

# Protect, Promote, and Preserve:

## Defining the Optimal Packaging for Food

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## 1. Introduction

*Choosing the right packaging for their products is a decision that brands will often dedicate considerable time to—and rightfully so. Optimal packaging, in terms of format, size, and material can help maintain product integrity and enhance the customer experience.*

Selecting the right type of packaging is particularly important for food products, which require exceptional protection to reduce the risk of damage and food waste during storage, handling, and consumption. Many companies within the food industry have therefore opted to enclose their products in metal cans, a type of packaging offering superior levels of robustness and durability relative to alternatives on the market. In fact, such has been the predominance of the metal can that the United Kingdom's Royal Society named it as one of the three most significant inventions in the history of food and drink.<sup>1</sup>

Notwithstanding the prevalence of the can, consumers often seek clarification on the effects of canning on the quality and nutritional content of food, and if the inks and labels on the outside walls of cans interact with food contents. Newer questions are also emerging as the momentum for sustainability grips individuals and policymakers around the world. For example:

- With 1.3 billion tonnes of food produced for human consumption—a staggering one-third of total global food production—going to waste each year, what role does canning play in the fight against food waste?
- As the world transitions from a 'throw-away' economy to a new era of circularity, how can metal cans keep products and materials in perpetual loops of use?
- To what extent does metal packaging challenge the conventional tradeoff between packaging functionality and its recyclability?

This whitepaper sheds light on these questions by providing a closer look at the intrinsic attributes of metal cans, as well as the three material benefits they provide: **Protect, Promote, and Preserve**. Insights presented in this paper are informed by the latest scholarly literature on packaging, expert interviews, and data from Trivium Packaging (Trivium)'s Buying Green Report, a global study on consumer perceptions and buying behavior.



## 2. Food in a Can: A Primer

*When Peter Durand, a British merchant, debuted the tinfoil can in 1810, he had to use a proverbial hammer and chisel to open it before he could access its food contents.<sup>2</sup> Since then, the can has evolved into an exemplar of reliable, practical, and robust packaging for food. Underlying the ubiquity of the can are the tremendous advances in steel and can-making technologies that have occurred over the past several decades. But its popularity is equally driven by the inherent attributes of metal, which make cans optimal for storing and selling food products.*

### 2.1 The Making of the Modern Can

Much has changed in the way cans are manufactured since Durand's first tinfoil canister. Advances in can-manufacturing technologies have primarily focused on optimizations in three core areas: **safety, speed, and environmental impact.**

- Food can production is subject to extremely rigorous quality standards, ensuring that the final packaging is fit for its intended purpose. This stringency is necessary: cans come into contact with a wide array of foods, often over prolonged periods of time. It is imperative that cans are and remain food safe.
- Engineering advances have accelerated the speed at which cans are manufactured and filled. Can producers today are able to manufacture food cans with high precision at speeds of up to 500 cans per minute. In combination with parallel developments in shaping and printing technologies, such advances have enabled can producers to both meet the rising global demand for food and fulfill the heterogeneous preferences of today's consumers.
- There has also been significant progress made in reducing the environmental impact of can manufacturing. For instance, it is estimated that new-generation steel food cans are now 46% lighter than those of 30 years ago—and are still as durable.<sup>3</sup> Such light-weighting, coupled with higher recycled content uptake, has allowed cans to retain their functionality while lowering their environmental footprint.



## 2.2 The Three Ps of Optimal Food Packaging

Technological feats aside, the effectiveness of cans can be attributed to the material from which they are made— metal. Metal allows cans to fulfill the primary function of any packaging, namely protecting contents from contamination, spoilage, and damage at all stages of the supply chain. The expectations of food producers and consumers have evolved, however: rarely is today's packaging expected to only protect its contents. Packaging, for example, often serves as a promotional platform that, when correctly designed, can help brands stand out on crowded shelves, and drives sales by communicating the brand's values, backstory, and other purchase-driving messaging. At a time when the environment is at the forefront of consumers' and regulators' minds, today's packaging is also being increasingly assessed on the basis of its sustainability credentials.

The abovementioned criteria lead us to a three-P framework for evaluating the effectiveness of any packaging placed on the market, including packaging designed for food products. Specifically, we define optimal packaging as packaging that effectively protects products and promotes brand values—all while preserving natural resources in the process. In the next chapters, we subsequently demonstrate that **metal cans are often the optimal packaging choice** for food products.

