

U.S. Dairy Industry's Plastic Uses

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The development of a dairy product from on-farm milking to the presentation of a cheese, yogurt, ice cream, or fluid milk to a consumer or foreign market is a complex process that currently requires the use of certain plastics to maintain a high level of product quality, safety and integrity throughout the dairy manufacturing supply chain.

According to the FAO's 2021 Assessment of Agricultural Plastics and their Sustainability: a Call for Action, plastics' use in agriculture "can increase productivity and efficiency in all agricultural sectors and help minimize food loss and waste..." The report also states that due to the "versatility and variety of plastic polymers, their ease of manufacture, physical properties and affordability make them the material of choice for many applications in agriculture."¹

Nevertheless, U.S. dairy is dedicating significant focus to responsible management of plastic waste. U.S. dairy producers aim to continue producing safe, high-quality, nutrient-dense dairy foods while minimizing dairy's environmental impact, including by measuring and managing plastics use. We share the FAO's goal of "dealing with the issue of agricultural plastics holistically within the context of food security, nutrition, food safety, biodiversity and sustainable agriculture." In this background, the International Dairy Foods Association and U.S. Dairy Export Council (USDEC) provide an overview of the plastics needs of each step within the U.S. dairy production process.

On Farm Use

On dairy farms, different kinds of plastics play a role in animal comfort and care, safety for workers and animals, productivity, and environmental stewardship, among other factors.

Plastic use on U.S. dairy farms may vary depending on a variety of factors, but common uses include animal housing and tracking, milk collection, veterinary care, feed storage, and covering manure to reduce greenhouse gas emissions.²

¹ FAO. 2021. Assessment of agricultural plastics and their sustainability. A call for action. Rome. <https://doi.org/10.4060/cb7856en>

² Information on common uses in this paper is gathered from industry sources, as well as from the FAO paper in footnote 1.

Different plastic applications have different rationales and considerations for reuse, recycling, and/or disposal. For example:

- **Animal care and biosecurity:**
 - Housing - Plastic “hutches” made from high-density polyethylene (HDPE) are critical in animal health and biosecurity, providing individual housing that protects young calves from disease; allows for monitoring and observation; facilitates individual feeding requirements if needed; and keeps animals sheltered from heat, cold, and other weather conditions. Due to the durable nature of the HDPE material, calf hutches can withstand outdoor conditions and be reused for many years.
 - Identification and tracking – Plastic identification tags are used to track, trace and monitor individual animals’ health, nutrition, efficiency and productivity throughout their lives. These tags, often made of thermoplastic polyurethane, provide unique identifiers associated with individual animals and therefore often cannot be reused.
 - Plastics may be used for other animal care and biosecurity needs, including safe packaging and storage for veterinary and hygiene products (soaps, sanitizers, etc.), as well as personal protective equipment for farm workers.
- **Feed production & storage:** Plastics may be used in various stages of producing feed needed for healthy, productive animals. Plastic covers and bags are essential to storing and protecting dairy cows’ feed (called silage), reducing spoilage and waste, preventing contamination and disease, and preserving nutrients.
 - Silage covers have also increased efficiency, allowing feed to be stored closer to the animals in the field or barn. This reduces fossil fuel use in feed transport and all but eliminates the need for conventional silos, which are costly to build, also have an environmental impact themselves, and increase safety hazards for farm workers.
 - Silage covers and bags are typically made of thin plastics that cannot be recycled. Reuse is impractical because covers and bags are typically cut into strips to expose only the amount of feed needed for that day. Despite the challenges, opportunity exists to increase recycling capacity for this source of plastic. Wisconsin, for example, is developing state-level programing to increase the recyclability of silage covers and bags.
- **Milk collection:** Many components of a milking machine may be made of plastics, these can include milking tubes, shields, and filters, all of which must meet strict standards for hygiene and quality to ensure food safety.
- **Environmental stewardship:** U.S. dairy have set a goal to achieve greenhouse gas neutrality by 2050, including through innovations such as capturing emissions from

manure and turning them into renewable fuel. Plastics covers and liners help capture gases emitted by manure and prevent soil and water leakage. These covers and liners are made from thick, rubberized plastic material with lifespans of up to 20 years before they need to be replaced.

