



Plastic Packaging Landscape Review: 2023 Update

**Analysis of Changes in the Volume and Types of
Plastic Packaging Utilized by Canada's Produce
Industry**

October 30, 2023

Executive Summary

Plastic packaging (PP) has played a crucial role in enabling the global fresh produce industry to operate effectively and efficiently. Packaging protects products throughout the value/supply chain, aiding transportation and logistics. It extends shelf life and reduces food loss and waste (FLW) along the value chain. It enhances food safety by mitigating environmental circumstances that would lead to microbial growth and/or contamination by foreign materials. It provides a mechanism for improving dietary health by providing highly nutritious foods in convenient ready-to-eat formats.

Since VCMI's completion of the initial 2018/2019 plastic packaging landscape review for CPMA, much has changed in terms of industry, government and consumer perspectives and intentions. **The purpose of this project was to quantify changes that have occurred since the 2019 landscape review of plastic packaging in the Canadian produce industry was published, and the key drivers of identified changes.** As the majority of fresh fruits and vegetables purchased by consumers is imported, the study explored the potential impact of packaging decisions in relation to domestically grown and imported produce.

The study employed the same research methodology and techniques as the 2019 study. An analysis of Statistics Canada food availability data for 2022 identified the 20 categories of fresh produce that dominate the produce sector in terms of the volume of sales and their likelihood to be purchased by consumers prepackaged. In addition to the analysis of secondary data, the research included 1) an industry survey circulated to industry; 2) a retail-centric survey regarding the incidence of plastic packaging in their produce departments; 3) a presentation to CPMA's plastics working group to critique the validity of initial research findings and conclusions being drawn; 4) semi-structured interviews conducted with expert industry representatives, who together represented the entire fresh produce value chain; and 5) plastic packaging audits conducted in relation to different retail banners. The combined results of these research activities informed a mass balance model created to infer research findings across the Canadian produce industry.

The research estimated that the majority (55%) of fresh fruits and vegetables purchased by consumers are sold loose or in non-plastic packaging. This is slightly lower than the 2019 estimate of 58 percent. The reasons for this change all relate to changes in consumer attitude and purchasing behaviours. They are: 1) consumers' hygiene concerns following the 2020 onset of the COVID-19 pandemic; 2) inflationary pressures leading to more consumers purchasing from discount stores, where a higher proportion of total fresh produce sales are typically sold prepackaged; and 3) a growing desire for value-added convenient easy-to-prepare/serve/cook fruits and vegetables. These factors drove increased demand for prepackaged fresh produce. Suppliers and retailers are working to reverse this shift, though it is challenging given consumers' price sensitivities and lingering post-pandemic hygiene concerns.

Using Statistics Canada food availability data for 2022, the mass balance calculation estimated that **the produce sector used approximately 87,200 metric tonnes of plastic in 2018 and 113,798 metric tonnes of plastic in 2022.** This estimate includes 198 tonnes of plastic associated with PLU stickers. As some of the highest selling produce items by volume (e.g., bananas) are invariably sold

unpackaged and carry fewer PLUs as a percentage of items sold than other types of fresh produce sold loose, in reality this estimation is likely higher than what actually occurs.

Though the volume of produce sold prepackaged in plastic has increased, there has been a measurable shift in the types of materials used by the fresh produce industry, and the volume of plastic associated with each unit of fruits and vegetables. **Industry has shifted to using less complex, more recyclable materials, with measurably more readily-recyclable materials, such as PET, being used when compared to 2019. The redesigning of many items' packaging, such as replacing clamshell lids with top seal and using thinner wrapping, has led to a 17 percent reduction in the volume of packaging per kg of food.** Industry is also including more recycled materials in packaging.

Forty-nine percent of survey respondents are directing significant efforts and financial investment in incorporating “design for recycling” into the strategic plastic packaging decisions. The majority (76%) of survey respondents are investing effort and resources to incorporate PCR into their overall plastic packaging strategies. **Compared to 2019, a higher percentage of respondents are using preferred plastic packaging materials (34% vs. 47%, respectively). Considerably fewer survey respondents are using unfavourable or unclassified plastic packaging materials (40% in 2019 compared to 24% in 2023).** These conclusions are supported by evidence from the retail surveys, stakeholder interviews and retail-level plastic audits performed by the research team.

The research also quantified the potential for negative consequences arising from industry facing a forced move away from current preferred materials — either to less effective packaging or having to sell produce loose. The research also quantified the potential effects of industry being forced to adopt mandatorily provincial or territorial level labelling of plastic packaging's recyclability.

Findings regarding the impact that a premature forced transition to less effective packaging and merchandizing options could have on FLW and businesses' operating costs closely align with 2019 research results. Across the entire produce industry, the potential increase in FLW totals 495,000 tonnes above current levels. **Based on differences in the average quarterly index price for the commodities under review in 2018 versus 2022, this increase in FLW is valued at \$3.4 billion.** This estimate should be considered conservative, because it does not include the withdrawal of PP causing a complete disruption to some sectors of the fresh produce industry, and the anticipated 17.5 percent increase in operating costs voiced by respondents that industry would incur.

Sixty percent of respondents indicated that the mandatory label plastic packaging (in definitive “yes/no” terms regarding its recyclability at a provincial/territorial level) would be problematic for their business. Of these respondents, 72 percent indicated that this could well lead to higher prices.

The research demonstrates that industry has responded to the need voiced by industry groups such as CPMA, environmental and packaging experts, and governments to transition to packaging materials suited to the creation of circular economies. Changes in consumer attitude and purchasing behaviours (e.g., due to the pandemic) may have driven an increased demand for prepackaged produce, though this did not impact industry investing in packaging innovations.

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1 Introduction

Plastic packaging (PP) has played a crucial role in enabling the creation of a global fresh produce industry that operates effectively and efficiently. It protects products throughout the value/supply chain, aiding transportation and logistics. It extends shelf life and reduces food loss and waste (FLW). It enhances food safety by mitigating environmental circumstances that would lead to microbial growth and/or contamination by foreign materials. It provides a mechanism for improving dietary health by providing highly nutritional foods in convenient ready-to-eat formats.

Three forms of packaging exist: primary, secondary and tertiary. Primary packaging is that which consumers take home. Secondary and tertiary packaging predominantly play a logistical role in enabling produce to be effectively and efficiency distributed from the place of production/processing to the point of purchase by consumers. Examples of secondary plastic packaging include crates and returnable plastic containers (RPCs). Tertiary plastic packaging include skids, corner boards and shrink wrap.