### Protect

Safeguard contents from external elements and shocks

### Promote

Serve as platform for brand differentiation and consumer messaging

### Preserve

Retain natural resources in closed loops/systems



### 3. Protecting Nutritional Content

*Canned foods make up a significant component of individuals' diets in developed countries, offering year-round nutrition and round-the-clock availability. The convenience that metal cans deliver to consumers is often cited as their key strength, but cans additionally lock in essential nutrients and preserve food freshness. In fact, canning is one of the most effective ways to maintain food quality at its peak.*

#### 3.1 Locking in the Good and Keeping Out the Bad

The key to the nutritional value of canned food lies in the particularly short lag between getting the food from the farm (or ocean) and into the can. Fruits and vegetables are often canned very quickly after harvesting, sometimes in as little as three hours.<sup>4</sup> Quick processing preserves the nutritional content of food and reduces vitamin loss. Many types of fish also undergo rapid canning shortly after being caught, preserving essential nutrients such as omega 3 fatty acids.<sup>5</sup>

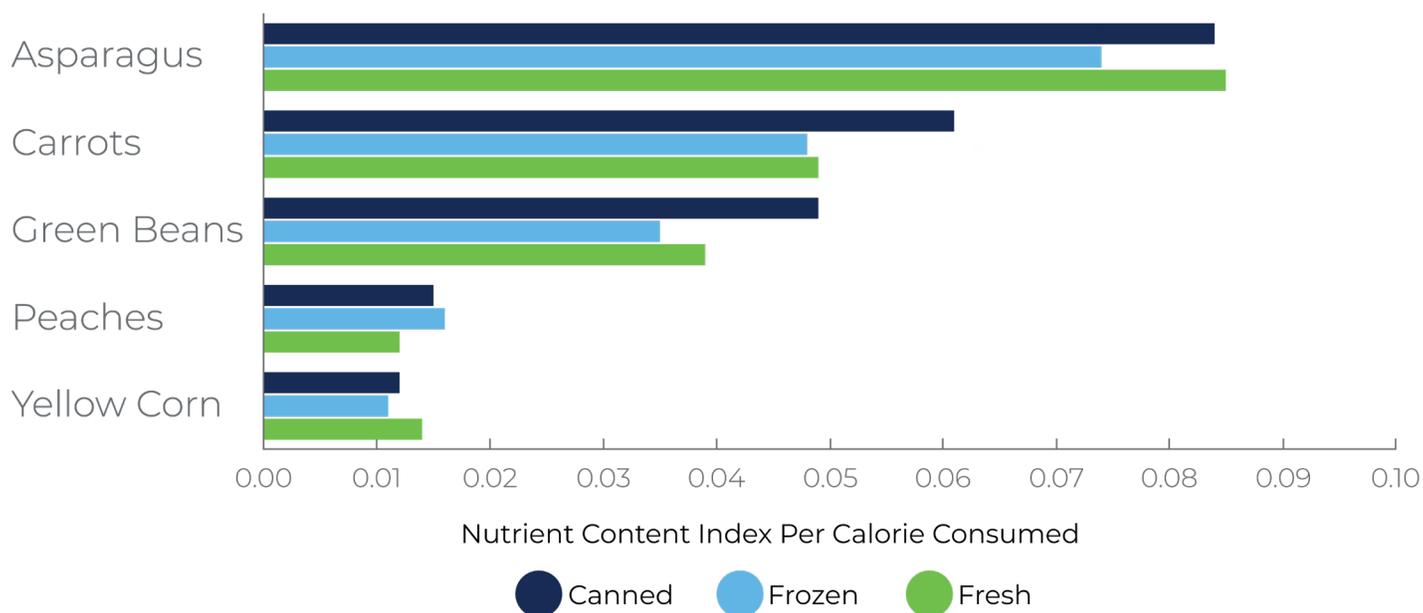
After packing, canned items undergo sterilization through a heating process that is more effective than blanching and pasteurization. Sterilization under high temperatures destroys a variety of pathogens and micro-organisms, and further neutralizes spores that might otherwise cause food spoilage. The process is meticulously regulated to ensure that heat does not jeopardize vitamins and minerals within the food or affect its sensory characteristics.

