CPMA ACDFL
CANADIAN PRODUCE MARKETING ASSOCIATION
ASSOCIATION CANADIENNE DE LA DISTRIBUTION DE FRUITS ET LÉGUMES

CASE LEVEL CONTAINERS (CLC)

BEST PRACTICES

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INTRODUCTION

As cases of fresh produce move through the supply chain, including increasingly through automated warehouses, common practices are necessary to ensure efficiencies while maintaining the integrity of cases to the downstream recipient. To support industry, a group of supply chain experts developed this document to provide guidance for consistency in labelling, recommendations for case construction to support stability in repalletization, consideration of challenges identified with various case-level packaging types, and costs to consider when making case level packaging decisions.

CASE LABELLING

Various factors should be considered when labelling a case for shipment through the supply chain. Label composition and placement, information included on the label and differences depending on the case type are important to ensure labels meet expectations throughout the supply chain. The PTI Best Practices for Formatting Case Labels provides guidance based on input from supply chain stakeholders across Canada and the U.S. and remains the standard implementation guidance for any organization shipping within, or into, these two countries. This guidance, like all other Produce Traceability Initiative (PTI) documents, is based on GS1 global standards for business. Please consider the following when preparing case labels:

- The *PTI Best Practices for Formatting Case Labels* includes guidance on the PTI Voice Pick Code. This Code is used by only a few buyers and when making a decision regarding including this on the label, users should ask their buyers if it is a requirement.
- The PTI Best Practices focus on corrugate cases, Reusable Packaging Containers (RPCs) and other case level packaging formats (e.g. master bags for carrots or onions) - the type of container may impact placement of the case label. *(**NOTE**: Although there are various long forms of RPC, for the purposes of this document, the acronym RPC is understood to mean Reusable Packaging Containers.)*

Specific to RPCs, please note the following labelling guidelines:

• Only one label should be applied to each RPC and cannot be any larger than 4" wide by 2" tall (inches).
• Labels must be applied to the short panel end walls only.
• Do not adhere labels under tines/card holder prongs, this is for cardstock only that is not glued to the RPC.
• Labels should not be applied on the long side panels, bottom or inside RPCs.
• Labels must not be wrapped around handle areas.
• Oversized pallet labels or stickers must be applied on the outer shrink wrap and not directly to the surface of the RPCs.
• Use only approved labels as per IFCO specifications found at IFCO.com in the “IFCO Approved Label Requirements” Document.
• If larger RPCs are used, labels should be placed on dimpled areas of short wall not on corner locks.

*(**NOTE**: The above guidance for RPCs is based on the IFCO Label Placement Guideline available here. When using other manufacturer RPCs, please confirm this guidance is aligned with their recommendations.)*

CASE HANDLING

It is recognized that, when selecting a case level container for a product, a one-size solution will not fit all; different fresh produce commodities will have different case-level container needs.
Industry members are strongly encouraged to discuss the specific needs of their particular commodity with their case-level container supplier to explore potential design options available to address them.

*(**<u>NOTE</u>**: To support these discussions between supply chain partners, industry members should also refer to the Cost Analysis Framework in this document for guidance regarding the potential cost considerations for different case-level container options.)*

<u>Industry options to address challenges with case level container stability</u>

Case level stability issue	Description	Type of case level container and/or specific commodities impacted	Potential solutions for consideration
Corner strength	• Collapsing in pallet	• Corrugate • Commodities with higher humidity • Smaller boxes (e.g. berries) • Some weaker bottoms for products like citrus • Containers with tabs (stacking issues with alignment)	• Corner boards • Corner guards/bars • Slip sheets • Reinforced corners for corrugate • Switch to RPC
Wall strength	• Collapsing in pallet		• Slip sheets • Increased corrugate strength • Switch to RPC
Open top container	• Bags/film sticking out of top • Clamshells opening due to pressure	• Corrugate • RPCs • Clamshell issue seen more with lighter weight commodities (e.g. berries) • Citrus bags	• Corrugate cases with flaps • Containers with tabs • Top seal on consumer packs • Ensure appropriate size container to avoid bags/film sticking out
Irregular shape	• Difficulty palletizing	• Master bags	• Training on palletization

	• Difficulty being integrated in automated systems		• Switch to corrugate and/or RPC options

Palletization of case-level containers

It is important to understand that, while the options above can support industry in selecting the appropriate case-level container to effectively handle the specific needs and meet weight/strength specifications of their product, these containers may not be designed to handle excessive additional weight stacked on top of them on a pallet.