2 Background

Since VCMI's completion of the initial 2018/2019 plastic packaging landscape review for CPMA, much has changed in terms of industry, government and consumer perspectives and intentions. Industry changes include businesses voicing an intent to transition from current packaging materials to plastic packaging materials suited to the creation of circular plastic economies, "compostable" packaging, or paper/cardboard packaging. Government changes are occurring at the provincial and federal level. Provincial changes include Quebec actively seeking to financially penalize businesses that choose to use compostable packaging, and a number of provinces introducing EPR programs. Planned federal changes include banning certain plastic items and packaging, outlawing the term "biodegradable" and strengthening compostable packaging regulations.

The primary purpose of this update was to quantify what has changed in terms of the volume and types of plastic packaging materials utilized by the produce industry in Canada, and why.

The primary purpose of this update was to quantify what has changed in terms of the volume and types of plastic packaging materials utilized by the produce industry in Canada, and why. The project also sought to determine changes in the types of plastic or alternative packaging materials utilized by the overall produce industry and in relation to discrete products.

3 Research Methodology

The objective of this research was to update the information published in the 2019 report, "A landscape review of plastic packaging in the Canadian fresh produce industry." This 2023 update employed the same methodology and research techniques employed in 2019. It included an analysis that focused on the 20 categories of fresh produce that dominate the produce sector in terms of availability (sales) and likelihood of their being purchased prepacked in plastic packaging. A

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comparative analysis of the 2018 and 2022 Statistics Canada food availability¹ data series found that, while changes had occurred in the availability/consumption rates of discrete commodities, the 20 commodities deemed most likely to be sold prepackaged and purchased in the highest volumes by Canadian consumers remained unchanged overall.

In addition to the analysis of Statistics Canada and other secondary data, the research methodology included 1) an industry survey circulated to growers, packers, processors, distributors, and retailers; 2) a retail-centric survey regarding the incidence of plastic packaging and PLU (price look up²) stickers in produce departments; 3) a presentation to CPMA's plastics working group to critique the validity of initial research findings and conclusions being drawn; and 4) semi-structured interviews conducted with expert industry representatives who together represented the entire fresh produce value chain.

The research team also completed a retail audit. They visited retail stores to assess the incidence of prepackaged plastic packaging and the utilization of PLUs across banners. The packaging associated with each unit of commodity purchased was then weighed and its material recorded. The type and weight of plastic PLUs associated with commodities sold loose was also recorded. This weighing of plastic packaging and the fruit(s) and vegetable(s) contained within enabled an estimated ratio of packaging to produce to be established. The weighing of PLUs on micro-scales, combined with confidential discussions with PLU manufacturers, enabled a typical plastic PLU weight (and the incidence of PLUs manufactured from plastic versus alternative materials) to be established. Both the packaging and PLU investigations extended beyond the 20 commodities that formed the primary focus of the study.

The triangulation³ of primary and secondary data from each of the distinct sources described above informed the mass balance model used by VCMI to estimate the volume and types of plastic associated with prepackaged fruits and vegetables purchased by consumers in Canada. Details of this mass balance model form Appendix A. Details of the model used to calculate the weight of plastic associated with PLUs on fruits and vegetables used in Canada forms Appendix B.

3.1 Survey Design and Distribution

The 2023 survey followed a similar format to the survey distributed to the CPMA membership and the wider produce industry in 2018/2019. Doing so enabled direct comparisons in survey responses to be quantified and conclusions drawn. The survey was distributed throughout the CPMA membership and by provincial organizations across the country. Responses were predominantly

¹ A [data series published annually by Statistics Canada](#) in conjunction with Agriculture and Agri-Food Canada. Each data series details the volume of distinct foods physically present in Canada for consumption the prior year.

² For a description of why PLUs are used and their importance to the efficient operation of the produce industry see: [IFPS](#).

³ [Triangulation is a strategic research practice](#) used to strengthen the validity and credibility of findings, while simultaneously reducing the chance of researcher or respondent bias negatively impacting conclusions drawn.

received from producers/growers and wholesalers/distributors who are very familiar with the packaging trends within the industry (Table 3-1).

Table 3-1: Survey responses 2019 & 2023

Chain Location /Organization Type	2019 Responses		2023 Responses	
	Count	%	Count	%
Greenhouse grower	28	26%	5	15%
Grower (open field)	30	28%	10	29%
Grading/packing	19	17%	8	24%
Further processing	12	11%	1	3%
Retail	4	4%	1	3%
Wholesaler/distributor	16	15%	9	26%
TOTAL	109		34	

Compared to the survey conducted in 2019, in 2023, respondents were more focused within the Canadian market (Table 3-2). The volume of produce that they together handle equates to over 90 percent of fresh produce volumes contained in Statistics Canada 2022 food availability data set.

Table 3-2: Respondents' location

	2019 Respondents	2023 Respondents
Headquarters		
Canada	66%	72%
USA/Other	34%	28%
Markets Served		
National/Domestic	51%	62%
International	49%	38%

In addition to the industry survey, a retail-specific survey was distributed to retailers across Canada. The purpose of that survey was two-fold. The first purpose was to provide additional points of triangulation for quantifying the percentage of each of the 20 commodities sold prepackaged in plastic across their various retail banners. The second purpose was to capture retailers' perspectives on the percentage of each commodity sold loose that carry PLU stickers. These latter insights extended to all high volume commodities that carry PLUs, such as bananas, which are increasingly unlikely to be sold pre-packaged. Together, the responding retailers handle the majority (~90 percent) of fresh produce purchased by Canadian consumers.

3.2 Validation Interviews

Following completion of an initial analysis of data contained in the industry and retail surveys, a series of validation interviews were conducted with 15 key industry stakeholders via phone or Zoom. Two further stakeholders provided written responses to the interview questions. The interviews provided an opportunity for the researchers to test initial conclusions drawn by the analysis of survey results regarding 1) the percentage of each commodity sold prepackaged in

plastic; 2) how those estimates compared to 2019 findings; 3) changes in packaging materials (plastic resins/polymers) employed by the Canadian produce industry and its international suppliers; and 4) key drivers of change. These interviewees spanned the entire fruit and vegetable value chain, from production to retail.

The interviews provided further insights into the comparative impact of different drivers upon fresh produce packaging decisions in relation to consumer segments and retail banners.

In addition to informing the final analysis of survey data and conclusions drawn, the interviews provided further insights into the comparative impact of different drivers upon fresh produce packaging decisions in relation to consumer segments and retail banners (e.g. discount vs. mainstream). In so doing, they provided an additional triangulation point for the research.