The combination of rapid processing and heat-based preservation has helped canned food deliver a **strong record of safety**. For example, the United States Food and Drug Administration has reported zero incidents of food-borne illness resulting from a failure of metal cans in more than three decades.<sup>6</sup>



Research additionally shows that cans are **excellent preservers of nutrients**, delivering food that has comparable nutritional value to its fresh and frozen counterparts when prepared for a table dish.<sup>7</sup> In some cases, canned food holds even higher nutrient levels than fresh produce (Figure 1). Canned tomatoes, for instance, hold up to four times the amount of lycopene—a rich nutrient with heart health promotion and cancer-fighting qualities—found in freshly prepared tomatoes. Similarly, canned ‘sauerkraut’ (sour cabbage) contains almost two times the amount of calcium found in its freshly prepared counterpart.<sup>8</sup>

FIGURE 1. CANNED FRUITS AND VEGETABLES OFFER COMPARABLE NUTRITIONAL CONTENT TO FRESH AND FROZEN PRODUCE



Source: Miller and Knudson (2014)<sup>9</sup>; Nutrient Content Index is a standardized composite measure of nutrient density encompassing 29 different vitamins and minerals that are benchmarked against the average adult dietary reference intake

### 3.2 Here to Stay

Once placed on the market, canned food enjoys the added advantage of having **exceptionally long shelf lives**, typically ranging between 1 to 5 years.<sup>10</sup> Metal cans and closures provide a hermetically sealed functional barrier that insulates food contents from sunlight and oxygen, the two primary drivers of premature quality degradation in food. Such exceptional barrier qualities contrast sharply with those of materials such as paper and plastic, which are generally more permeable to gases, water, organic vapor, and low molecular weight compounds.<sup>11</sup> Thus, whereas canned foods have shelf lives that are normally measured in years, foods stored in other packaging materials often have shelf lives that are measured in weeks or months.<sup>12</sup> For food categories that have an intrinsically short shelf life—such as meat, poultry, and seafood—or those with low oxygen tolerance—such as tomato-based products—the shelf-life extending benefits of metal packaging can therefore be enormous.

## 4. Promoting Brand Values and Differentiation

*In competitive markets, successful brands are those that find effective ways of promoting their products and connecting with customers. Packaging can help.*

### 4.1 Pick Me!

Within the Consumer Packaged Goods sector, some of the fastest-growing companies are leveraging the power of attention-grabbing packaging to have their products stand out on crowded shelves.<sup>13</sup> In particular, brands are increasingly opting for packaging with prominent prints and labels that ‘speak’ to what people are looking for in a product—be it ice cream or corned beef.

Yet, depending on the type of packaging material, the use of colors and labels as a differentiation tactic can come at a considerable cost to the environment. Plastic packaging is a case in point. Relative to clear or white plastic, dyed and pigmented plastic packaging is significantly challenging to recycle. Because of its pigmentation, colored plastic can only be recycled into darker shades of the original dye (or black), which limits its recycling potential (and market value). For this reason, many recycling facilities regard pigmented plastics as contaminants to the recycler stream and subsequently send them for incineration or landfill.<sup>14, 15</sup>

In contrast, metal packaging provides greater and more sustainable opportunities for brands looking to **differentiate their product offerings**. Market research indicates that consumers naturally associate metal packaging with a “premium” look and feel relative to other substrates.<sup>16</sup> In addition, brands can make use of advanced graphics and prominent colors on their cans **without sacrificing packaging functionality and/or recyclability**. Can-printing does not compromise product safety because of the impermeability of metal, and because inks used for food cans are fully compliant with strict food safety regulations (e.g. Article 3 of Regulation (EC) No 1935/2004, GMP 2023/2006, CEPE/EuPIA exclusion list, Swiss Ordinance 817.023.21 Annex 10). Similarly, printing does not undermine the recyclability of metal packaging given that cans around the world are commonly sorted and recycled together, irrespective of their size, shape, and the color of their overcoats.