It is recommended that a pallet should be used throughout the supply chain to maintain the integrity of the load and to minimize contamination concerns that may arise should product come into contact with the floor.

When building a pallet, consideration should be given to the following:

- Every effort should be made to ensure that heavier commodities and/or sturdier case-level containers are placed on the bottom, with lighter commodities and/or less sturdy, open-top or irregular containers stacked on top.

- It is important that pallets are constructed in a manner (e.g. cross hatching, pallet wrapping) that ensures structural stability.

- The height of the completed pallet should be appropriate to the weight and strength of the case-level containers on the pallet to avoid container collapse and ensure employee safety.

- Employees and/or automated palletizers should be provided with training/programming on these considerations to inform pallet building.

(NOTE: To support operational efficiency, industry members should also refer to the Case Labelling section above regarding the placement of case-level container labels.)

CASE LEVEL CONTAINER (CLC) CHALLENGES

Although the fresh produce supply chain has multiple safeguards in place to prevent concerns arising from case use, challenges are still sometimes noted relative to food safety, plant health, and cleanliness (i.e. what info is needed by growers to address concerns). As part of the efforts to establish this Best Practices document, identifying those "other" considerations which packers should contemplate when deciding on the CLC to use was included. In general, this type of packaging encompasses product which is further subdivided into consumer packs or bulk product.

Examples:
A CLC of bagged salads = 24 consumer pack bagged salads
A CLC of raisins = 6 tertiary packs = 12 consumer packs for a total of 72 consumer packs
A CLC of bulk apples = 48 bulk apples (for this example, each apple is effectively a consumer pack)

Each CLC material and configuration comes with a set of challenges which the packer must overcome.

1) Customer requirements – Packers must consider the format which their customers have requested in any contracts and/or specifications. It’s likely that different customers will require different CLC’s. Product being packaged for retail (i.e. the final consumer) will likely be a different format than those required for foodservice or further processing clients.

2) Mixed CLC Requests – Packers will likely be faced with requests for traditional packaging, corrugate or bulk bags, in addition to other options, like RPCs. This creates issues as differing formats have distinct attributes including life cycle, storage requirements, and various equipment functionality protocols.

   Material Considerations – Traditionally, produce CLCs have been single use corrugate boxes, plastic bags, burlap sacks or reuseable plastic/wooden bins. For all of these, except the bins, product would flow in a single direction through the supply chain. The risk of contamination, microorganisms, foreign material, or chemical, was primarily a production/packaging issue. It's crucial to recognize that contamination risks are not exclusive to one type of packaging and can occur at any point throughout the supply chain for all materials used.

3) Microbial (bacteria, yeast and mould) Contamination – Microbial pathogens, human and plant, once introduced to any packaging material have the potential to contaminate both the material and the product itself. Legislation addresses this issue by requiring that food-packing materials be suitable for their intended use by being either cleanable or single-use to prevent bacterial growth or transfer. It is crucial that containers such as RPCs, which are intended for multiple uses, be returned after each use for washing and sanitizing.

4) Viral (plant pathogen) Contamination – Recent viral plant pathogen outbreaks (i.e. Tomato Brown Rugose Fruit Virus (ToBRFV) or Fusarium oxysporum) can be devastating to producers especially in closed systems like greenhouses. The minuscule size of viral particles and the ability of some to survive long periods exposed to the environment, and, in some cases, a resistance to sanitizers, makes them a significant challenge to the industry. Strict protocols are required when viral outbreaks are occurring as these pathogens can be easily transferred from surface to plants via equipment, personnel, environmental factors and packaging. Protocols are required for all aspects of an operation, regardless of CLC systems, to ensure the threat of viral contamination is mitigated.

5) CLC Cleanliness – Packaging which travels the supply chain and is ultimately removed from the chain must follow regulatory requirements on storage, unintentional contamination prevention, and various material attributes. In a circular system, the hygienic integrity of reusable containers is maintained through a validated cleaning process, which significantly reduces the risk of cross-contamination in the food supply chain.