4 Research Results

4.1.1 Demand for Prepackaged Produce

The analysis of survey data identified that, across fresh produce generally, consumer demand for prepackaged fresh produce has increased since 2019. As described below, this increased demand for prepackaged produce largely stems from the impact that the COVID-19 pandemic has had on consumers' attitudes and purchasing behaviours, and its ripple effects on the broader economy.

Across the 20 commodities that formed the primary focus of the analysis, differences exist in how consumer demand for — and the incidence of — prepackaged fruits and vegetables has changed since 2019. This finding was reflected across all of the primary data sourced, and subsequently the mass balance model.

The majority of respondents indicated that the greatest increase in demand for prepackaged produce had occurred in the last three years.

The majority of respondents indicated that the greatest increase in demand for prepackaged produce had occurred in the last three years. Individuals' estimation of increased demand for prepackaged fruits and vegetables ranged from 5 to 90 percent, the median being a 15 percent increase.

The mass balance model estimates that this translated into a 15 to 16 percent increase in the tonnage of produce packaged in plastic. This 15 to 16 percent increase in demand for prepackaged produce should be viewed in the context of an approximate 5 percent increase in the Canadian population since 2019. This, in turn, translates into the actual increase in prepackaged fresh produce that has occurred since 2019 being between 10 and 11 percent.

Table 4-1 shows the changes in food availability data for 2018 to 2022 and the percentages of individual commodities by type sold prepackaged in PP from across the 20 key commodity categories that formed the primary focus of the research. As can be seen, in certain commodities such as wax and green beans, the percentage of total sales sold prepackaged in PP increased from 48 to 97 percent. On the flipside, the total volume of pears sold prepackaged in PP decreased from 16 to 5 percent.

Table 4-1: Fresh produce availability & percentage sold in prepackaged plastic packaging 2018/22

Commodity	2018		2022		Percentage point change in plastic usage
	Available Tonnes ⁴	Estimated % Sold in Plastic ⁵	Available Tonnes ⁴	Estimated % Sold in Plastic ⁵	
Leafy greens	373,000	75%	372,099	81%	6
Soft berries	214,848	100%	218,465	100%	0
Tomatoes	313,320	44%	294,300	55%	11
Potatoes	888,859	65% ⁶	1,271,894	66%	1
Carrots	268,933	95%	237,326	90%	-5
Mushrooms	74,227	90%	62,868	90%	0
Citrus fruit	604,633	45%	605,102	54%	9
Cherries	36,181	100%	22,004	100%	0
Onions and shallots	324,510	68%	361,490	60%	-8
Grapes	170,834	99%	172,493	100%	1
Apples	371,135	30%	303,337	40%	10
Soft fruit	82,806	30%	78,192	30%	0
Pears	69,005	16%	62,082	5%	-11
Peppers	161,509	45%	152,847	45%	0
Beans (green and wax)	34,689	48%	33,791	95%	47
Cucumbers	132,788	95%	90,372	96%	1
Beets	36,181	33%	35,756	35%	2
Celery	99,591	5%	89,587	3%	-2
Broccoli	92,877	5%	116,305	30%	25
Kiwis	16,039	50%	24,361	66%	16
Total	4,365,965		4,604,671		
20 categories as percentage of all fresh produce available	67% ⁷		67%		

⁴ Calculated using Statistics Canada Food Availability Data 2022 multiplied by the Canadian population in Q4 2022.

⁵ Median results from survey of 5 Canadian retailers.

⁶ Median of responses was 70%; this was adjusted down by 5% as there was a missing response regarding potatoes.

⁷ The report prepared for CPMA in 2019 stated that the 20 types of commodities researched in detail represented 64 percent of total fresh produce purchased by consumers. Retroactive adjustments to the dataset by Statistics Canada show that it was actually 67 percent. This is the same proportion of total fresh produce sales that the same 20 types of commodities accounted for in 2022.

The primary drivers of increased demand for prepackaged fresh produce identified by survey respondents and confirmed by interviewees are:

- 1) Consumers' hygiene concerns following the 2020 onset of the COVID-19 pandemic⁸
 - a. Concerns surrounding the contraction of COVID-19 from food purchased directly led to consumers purchasing more prepackaged foods. Simultaneously, those same concerns reversed consumers' interest in measurably reducing the volume of plastic food packaging.
- 2) Inflationary pressures⁹ leading to more consumers purchasing from discount stores, where a higher proportion of total fresh produce sales are typically sold prepackaged
 - a. The distribution and operational costs associated with prepackaged produce are lower than bulk produce. Prepackaging also allows lower quality produce that would not stand up to the rigour of handling in a loose format to be distributed and sold by retailers. This enables them to sell at lower prices compared to mainstream retail.
- 3) A growing desire for value-added convenient easy-to-prepare/serve/cook fruits and vegetables
 - a. This, a number of respondents suggested, is in response to the combined effects of the pandemic and inflation, encouraging people to eat in the home rather than dine out. During the pandemic lockdowns, dining out was not an option, meaning that consumers could only source the vast majority of their fresh produce from retail stores (in person or online).

Respondents stated that they and their retail customers are working to reverse this shift, though it is challenging given consumers' price sensitivities and their ongoing hygiene concerns. In 2019, the analysis completed by VCMI indicated that, on a total tonnage basis, approximately 60 percent of the 20 produce categories were sold prepackaged in plastic packaging. This translated to approximately 79,000 metric tonnes of plastic. The 2023 update estimates that approximately 64 percent of the tonnage within these 20 products are sold prepackaged in PP. The total volume of plastic associated with these 20 types of fresh produce was 107,400 metric tonnes. This, and the results derived from inferring research results across all fresh produce purchased by Canadian consumers, is presented in Table 4-2.

Table 4-2: Model results

	2018	2022
Population	37,250,385	39,292,355
Produce tonnage	6,512,857	6,856,909
Produce in plastic (tonnes)	2,750,833	3,092,784
Plastic packaging	87,245	113,677
Percent of produce prepackaged in plastic	42%	45%
Volume ratio of plastic to produce (tonnes)	1.3	1.7

⁸ [Plastic Food Packaging: Before and After COVID-19 - Agri-Food Analytics Lab - Dalhousie University](#)

⁹ [COVID-19 pandemic related factors have exacerbated the scale and rate of food price inflation – Statistics Canada](#)

These 20 items represent 67 percent of produce available to the Canadian population. To extrapolate the estimation to include all produce, it was assumed that the other fresh produce items¹⁰ had at least 5 percent of the tonnage packaged in plastic packaging. The median packaging ratio (plastic weight to food weight) established during the analysis of the 20 investigated items was then applied. In numerous types of fresh produce, the median volume of plastic packaging used on a per unit basis has reduced by 17 percent. For every tonne of produce purchased by consumers in 2022, industry used 17kg of plastic packaging. In 2018, the industry used 13kg of plastic packaging per tonne of fresh produce.