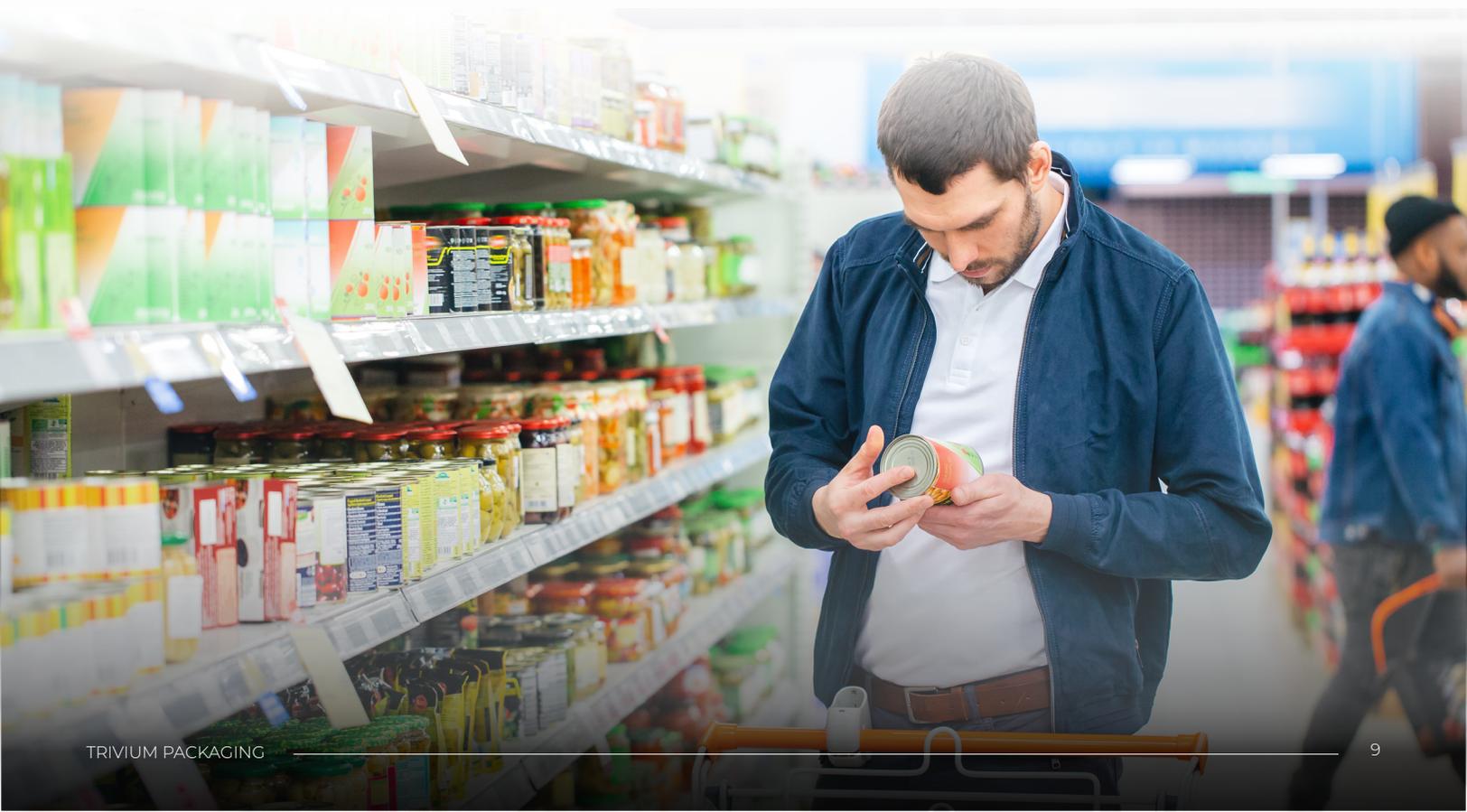


## 4.2 The Fine Print Matters

Colorful, eye-catching packaging can be the reason why a consumer will pick up a product from the shelf, but it will not guarantee that a subsequent purchase will be made. This is because consumers today are spending more and more time reading the information on the packaging before deciding whether to buy a product.<sup>17</sup> For food products in particular, consumers are often eager to know more about the food that they're buying, including its ingredients, how and where it's been produced, its nutritional content, and safety accreditation. Importantly, consumers want to know more about a product's packaging as well, particularly its environmental impact. In fact, [Trivium's 2021 Buying Green Report](#) shows that up to 52% of consumers look for information on the recyclability of the packaging of the products they buy, and that 73% of them are **willing to pay a premium** for products that come in more sustainable packaging.<sup>18</sup>