Mitigation Strategies

Given that each CLC system is unique to the partners involved in the movement of produce, it’s impractical to suggest specific solutions to the challenges outlined above, but some general considerations are warranted:

1) Trading partner communication is critical in finding efficiencies within the system. Producers, wholesalers, distributors, retail, foodservice and further processing organizations must understand the requirements with respect to CLCs. Fresh produce is a very dynamic industry with multiple input and output avenues. By understanding how the produce will be moved along the chain, decisions can be made to optimize which formats of CLCs are the most appropriate.

2) The issue of mixed CLC formats is one that increases in complexity along the chain. A single producer can produce shipping configurations which optimizes the type of CLC they have chosen. A large retailer will have hundreds of SKUs in a variety of CLC configurations to manage. This makes the process of selecting, pallet building and securely shipping produce very challenging. As in 1) above, communication between producers and buyers is key to reducing the burden of mixed CLCs. One process to avoid is repacking product from one format to another. Produce is fragile and very susceptible to condition damage, temperature abuse and cross contamination. The repacking of product significantly increases the risk that commodities will have lower quality and possibly greater food safety risks.

3) Preventing microbial contamination, including viruses, to reduce the risk of plant pathogens and food safety is a cornerstone of all fresh produce operations. Unfortunately, the risk of contamination exists at all stages of the supply chain, regardless of whether the packaging is single-use or reusable. Packaging material can play a significant part in reducing the risk associated with these hazards. CLCs which move straight through the supply chain are unlikely to introduce risk provided they are managed in a safe responsible manner by all participants. Risks to CLCs involved in circular systems can be mitigated through thorough validated inspection, cleaning and sanitizing processes. Regardless of the CLC type, organizations must ensure they have rigorous policies and procedures to manage the risks.

Unlike microbial hazards, cleanliness is a visceral issue which can have a significant impact on the overall perception of a particular CLC decision. Any packaging which is stored in an unclean manner, has visible filth or appears to be in poor condition will elicit a negative reaction. While circular systems have unique challenges related to the repeated use of materials, linear systems also face issues with contamination, damage, and improper disposal leading to negative impacts.

CASE LEVEL CONTAINER COST ANALYSIS & FRAMEWORK

BACKGROUND

When considering the use of Case Level Container (CLC) options for transporting fresh produce, several cost considerations come into play, including but not limited to:

1. **Upfront Costs**: what is the initial investment cost of the case level packaging?
2. **Operating Costs**: what are the expenses associated with cleaning, maintaining, and storing the packaging, if/when applicable?
3. **Transportation Efficiency**: What are the cost impacts regarding space usage, rate of damage, etc. during transit?
4. **Labor Costs**: What are the ergonomic and handling considerations which might impact labor costs?
5. **Environmental Impact**: What are the indirect environmental impacts, benefits and related costs?
6. **Lifecycle Costs**: What additional considerations with respect to total cost of ownership needs to be accounted for?

By properly accounting for key cost considerations, businesses can make more informed cost-related decisions about case level packaging alternatives.

CASE-LEVEL CONTAINERS GROUPINGS

The most effective way to group these containers is by their primary material. This approach clearly separates them by their physical properties, cost, and sustainability profiles. The attribute of "Virgin vs. Recycled Content" is a characteristic that applies *across* the corrugated category, rather than being a category itself. Similarly, "Modified Atmosphere Packaging" is a technology that can be applied to several types of containers, not a container type on its own.

Group 1: Corrugated Fiberboard Containers

This is the most common category, defined by its paper-based construction. The sub-categories are based on coatings and structural integrity.

- Uncoated Corrugated: Standard "cardboard" boxes used for produce with low moisture content and less demanding supply chains (e.g., potatoes, onions).
- Coated Corrugated: These are treated to enhance performance in moist environments.
  - Wax Coated: The traditional method for creating a moisture barrier. Commonly used for iced produce like broccoli and greens.
  - Functional Coated: Represents a more modern approach using non-wax-based, often recyclable, water-resistant coatings. These are functionally similar to wax but have a different environmental and recycling profile.

Group 2: Plastic Containers

This group is defined by its use of polymers, offering durability and reusability.

- RPCs: Rigid, reusable, and often collapsible containers used in a closed-loop system for a wide variety of produce. They are valued for their durability and product protection.
- Corrugated Plastic Cases ("Coro-Plast"): Made from corrugated plastic sheets (polypropylene), these containers are lightweight, durable, and water-resistant, similar to plastic-coated cardboard but more durable and reusable. They are often used for sensitive produce like asparagus and herbs.
- Master Bags (as a shipping unit): Large format bags that function as the case-level container.
  - Mesh Bags: Used for items requiring high ventilation, like onions and citrus.
  - Plastic Film Bags: Used for produce like apples, carrots, and potatoes, often with micro-perforations for respiration.