In numerous types of fresh produce, the median volume of plastic packaging used on a per unit basis has reduced by 17 percent.

Based on Statistics Canada food availability data, the mass balance calculation estimated the produce sector used approximately 87,200 metric tonnes of plastic in 2018 and 113,600 metric tonnes of plastic in 2022. As some of the highest selling produce items by volume (e.g. bananas) are invariably sold unpackaged, in reality this estimation is likely higher than what actually occurs.

4.1.2 Strategic Packaging Decisions

The research found that there has been a measurable shift in the types of plastic materials used by the fresh produce industry.

The research found that, while the volume of produce sold prepackaged in plastic has increased, there has been a measurable shift in the types of plastic materials used by the fresh produce industry, and the volume of plastic associated with each unit of fruits and vegetables. In terms of plastic materials, industry has shifted to less complex, more recyclable materials. The redesigning of packaging, such as replacing clamshell lids with top seal and using thinner plastic wrapping, has led to a noticeable reduction in the ratio of food weight to packaging weight associated with many produce items. Industry is also including more recycled materials in their packaging.

Industry survey respondents were asked to indicate the level of effort/investment they are making with regards to incorporating “[design for recycling](#)” and “[golden design rules](#)” in their strategic plastic packaging decisions, and working towards the mandatory inclusion of 50 percent PCR (recycled) content in primary and secondary plastic packaging by 2030.¹¹

For each of the strategies/focal points, respondents were asked to indicate their level of effort and investment on a scale of 1-5. Answering 1 equates to a business expending little effort/investment, while answering 5 equated to extensive effort/investment. The chart below illustrates the responses. Each segment of the bar represents the level of effort/investment (1-5) with the percentage of responses that gave that score; the position of the bars indicate the propensity for responses to be at one end of the scale or the other. Grey is moderate/middle ground, green is significant effort, red is little effort.

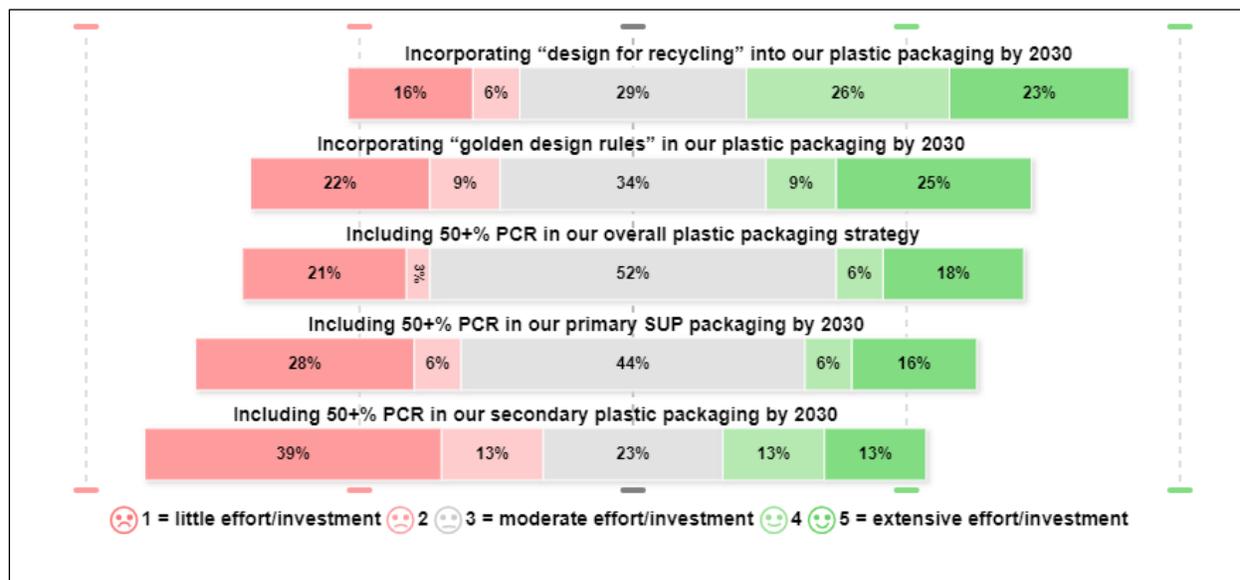
Figure 4-1 shows that 49 percent of respondents are directing significant effort/investment in incorporating “design for recycling” into the strategic plastic packaging decisions. This and

¹⁰ Those that are monitored in the Statistics Canada food availability data.

¹¹ [Proposed Minimum Recycled Content Requirements overview - Canada.ca](#)

incorporating “golden design rules” are where respondents are investing the greatest effort to transition to circular plastic packaging economies. For survey respondents, this represents many millions of dollars investment in R&D and equipment.

Figure 4-1: Effort/investment focus



Comparatively, the least likely area of development in which survey respondents indicated that they are investing effort and resources is the inclusion of post-consumer resins (PCR) in secondary

The majority (76%) of survey respondents are investing effort and resources to incorporate PCR into their overall plastic packaging.

followed by primary packaging. Examples of secondary packaging include boxes, trays and cartons, often seen on retail shelves. As these are more likely to be manufactured from cardboard than plastic, it is not surprising that they are where produce businesses are investing fewer resources to

incorporate PCR. The majority (76%) of survey respondents are investing effort and resources to incorporate PCR into their overall plastic packaging strategies. The main focus of these efforts are directed towards primary plastic packaging; this is the packaging which consumers take home.

4.2 Plastic Packaging Materials

The research identified that the types of plastic packaging materials utilized by the fresh produce industry are changing for the better.

The research identified that the types of plastic packaging materials utilized by the fresh produce industry are changing for the better. Industry has listened to the communication and guidance issued by industry organizations such as CPMA, as well as retailers operating in Canada and elsewhere (e.g. Tesco in the UK), and governments.

As described in the following section, these changes in packaging materials directly reflect a migration towards the materials that CPMA identified as preferred, and away from those materials identified as unfavourable. Stakeholders are also working towards minimizing the use of plastics

that are more difficult to recycle, though can also be more difficult to replace due to the role that they play in enabling the distribution and sale of value-added fresh produce to consumers.

Table 4-3 illustrates the preferred plastic material guide produced by CPMA in conjunction with packaging material and recycling experts and the produce industry. Preferred plastics are those which have the most potential and/or capability to be recycled or reused.