As consumer-driven demand for additional product information increases, so does the importance of packaging as a crucial tool for communication. Yet not all packaging is fit to meet this challenge. Displaying more information on glass jars, for example, obstructs consumers' ability to preview their contents, thus undermining a main reason why glass is selected to pack food in the first place. Similarly, several types of plastic packaging do not support direct printing, leading to the incorporation of product information on printed paper sleeves. Though sleeves can be enlarged to fit additional information or visual elements when needed, doing so severely undermines their recyclability<sup>19</sup>, meaning that brands, once again, are forced to make a tradeoff between the functionality of their packaging and its sustainability.

This is not the case for metal packaging. Direct, full-body printing is possible for cans, which eliminates the need for secondary materials for labels and retains the can's inherent recyclability. In effect, metal cans provide brands with a 360° canvas on which they can display **attention-grabbing graphics** and communicate **key product information** that drives sales.



## 5. Preserving the Environment

*Food requires robust protection to ensure safe and convenient consumption, but a traditional perspective on packaging has typically pitted functionality and/or safety against sustainability. Quality packaging does not have to be at odds with the environment, however. As demonstrated by metal packaging, cans are both durable and inherently sustainable. Furthermore, by combating food waste and supporting repeated recycling, cans are at the very forefront of the circular economy.*

### 5.1 Fighting Food Waste

According to the Food and Agriculture Organization of the United Nations, around **one-third** of global food production—approximately 1.3 billion tonnes—is lost or goes to waste each year.<sup>20</sup> Within the European Union, around 88 million tonnes of food waste -the equivalent of 20% of total food production- are generated annually.<sup>21</sup> In the United States, food waste is estimated at between 30–40% of the overall food supply.<sup>22</sup>

The reason why so much food is wasted differs between emerging and developed economies. Within emerging economies, food waste is primarily attributed to mismanagement in the early stages of the food value chain. Food is often lost during storage and transportation due in part to inadequate facilities and infrastructure.<sup>23</sup> In developed economies, 40% of food is wasted in later stages of the value chain, namely, at retail and consumer levels.<sup>24</sup> For example, food is often lost by retailers due to limited product shelf lives, and by consumers due to suboptimal meal planning (e.g. excess buying) and poor in-home storing.

The challenges posed by food waste are twofold. With 11% of people living on Earth today being undernourished<sup>25</sup>, food waste is first and foremost a pressing humanitarian concern. Yet, as the United Nations World Food Programme makes abundantly clear, world hunger is not a problem of food supply (the amount of food we produce each year can by some estimates feed the world's hungry four times over) but rather of accessibility and sound food management. Accordingly, calls for action on food waste have emphasized the need for packaging solutions that enable more robust product protection; longer shelf lives; and better portioning possibilities.<sup>26</sup>

