Wisbey Farms, 604-823-6772	Mulch film
	Black Sheep Reports	Silage/bale wrap

	Name and Affiliation	Expertise Provided
	Alexis Arthur Pacific Forage Bag Supply alexis@prairiepacificseeds.ca 604-319-0376 Mark Wilson & Mickey Abbott SilaGrow mwilson@silagrow.com mabbott@silagrow.com 250-804-4769 Stacey Barker Fraser Valley Regional District sbarker@fvrd.bc.ca 604-702-5000	
	Black Sheep Reports Mark Wilson Silagrow mwilson@silagrow.com 250-804-4769 Bill Awmack, Sales Manager, Quality Seeds West bill@qualityseedswest.ca 604-574-7333	Twine and net wrap (also an output)
	Ron Driedger Executive Director <i>British Columbia Used Oil Management Association</i> : Cell: 604-819-5396 rdriedger@usedoilrecycling.ca	Engine and Hydraulic Oil
Farm Outputs (generates wastes after product sale that are managed by the farmer's customers)		
	Cor Smit , CyGrower Supplies Ltd. cor@cygrowers.com 604-856-5186 Jol Hodgson , Beaver Plastics tjhodgson@shaw.ca 604-833-0620	Plant pots and trays
	Larry Schwartzenberger , Packaging Manager, Growers Supply Co. Ltd Larry@southvalleysales.com Tel: 250-498-6406	Cardboard boxes and masters
	Susan Van der Ende , Burnaby Lake Greenhouses Susan.vanderende@burlake.com 604-576-2088	Potted Plant Sleeves
	Don Hamilton Regional District Okanagan Similkameen dhamilton@rdos.bc.ca 250-492-0237 Peter Bissada , Sales & Marketing Mgr. Westcoast Plastic Recycling Inc. sales@westcoastplasticrecycling.com 604-247-1664 Jill Ackerman ackerman@9442shaw.ca Ryan Anderson , Polymere Recycling Group Inc. ryan@pacificequipment.com 604-240-2597	Recycling Programs