Table 4-3: CPMA’s preferred plastics guide

Unfavourable	Minimize	Preferred
PVC and polystyrene	OPP (Oriented polypropylene)	PET (Polyethylene terephthalate)
Oxy-degradable plastics	PP (Polypropylene)	HDPE (High-density polyethylene)
Rigid water-soluble plastics	Complex laminates	LDPE (Low-density polyethylene)
Polycarbonate	PVdC (Polyvinylidene dichloride)	PE (Polyethylene)
Acrylic		rPET and other PCR
Black/dark coloured plastic		

Source: [CPMA Preferred Plastics Guide](#)

The 2019 study found that a large proportion of plastic packaging materials used by the produce industry was categorized as unfavourable. Furthermore, a number of respondents indicated that

The 2023 study found that since 2019 there has been a distinct shift towards the utilization of more favourable plastics.

they were planning to transition into unfavourable plastics. The 2023 study found that since 2019 there has been a distinct shift towards the utilization of more favourable plastics.

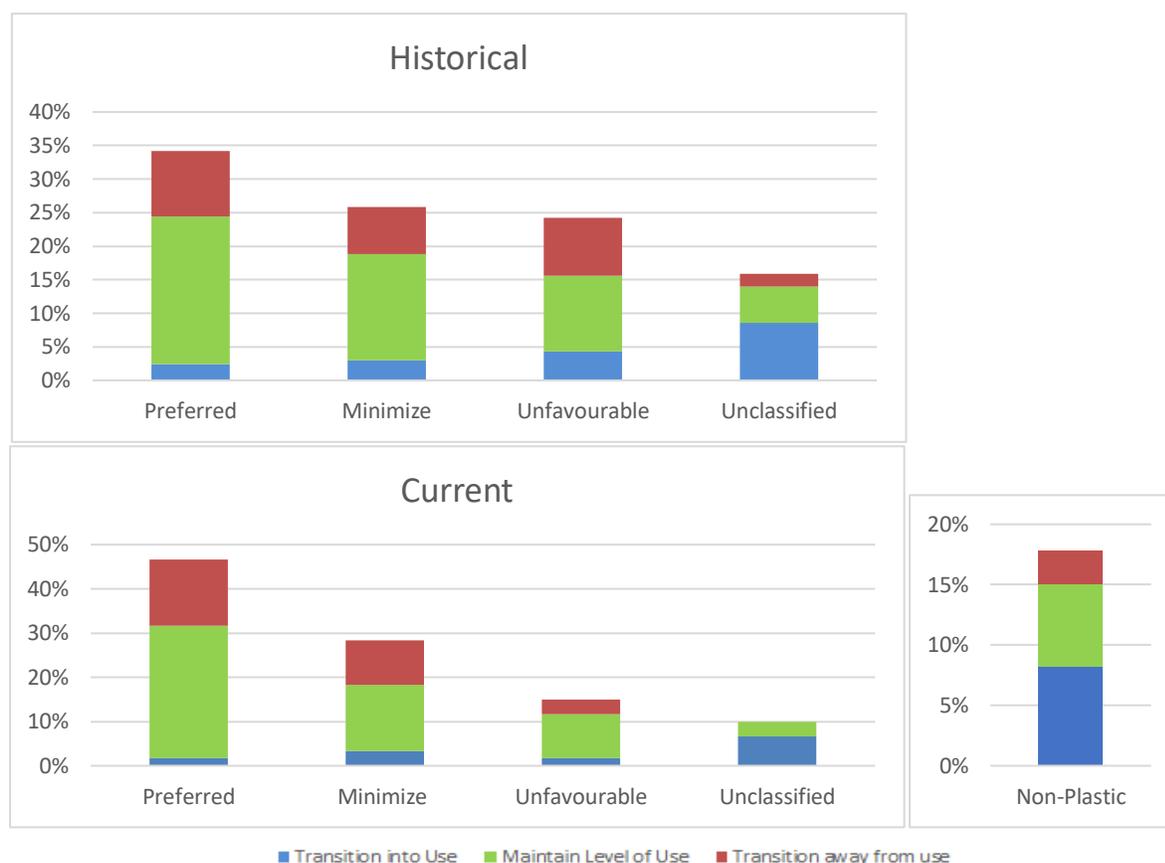
As shown in Figure 4-2, compared to 2019, a higher percentage of respondents are utilizing preferred plastic and a lower percentage related to unfavourable plastics. Those not already utilizing preferred plastics are planning to transition towards such. There has also been an increase in the number of respondents planning to transition into alternative materials.

These conclusions are supported by evidence from the retail surveys, stakeholders interviews and audits performed by the research team. All evidence confirmed that the majority of prepackaged fruits and vegetables purchased by Canadian consumers are packaged in preferred materials such as PET.

The industry surveys conducted in 2019 and 2023 both asked respondents to indicate their intentions regarding transitioning to, maintaining, or transitioning away from particular types of plastic (i.e., those listed in the CPMA preferred packaging guide). The survey did not identify whether any of the materials were categorized as unfavourable, minimize or preferred. This ensured that the wording of the survey did not influence the information provided by respondents.

In the 2023 survey, non-plastic was added as an option. This has therefore been included as a separate chart within Figure 4-2. The research found 8 percent of respondents have transitioned to non-plastic, while 7 percent reported that they intend to maintain their current use of non-plastic. Three percent of respondents indicated that they are considering transitioning away from non-plastic.

Figure 4-2: Historical (2019) and current (2023) intended plastic usage as % of responses¹²



Across all industry survey respondents, 76 percent indicated they have not decreased the volume of fresh produce sold prepackaged in PP. Seventy percent of respondents indicated they have not measurably decreased the volume of sales sold prepackaged in any material.

Compared to 2019 research results, a higher percentage of respondents are using preferred plastic packaging materials (34% vs. 47%, respectively). A number of these same respondents are also planning to transition away from plastic to alternative materials. Considerably fewer survey respondents are using unfavourable or unclassified plastic packaging materials (40% in 2019 compared to 24% in 2023).

Largely due to pandemic and inflationary related factors, while the total total volume of fresh produce sold in PP or prepackaged in any material has not declined, a large segment of the fresh produce industry has already transitioned, or is planning to transition, into preferred or non-plastic packaging materials.

It is worth noting that, while industry is using a measurably higher proportion of preferred plastics than previously, whether packaging manufactured from readily recyclable materials (such as PET, HDPE or LDPE) is recycled is beyond the influence of individual businesses. The successful creation

¹² Industrial compostable, home compostable and PLA are not classified in the CPMA Plastic Guide and therefore have been labeled as “unclassified” in the analysis.

of circular plastic economies also rests on the suitability of government policies and regulations for motivating the establishment of effective and efficient recycling systems.