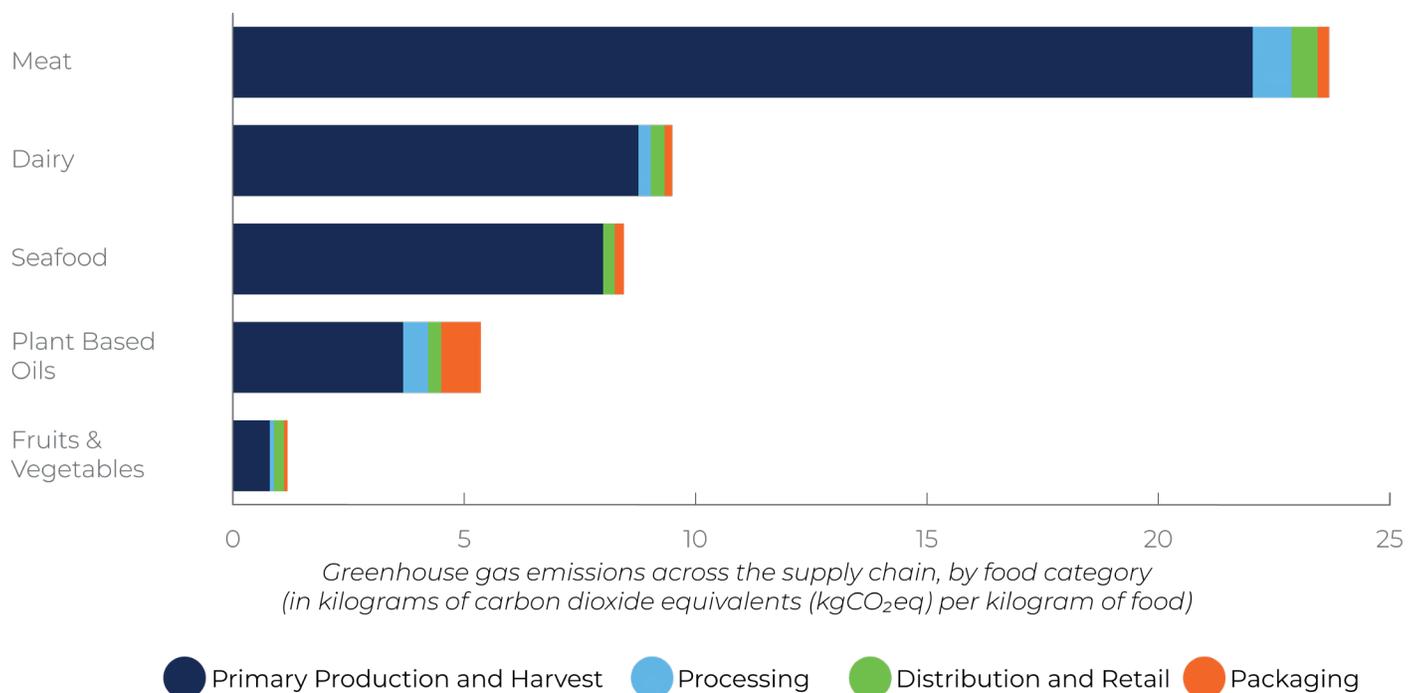
Food waste also poses a pressing environmental concern given the sizeable carbon footprint associated with the production and disposal of (spoiled) food. The Intergovernmental Panel on Climate Change estimates that **food waste** alone is responsible for **8–10% of global greenhouse gas emissions**.<sup>27</sup> To put this figure in perspective, emissions from food waste are almost six times greater than those generated from aviation, and are comparable to emissions from road transport.<sup>28</sup> It is worth emphasizing that these emissions are entirely avoidable—that is, they are generated from food that is produced but ultimately not consumed.



Given its severity, food waste is recognized today as a subject of urgent concern by policymakers, non-governmental organizations, and members of the public. Companies are also responding by committing to food waste prevention targets. In doing so, many have turned to metal cans as allies in their fight against food waste. It is easy to see why.

- Canned food is synonymous with **year-round availability**. By significantly extending product shelf-life, canning maintains the quality of food products for longer periods of time and limits the extent of spoilage and quality deterioration that such products would otherwise undergo if not consumed immediately. For food products with more sizeable harvest or production-associated carbon footprints, such as meats, dairy, and seafood, the environmental benefits of reducing spoilage through canning can be especially substantial (Figure 2).
- Canning comes hand-in-hand with **sustainable agricultural** by delivering an effective solution to surplus production. Surplus food, such as fruits and vegetables, that would otherwise be wasted can be preserved for future consumption through canning. Maximizing the amount of (food) resources that remain in the loop lies at the very heart of circularity.
- The structural robustness of metal means that canned food can be **easily and safely transported** globally at ambient temperatures, with minimal risk of damage and without the need for additional cooling systems. This robustness is crucial for food products that move through complex retail supply chains or cover long distances from the point of harvest to the point of consumption. That canned food additionally requires no refrigeration makes it among the most cost-effective and environmentally responsible ways to get food safely and sustainably to where it is needed.
- The versatility of metal means that cans can be sized to **suit a broad range of portions**, including family, single-serve, and on-the-go portions. Correct portioning ensures that the amount of product matches end consumers' preferences, thus reducing the amount of food that goes to waste.