Group 3: Wood Containers

This traditional category is valued for its rigidity and stacking strength.

- Wooden Crates: General-purpose nailed or stapled wooden boxes used for a variety of produce, often where strength is a primary concern.
- Wirebound Crates: A specific construction using wood and wire, offering high strength and ventilation.
- Wooden Bins (Pallet Bins): Large-scale containers used for field harvesting and bulk transport of robust produce.

Group 4: Other & Emerging Materials

This category captures containers made from less common or newer materials.

- Molded Fiber Containers: Trays and cases made from recycled paper pulp, offering a sustainable and protective packaging solution.
- Fabric Bags: A subset of "Master Bags," often made from woven polypropylene or burlap, used for products like potatoes and onions.

Cross-Category Considerations

- Virgin vs. Recycled Content: An important attribute that affects the strength, performance, and sustainability credentials of all corrugated container types. Virgin fiber offers maximum strength, while recycled content is often used for less demanding applications or as part of a sustainability program.
- Modified Atmosphere Packaging (MAP): This is a technology, not a container type. It involves altering the gas mixture inside a sealed package to extend the shelf life of produce. MAP can be applied to Plastic Containers (e.g., sealed trays) and Master Bags (e.g., sealed plastic film bags), or incorporated into other Case Level Container formats via innovative material solutions.

COST ANALYSIS FRAMEWORK

Assessing the cost of Case Level Containers requires accounting for numerous cost categories, and specific related cost factors, as outlined in the following table. Cost analysis considerations are summarized and provide a starting point for the development of a comprehensive cost analysis of CLC options.

Key strategic trade-offs, impacts of external forces and recommendations for implementing a comprehensive cost analysis of CLC options are also provided.

Cost Category[1]	*Cost Factors*[2]	*Supply Chain Stakeholders*[3]				*Cost Analysis Consideration*
		Packing	*Transport*	*DC/Retail*	*Other*	
Configuration Cost	CLC design cost	x				If new CLC design is required. Consider for both reusable (RPC, Wooden Crate) or non-reusable CLC options.
	CLC Modification cost	x				Consider if modification of existing CLC design is required, including major "upgrades" to current packaging design (e.g., strengthening, etc.)
Material-related Costs	Unit cost	x				Per Unit Cost (including identifying potential or historical cost fluctuations due to raw material costs and other factors); include considerations for consolidating as many SKUs as possible to minimize costs associated with multiple CLC assets being required.
	Replacement cost	x	x			Based on rate of return, leakage rate, rate of damage, etc. Considerations for reusable packaging loss/replacement vs. non-reusable formats should be incorporated, including ensuring strong reverse logistics to avoid losses.
CLC Usage-related Costs	CLC storage cost	x		x		Packing: Storages costs associated with storing CLCs Retail: storage costs post-use (if reusable or alternative CLC modalities)
	CLC Coordination cost	x				Costs related to coordinating multiple CLC format for single product
	CLC Cleaning cost	x				If applicable (if reuse); consider if cleaning costs are separate from rental costs.
	CLC Maintenance cost	x				Costs related to ongoing maintenance of CLCs (if reusable); e.g., label. Consider if maintenance costs are separate from rental costs.

[1] Major cost categories to consider when assessing CLC options
[2] Specific cost factors to review and determine if they apply to the CLC options under consideration.
[3] Supply chain stakeholders which should be consulted to ensure that the cost factors are dutifully assessed and estimated.