4.3 Impact of Proposed Plastic Packaging Labeling

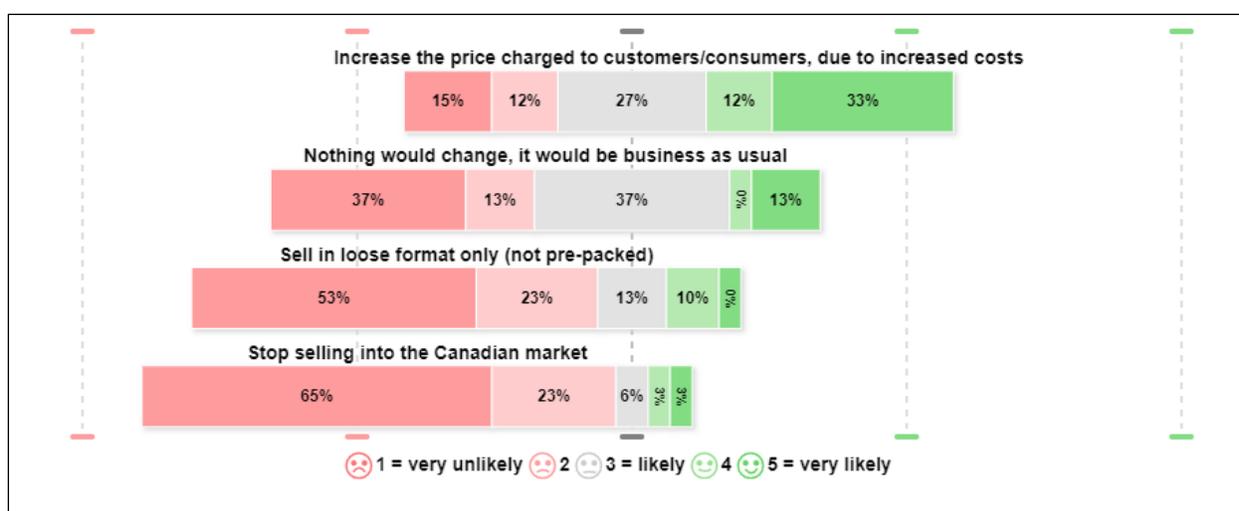
In April 2023, [ECCC released a proposed regulatory framework](#) that would require businesses to label plastic packaging in terms of its recyclability at a provincial level. The industry survey asked respondents to comment on whether this stipulation would affect their business decisions and/or operating costs.

60% of respondents indicated that if mandatory label plastic packaging differed ... it would be problematic for their business.

Sixty percent of respondents indicated that if mandatory label plastic packaging differed (in definitive “yes/no” terms regarding its recyclability) to ensure that they aligned with recycling systems that exist in each Canadian province or territory, it would be problematic for their business. Results

produced by the analysis of those survey responses are shown in Figure 4-3.

Figure 4-3: Business response to mandatory/differential labelling regarding packaging recyclability



72% indicated that the effect of (ECCC's proposed regulations) would most likely lead to higher prices being paid by consumers.

The majority of produce consumed in Canada is imported. The respondents who identified that ECCC's proposed regulations would negatively affect their business are predominantly national organizations handling imported fresh produce, and organizations who import fresh produce into Canada. Of these respondents, 72 percent indicated that the effect of this would most likely lead to higher prices being paid by consumers. Respondents are less likely to transition into only selling loose produce or exit the Canadian market.

5 Implications of Premature Migration in Packaging Materials

Survey respondents were asked to estimate the impact that a forced migration away from current plastic packaging would have on its customers and consumers. The two impacts explored in most detail within the industry survey and subsequent stakeholder interviews were the potential impact on food loss and waste (FLW) and operational costs.

5.1 Increased Food Loss & Waste

There is a clear expectation that a forced migration away from preferred packaging would lead to increased FLW.

There is a clear expectation amongst survey respondents that a forced migration away from preferred packaging would lead to increased FLW. The food industry typically refers to FLW as “shrink.”

Within the 20 types of commodities that formed the main focus of the research, the mass balance methodology (described in the Appendix) estimated that if those commodities were not packaged in preferred PP, the resulting increase in FLW above current levels would total 467,000 tonnes. This represents 16 percent of those 20 commodities currently sold prepackaged in PP. This is very close to the 17 percent increase in shrink identified during the 2019 study. As described in Section 4, those 20 types of commodities account for 67 percent of total produce fresh produce purchased by Canadian consumers.

The highest losses are expected to occur in commodities that are particularly perishable.

The analysis of survey data shows that the highest losses are expected to occur in commodities that are particularly perishable, most liable to damage, and/or require specialized packaging. Higher FLW is also expected to occur where plastic

packaging extends shelf life by protecting products that are ethylene sensitive. These include products that are often considered to be robust and suited to selling loose, such as carrots.

Applying that same 16 percent increase in FLW to the other 5 percent of fresh produce that the mass balance model estimated to be sold in PP would increase overall FLW occurring in Canada’s fresh produce industry by another 28,000 tonnes. This would bring the anticipated increase in total fresh produce FLW to 495,000 tonnes.

5.1.1 Value of Incremental Losses (Dollars)

In the 2019 study, the value of fresh produce was calculated by taking the average values from the Annual Summary of Daily Wholesale to Retail Market Prices (Wholesale Prices) provided by AAFC-Infhort. The study calculated 2018 Toronto wholesale prices, which were then converted to \$/kg.

To update the values produced in 2019 to align with 2022 food availability data, those values were adjusted by Statistic Canada’s quarterly wholesale services price index – fresh fruit and vegetables. This increase equated to the difference between the average quarterly index price in 2018 and the average quarterly index for 2022. The values assigned to each commodity are listed in Table 5-1.