FIGURE 2. REALIZING ENVIRONMENTAL BENEFITS THROUGH PROTECTION OF HIGH FOOTPRINT FOOD CATEGORIES



Source: Poore and Nemecek (2018)<sup>29</sup>

## 5.2 Circular by Nature

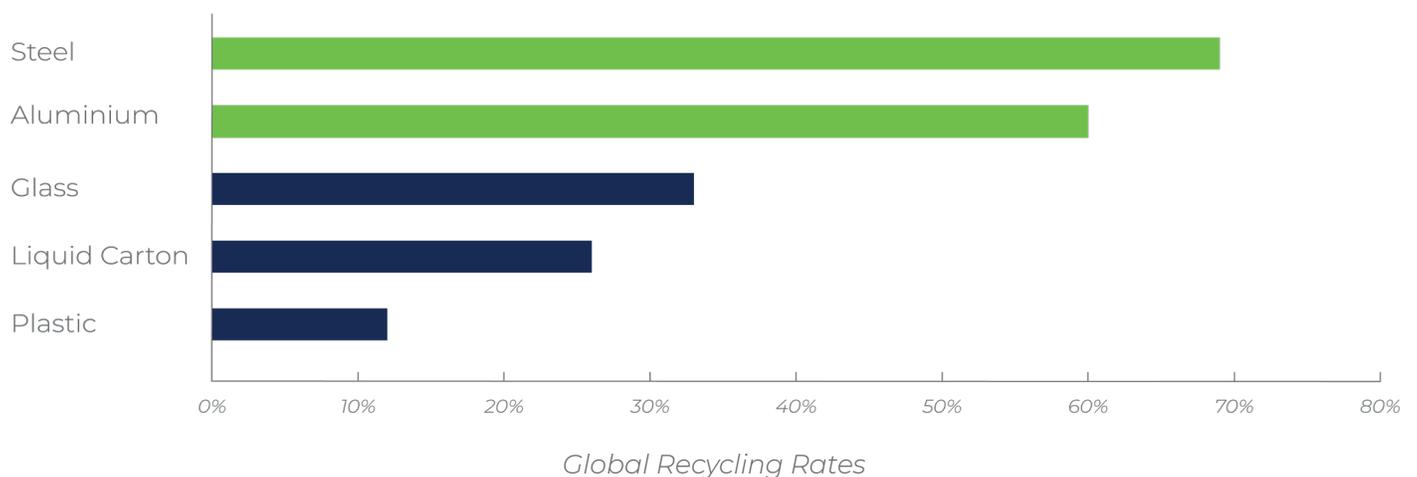
Today's consumers are more environmentally conscious than they have ever been. They are also more likely to act on their eco-friendly values when buying products. In fact, up to 57% of consumers hesitate to buy products with packaging that is harmful to the environment, and around three quarters of consumers are willing to pay more for sustainable packaging.<sup>30</sup> But what exactly makes some types of packaging more sustainable than others?

Experts note that **the gold standard of sustainability for packaging is its recyclability.** Sustainable packaging is packaging that can be effectively and efficiently separated from the waste stream; recycled at scale globally; and produces recyclates of sufficient quality to make new products. On this count, a wide array of packaging formats on the market perform underwhelmingly. Multilayered or composite packaging, such as beverage cartons and plastic pouches, are significantly challenging to break down into individual components. Other materials, such as certain classes of plastic, can only be downcycled, meaning that they can only be recycled once or twice before they suffer such quality loss that they have to be discarded entirely. To the detriment of the planet, a considerable amount of plastic and composite packaging therefore remains unrecycled and ends up as landfill or ocean waste.

Packaging material made of steel or aluminum, however, **stands clearly above the crowd.** Metal is an infinitely recyclable permanent material. Its inherent properties do not change or degrade over time, meaning that it can be used and recycled endlessly with no loss in quality. That is why, today, up to 80% of all metals ever produced are still available or in use.<sup>34</sup> With well-established and efficient recycling channels around the world, metal packaging is also among the most recycled materials globally (Figure 3).

The sustainability credentials of metal cans are especially impressive considering the way some packaging materials are attempting to tackle food waste. For example, to better preserve food contents, some formats have opted for thicker barriers or additional layers, but in doing so have increased packaging weight (and associated carbon footprint) and reduced packaging recyclability, respectively.<sup>35</sup> In contrast, metal packaging boasts superior recyclability and has simultaneously undergone significant light-weighting over time.