Transportation Related Costs	Packing efficiency cost		x			Costs associated with density of packing during transportation and interim storage.
	Weight-related cost		x			Costs associated with any premiums paid due to CLC weight over lighter weight alternatives.
	Rate of CLC damage cost		x			Costs associated with impacts due to CLC damage during transportation (e.g., damage to CLC leading to damage to product, exposure to weather during transportation, etc.).
Traceability Related Costs	Traceability related cost	x	x	x		Costs associated with ensuring traceability of CLCs from packing thru to retail.
Commodity-quality related costs	Shrink related costs	x	x	x		CLC impacts on commodity shrink from packing thru to unpacking.
	Product quality related impacts	x	x	x		CLC impacts on commodity quality from packing thru to unpacking; include outcomes such as rejections and other quality-related actions.
	Shelf-life related cost	x	x	x		CLC impacts on commodity shelf life, including potential additional cost of liners when beneficial to maximize shelf life.
Handling, labour & storage-related Costs	Packing automation-related cost (if CLC subject to automated environments)	x				Cost on existing automation or implementation of new automation; includes retooling costs to accommodate change in CLC format); account for extent of change in automation and related operations – from “minor” to “significant” (e.g., complete remodelling of existing automation/handling practices.
	Packing manual labour cost	x				Impacts on labour requirements from changes in CLC form.
	Transportation-related handling cost		x			Costs related to handling during transportation and shipping.
	DC handling related cost			x		Costs related to handling in DC.
	Stacking and storage efficiency cost			x		Costs related to stacking and storage efficiency in DC.
	Retail handling related cost			x		Costs related to CLC handling in retail setting.
Environmental-related Costs	Resale value of CLC material after usage			x		Value generated thru sale of CLC material collected post-usage (e.g., Old Corrugated Carboard/”OCC” current and/or forecast value per tonne).
	EPR Fees	x		x		EPR fees as a function of form, composition (recyclability of resin, coated vs. not, etc.), etc.
	Other disposal-related costs/fees			x		Disposal fees, if any. Consider various disposal-related costs, including store labor to dispose of CLCs, as well as tipping fees for disposal to waste management pathways.

Other Lifecycle-related Costs	Costs related to disruptions in current supply chain structure	x	x	x		Costs resulting from disruptions to the structure of the incumbent supply chain (e.g., move from non-reusable to reusable CLC solutions)
	Other total cost of ownership considerations	x	x	x		Other unforeseen costs.

Cost-Related Key Strategic Trade-Offs

- Capital Expenditure (CapEx) vs. Operational Expenditure (OpEx): The most fundamental choice is between a low-CapEx/high-OpEx model (single-use corrugated) and a high-CapEx/low-OpEx model (owned RPCs/automation).
- Product Protection vs. Packaging Cost: There is an inverse relationship between the cost of the container and the cost of product shrink. Investing more in a highly protective CLC directly reduces the much larger potential costs associated with product damage and loss. For high-value or fragile commodities, the ROI on a more expensive, protective package is a key driver.
- Labor vs. Automation: Decisions to invest in automation are a direct response to rising labor costs and shortages. This large capital investment then creates a strong incentive to adopt CLCs that are optimized for that automation, demonstrating a value proposition where labor pressures ultimately influence packaging selection.

Cost Impacts of External Forces

The costs calculated within this framework are not static. They are subject to dynamic external forces that must be continually monitored.

- Regulatory Pressures: EPR legislation is expanding rapidly across North America, and the associated eco-modulated fees will increasingly penalize hard-to-recycle packaging and reward reusable and highly recyclable formats. FSMA and other food safety regulations will continue to impose compliance costs that are influenced by packaging material and design.
- Market Forces: Fluctuations in the price of raw materials (wood pulp, plastic resin, etc.), energy, and fuel will continuously alter the cost basis of all CLC types. Critically, the availability and cost of labor will remain a primary driver of automation adoption and, by extension, the push toward automation-friendly CLC packaging.

Recommendations For Implementing a Comprehensive Cost Analysis Method

1. Adopt a Total Cost of Ownership (TCO) Mentality: It is strongly recommended that all cost analyses utilize a comprehensive TCO methodology. A simple comparison of per-unit purchase price is inadequate and may lead to flawed conclusions.

2. Prioritize Commodity-Specific Analysis: Cost findings cannot be extrapolated across commodities. The framework should be applied on a case-by-case basis for distinct produce categories (e.g., leafy greens, root vegetables, berries) to account for their unique requirements for protection, ventilation, and handling.
3. Utilize Scenario Modeling: The framework should be used as a tool for dynamic scenario modeling. By adjusting key variables (e.g., modeling a future with 50% higher labor costs, or one with stringent EPR fees on plastics), the framework can help assess the financial resilience of each CLC option under different potential future conditions, leading to more robust and future-proofed strategic decisions.
4. Learn By Doing: Costing best practices should be adopted whenever possible, based on prior experience with CLC analysis and/or consulting with industry experts and peers to help shape and develop a comprehensive cost analysis of CLC options.