Table 5-1: Values assigned to each category

Produce Category	\$/kg	Produce Category	\$/kg
Leafy greens	\$4.95	Apples	\$4.72
Soft berries	\$18.34	Soft fruit	\$11.25
Tomatoes	\$5.36	Pears	\$3.96
Potatoes	\$2.24	Peppers	\$1.80
Carrots	\$2.14	Beans (green and wax)	\$7.71
Mushrooms	\$13.47	Cucumbers	\$0.66
Citrus fruit	\$5.77	Beets	\$6.10
Cherries	\$14.42	Celery	\$1.04
Onions and shallots	\$1.66	Broccoli	\$7.24
Grapes	\$6.83	Kiwis	\$5.73

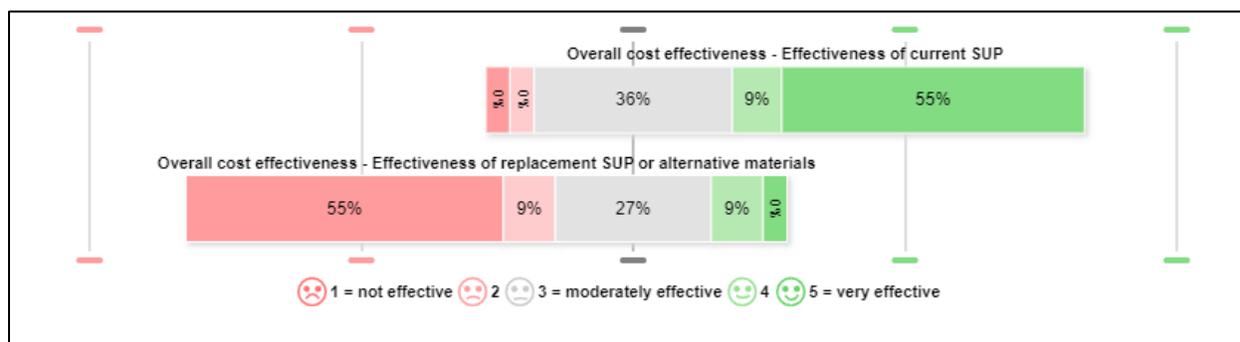
The total value of FLW if PP was not available is estimated to be \$3.4 billion. For reasons that include the withdrawal of PP causing a complete disruption to some sectors of the fresh produce industry, and the estimation not including increases in operational or material costs that industry would incur, this estimate is conservative.

5.2 Operational Costs

Survey respondents were asked to rank the relative effectiveness of current PP and an alternative packaging material in relation to a selection of factors.

Similar to 2019 survey results, the key factor voiced by respondents was the effect that a forced migration away from preferred PP would have on businesses' operating costs. Operating costs include materials, labour, equipment, training, energy, and transportation. Figure 5-1 illustrates the comparative cost effectiveness of current packaging versus alternative and less effective plastic packaging or alternative materials. The chart represents respondents scoring the comparative cost effectiveness of packaging on a scale of 1-5, where 5 is very effective and 1 is not effective.

Figure 5-1: "Overall cost effectiveness" of current vs. replacement packaging material



As can be seen, 64 percent of respondents described their current packaging as effective or very effective. Just 9 percent of respondents described alternative packaging as being effective. None described it as being very effective from an operational cost perspective.

When asked to estimate by how much percentage wise replacing PP with an alternative packaging would change the costs of doing business, the median response was an increase of 17.5 percent. This estimate is similar to VCM's 2019 research findings, which indicated that the majority of Canadian businesses expected that a forced premature change to alternative (non-plastic) packaging would increase operational costs by between 11 to 25 percent.

Two survey respondents indicated a move away from plastic packaging would potential decrease their operational costs. Both respondents dealt with products (e.g., apples, potatoes and onions) that are typically more suited to sale to consumers in bulk or non-plastic packaging than other fresh produce.

5.3 PLUs

To calculate the number and weight of plastic PLUs associated with the Canadian produce industry, the research team first used Statistics Canada's 2022 food availability data and its knowledge of the produce industry to identify the highest selling commodities (volume of sales) that are most likely to carry such stickers. Data on the percentage of individual types of fruits and vegetables sold loose that carry PLU stickers was captured from the previously mentioned survey circulated amongst retailers, and the store audits. This approach ensured that the PLU data used in the subsequent analysis included all high volume fresh produce items sold loose, and the appropriate percentage of PLUs per type of commodity. These were identified as:

1. Tomatoes
2. Peppers
3. Pumpkins, squash and gourds
4. Cucumbers
5. Eggplant
6. Bananas
7. Watermelons
8. Apples
9. Avocados
10. Citrus fruit (oranges, mandarins, grapefruit, limes, lemons)
11. Onions & shallots
12. Potatoes
13. Pears
14. Kiwis

Not every item sold loose carries a PLU. For example, less than one in four bananas (>25%) may carry a PLU. Typically, for most commodities, retailers will officially stipulate that 90 percent of items that will be purchased by consumers loose must carry a PLU. For a variety of reasons, however, the actual percentage of fruits and vegetables that carry a PLU is less. Reasons for this include certain circumstances where, for example, smaller regional suppliers are allowed to supply produce items that do not carry PLUs in order to prevent the need for capital investment in equipment. Such circumstances occur where retailers sell just one type of commodity within a category: such as only one yellow onion SKU. As well, it would be impractical to apply PLU to items

such as green beans. On the flipside, because some (typically smaller) retailers may choose to sell a formerly prepackaged item loose, a low percentage of commodities sold to retailers in pre-packaged format will also carry a PLU. For these reasons, the calculations are based on 90 percent of legitimate items and 25 percent of bananas sold loose carrying a PLU.

There are approximately 15 billion (PLU) stickers used in the Canadian produce sector per year.

Details of the calculation are provided in Appendix B. This calculation estimated that there are approximately 15 billion stickers used in the Canadian produce sector per year. Based on packaging experts' insights, approximately 40 percent of

the PLUs carried on fruits and vegetables sold in Canada are manufactured from paper and certified compostable materials. Based on the estimated incidence of three distinct sizes and weights of PLU in relation to the national volume of sales for discrete items,¹³ the volume of plastic associated with PLUs totals approximately 198 metric tonnes. Numerous produce and packaging industry experts stated that this volume will decrease as material and process innovations occur and manufacturing capacity grows. Some of the challenges that will remain for the foreseeable future in relation to replacing all plastic PLUs with paper and certified compostable alternatives include the following.

1. Certified compostable PLUs cost around three times more than paper or plastic PLUs.
2. The integrity of paper PLUs is affected by high moisture environments. They are therefore not suited to all situations that occur during the distribution and sale of fresh produce.
3. Particularly in relation to fruits and vegetables that are not peeled prior to consumption, the chances of a food safety risk arising from the use of paper and compostable PLUs can be higher than those associated with plastic PLUs.
4. The adhesives currently certified as compostable are inadequate for certain produce items, such as kiwi fruit, due to "hair" impacting adhesion rates. This results in PLUs falling off and failing to perform their intended task.

6 Conclusions

Plastic packaging (PP) plays a crucial role in enabling the global fresh produce industry to operate effectively and efficiently. The purpose of this project was to quantify changes that have occurred since VCMI's completion of a 2019 landscape review of plastic packaging in the Canadian produce industry, and the key drivers of any changes identified. As Canada imports the majority of fresh fruits and vegetables purchased by consumers, the study explored the potential impact of packaging decisions in relation to domestically grown and imported produce.