FIGURE 3. METAL PACKAGING BOASTS UNRIVALED GLOBAL RECYCLING RATES



Source: Association of European Producers of Steel for Packaging; Ellen MacArthur Foundation/World Economic Forum/McKinsey & Company; European Aluminium/Metal Packaging Europe; Eurostat; Global Recycling; International Aluminium Institute; Recovery; UNEPA, SPC, CalRecycle, Carton Council

## 6. Behold the Canned Revolution

The modern can has evolved into something much more ambitious than a simple functional housing for food. Today's metal cans offer superior barrier qualities that extend product shelf life and reduce food waste; provide superior possibilities for promotional branding without compromising on the packaging's functionality and recyclability; and boast excellent circularity credentials owing to the infinite recyclability of metal. On the basis of the three key performance criteria of packaging—the three Ps—, our assessment shows that metal cans hold a clear advantage over other substrates on the market.

	Protect	Promote	Preserve
<p><b>Metal Can</b></p> 	<p>Safeguard contents from external elements and shocks</p> <p>Impermeable and robust nature of barrier enables superior level of product protection and long shelf life</p> <p>●</p>	<p>Serve as platform for brand differentiation and consumer messaging</p> <p>Attention-grabbing direct printing and labeling opportunities possible, including embossing, debossing and decorative elements for added visual appeal</p> <p>●</p>	<p>Retain natural resources in closed loops/systems</p> <p>Can be infinitely recycled with no loss in quality; enjoys highest recycling rates globally</p> <p>●</p>
<p><b>Glass Bottle</b></p> 	<p>Barrier offers insulation against water vapor, gases, and odors but less effective against light; is highly fragile</p> <p>●</p>	<p>Opportunities to include prints, colors, and labels often limited by desire to maintain transparency of packaging</p> <p>●</p>	<p>Can be infinitely recycled with no loss in quality; enjoys medium-high recycling rates globally</p> <p>●</p>
<p><b>Plastic Container</b></p> 	<p>Higher permeability to water vapor and gases, leading to shorter shelf life; susceptible to breakage</p> <p>●</p>	<p>Printing and labeling typically require a secondary sleeve that hampers recyclability of overall packaging</p> <p>●</p>	<p>Most plastic food packaging is either not at all recycled or is downcycled, leading to considerable environmental leakage</p> <p>●</p>
<p><b>Multilayer Pouch or Carton</b></p> 	<p>Low permeability due to presence of multiple insulating layers, yet susceptible to cuts, punctures, and pinholes</p> <p>●</p>	<p>Attention-grabbing direct printing and labeling opportunities possible</p> <p>●</p>	<p>Challenging to recycle due to lack of adequate infrastructure globally; can only be downcycled into lower quality recyclates and cannot be recycled into new food packaging</p> <p>●</p>
<p><b>Performance Key</b></p> <p>● Superior      ● Good      ● Average      ● Inferior</p>			

For many brands, choosing metal packaging for food could thus constitute a meaningful and environmentally responsible step towards enhancing their product offering in an increasingly competitive market. Research and experience demonstrate that this strategy is especially likely to pay off when complemented with the following:

- **Collaborating with the right packaging partners.** Choosing the right metal packaging partner is key to ensuring optimally designed and produced food cans. Such collaborations are even more effective if partners are involved early in the project as they can provide guidance on which formats, sizes, and technologies could be most effective at achieving the brand's desired goals.
- **Cans as marketable collectibles.** Today, collecting a series of packaging designs for a specific brand is a growing trend among young consumers in particular, who see the design of the package as part of the allure and desire to "collect them all." Differentiating between the design of different product flavors can therefore open the opportunity to brands to reach younger markets who may buy and try the product simply because of the look of its packaging. With their direct printing possibilities and long-term durability, metal cans are ideally suited to serve as collectibles.
- **Promoting metal packaging as an environmentally conscious choice.** Brands that opt for cans are opting for sustainability. By adding labels such as the "Metal Recycles Forever" logo to their products, brands can visibly reinforce their environmental commitments and commend customers on their responsible purchasing decisions.

### For More Information

Do you have questions or are you interested in learning more about our food can portfolio?  
Visit: [triviumpackaging.com](http://triviumpackaging.com).



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