As in 2019, the majority of fresh produce purchased by Canadian consumers is loose or packaged in non-plastic packaging such as paperboard. The study found that, driven primarily by consumers' concerns surrounding the COVID-19 pandemic and the impact of inflationary pressures on consumers purchasing decisions, compared to when the initial landscape review was conducted in 2019, demand for prepackaged fruits and vegetables has increased. The study estimated that 45

¹³ PLUs' size and weight were categorized into three groups. Along with examples of distinct fruits and vegetables associated with each, they were: small ≈0.0175g (apples), medium ≈0.035g (bananas), and large ≈0.26g (melons).

percent of all fresh produce purchased by consumers in Canada is prepackaged in some form of plastic. Suppliers and retailers expressed that they are working to reverse this shift, though it is challenging given consumers' price sensitivities and their ongoing hygiene concerns.

The volume of plastic packaging utilized by the Canadian produce industry is estimated to have risen from 87,245 to 113,798 metric tonnes.

Due to the combined effects of increased demand for prepackaged produce and an approximate 5 percent increase in the Canadian population since 2019, the volume of plastic packaging utilized by the Canadian produce industry is estimated to have risen from 87,245

to 113,798 metric tonnes. This estimate includes 198 tonnes of plastic associated with PLU stickers. Given that this estimate encompasses products such as bananas (one of the highest volume items in Canada's produce sector and typically not sold prepacked in any form, and less than one in every four bananas may carry a PLUs), in reality this estimation is likely on the high side.

An important finding is the changes in the volume and types of materials used to prepackage many fruits and vegetables.

An important finding is the changes in the volume and types of materials used to prepackage many fruits and vegetables. Industry innovations, such as replacing clamshell lids with top seal and redesigns that have enabled reductions in the thickness of plastics used,

have resulted in the volume of packaging per kg of food decreasing by a median of 17 percent. A large segment of industry has actively migrated to utilizing readily-recyclable plastics such as PET. The majority of research respondents are actively investing in incorporating principles associated with circular packaging economies into their strategic packaging plans. More business are utilizing PCR materials.

Research conclusions regarding the potential effects of industry being forced to prematurely migrate from current preferred PP to alternative materials or sell fresh produce loose instead of prepackaged closely matched those contained in the 2019 study. This included an expected 16 percent increase in FLW amongst the 20 types of commodities that formed the main focus of the research and the estimated 5 percent of additional produce items sold in PP. This represents an additional 495,000 metric tonnes of fresh produce being lost and wasted above current levels. Based on changes to Statistics Canada's quarterly wholesale services price index – fresh fruit and vegetables, since 2019, the value of this additional FLW above current levels conservatively equates to \$3.4 billion.

A forced migration away from current PP could increase industry's operating costs by 17%.

In addition to economic losses associated with increased FLW, the research identified that a forced migration away from current PP could increase industry's operating costs by 17 percent. The two survey

respondents who indicated that a move away from PP packaging would potentially decrease their operating costs are producers/packers, who handle items more suited to sale to consumers in bulk or non-plastic packaging than other fresh produce: apples, potatoes, and onions.

7 Appendix A: Mass Balance Methodology

The purpose of the mass balance was to estimate:

- 1) The volume of packaging utilized by the top 20 prominent types of produce — identified by determining their comparative volume of sales and likelihood to be sold in plastic — in the Canadian produce industry (packaging type and materials most commonly used in each of the 20 types of produce were factored into the analysis)
- 2) The percentage and volume of incremental losses above current levels that could result from a premature withdrawal away from current plastic packaging
- 3) The number and volume of PLU stickers utilized

Plastic Volume (Metric Tonnes)

To achieve this, VCMI built a model to estimate the quantity of plastic packaging (PP) used in the Canadian produce industry, and to estimate the amount of FLW that would occur without the use of PP. The tonnage of PP used in the Canadian produce industry was estimated using the following calculation:

$$SUP = \sum_{i=1}^{20} x_i$$

$$x_i = \left(\frac{R_x \times F_x}{P_x} \right) \times W_x$$

Where:

x = fresh product category

R = % sold in SUP based on most common % item from 5 retailers

F = Tonnage of food available = $\left(\frac{\text{kg}}{\text{person}} \times \text{population} \right)$

P = Typical pack size

W = weight of typical packaging

SUP = tonnage of single use plastics

The calculations are based on Statistics Canada fresh produce availability. VCMI then reached out to key retailers and requested them to identify the percentage of each of the 20 categories of products listed in Section 4 that they sell prepackaged in PP. The typical pack size and type were assigned based on common pack size and type viewed at Canadian retailers and through an online investigation. The resulting median packaging to produce weight ratio was applied to 5 percent of all other produce items to estimate an overall tonnage of plastic used in the Canadian produce sector.

Incremental Losses (Volume)

The loss estimation was calculated using the estimated tonnage of product sold in PP as the baseline, and applying a roll throughput methodology along the value chain. Losses applied to the mass balance were tested against data provided by the online survey. Each stage of the chain was allocated at least one percent loss due to food safety issues, and at distribution, a 65/35 split was applied to retail/HRI, respectively. It was assumed that HRI pack size and/or PP mass is the same as retail, and that HRI would likely be able to manage FLW better than households.

8 Appendix B: PLU Plastic Sticker Calculation (Volume)

The equation below provides the method used to calculate the volume of PLU stickers used in the Canadian produce sector. It was assumed that the equivalent of 90 percent of fresh produce sold in loose format carries a PLU sticker. Of the total number of PLU stickers, 60 percent are assumed to be plastic (not manufactured from paper or certified compostable materials).

$$PLU = \sum_{i=1}^{14} x_i$$

$$x_i = \left(\frac{(1 - R_x) \times F_x \times 1,000,000}{A} \right) \times \left(\frac{0.9}{U_x} \right) \times W_x$$

Where:

x = fresh product category

R = % sold in SUP based on most common % item from 5 retailers¹⁴

F = Tonnage of food available = $\left(\frac{\text{kg}}{\text{person}} \times \text{population} \right)$

A = Average weight of individual produce item

U = Unit correction¹⁵

W = weight of typical PLU sticker¹⁶

PLU = tonnage of PLU stickers

¹⁴ Where the item is not typically sold in PP and a % was not gathered from retailers, it was assumed 100% sold loose.

¹⁵ Typically, for all but bananas = 1 unit per PLU sticker. For bananas = 4 units per PLU sticker (i.e. there is typically one PLU sticker per 4 bananas in a bunch).

¹⁶ PLUs' size and weight were categorized into three groups. Along with examples of distinct fruits and vegetables associated with each, they were: small ≈0.0175g (apples), medium ≈0.035g (bananas), and large ≈0.26g (melons).