Processor Use

Dairy companies select packaging for specific functionality that goes above and beyond product containment and delivery to the consumer. The range of available dairy products is very wide, and each product type has its own sensitivities to temperature, moisture, sunlight and gases that can lead to spoilage and undesirable changes to flavors, textures, and colors. Other considerations for packaging include prevention of taints, shelf-life for extended supply chains and export, chemical migration barriers, and hygienic barriers at re-processing.

Therefore, each dairy product package must be carefully designed to use the minimal amount of material while maintaining quality, temperature, shelf life, and the safety of the products it contains – all in compliance with strict U.S. Food and Drug Administration (FDA) rules. At the same time, packaging decisions consider environmental and cost concerns, thus dairy product packaging decisions must assess the food safety and quality needs against the cost and environmental impacts. For this reason, dairy companies need flexibilities in their material choices.

- **Fluid milk, yogurts and cultured products:** Polyethylene terephthalate (PET) and high-density polyethylene (HDPE) are two commonly used plastics used for milk jug packaging and drinkable yogurts that offer the necessary rigid structure, heat resistance, moisture and water resistance. Low density polyethylene (LDPE) is also commonly used as both an exterior and interior coating on gable top fluid milk cartons. Furthermore, polypropylene (PP) is commonly used in injection molded tubs and cups, providing a tough, transparent, and high moisture barrier.
- **Cheese:** Packaging requirements for cheese vary depending upon the specifications for natural, powdered and processed cheese, but typically cheese is packaged in polyethylene (PE), LDPE, PP and other films. Plastic films are important to maintaining cheese quality and safety as there is variation in the necessary film functions. Natural cheese, which continues to age on the shelf, requires packaging with greater barrier properties than processed cheese because natural cheese is highly susceptible the transfer of outside aromas and spoilage/bacteria from exposure to oxygen. The type of PE film used in natural cheese will also depend on how long the cheese will be aged, with short hold cheese requiring greater gas barriers to help slow the aging process. Even individual types of cheese require variations; for example, swiss cheese requires a film that allows

the escape of the natural gases that form the holes within the cheese. Processed cheese, on the other hand, require grease as opposed to gas barriers because of the presence of emulsifiers in the cheese. Flex cracking and hermetic seal requirements are also relaxed for processed cheese.

Export Use

Many of the top five dairy products exported globally, nonfat dry milk powder, cheese, whey, lactose, and infant formula, require specific packaging to ensure the safety of these products per FDA regulations. Companies use a combination of the plastic materials noted above alone or in conjunction with other materials specialized to maintain quality, shelf life, and temperature safety. For the export market, plastic also reduces the weight of the product and allows for protection of larger volumes of contents.

- **Cheese and bulk powders:** Acting as a moisture barrier, PE and LDPE films keep the desired level of moisture in the cheese and milk powder, at the same time keeping moisture out. This inhibits the growth of mold and bacteria that could cause serious food safety concerns.
- **Lactose, nonfat dried milk and skim milk powder, and powdered whey:** Dairy powders are generally manufactured, packaged and stored in LDPE flex film plastic bags that maintain the optimal moisture levels for long periods of time.

Recyclability

Dairy companies must balance the environmental and recycling concerns with the product safety/integrity requirements noted above. To achieve the safe delivery of the product, many products used mixed materials, such as plastic liners in bags or plant-based cartons with plastic coatings, which complicates recycling and may require separation of the package's components for recycling.

With respect to post-consumer recycled content (PCR), PET and HDPE dairy containers are 100% recyclable, but actual recycling rates in the US are generally around 30%. This poses a serious challenge to the domestic availability of PCR packaging comprised of PET and HDPE. Fabricators are slowly increasing supply of PCR for those materials, but many factors, such as low consumer recycling rates, FDA food safety regulations, lack of recycling infrastructure, contamination and high value non-food demand for PCR continue to be a challenge to innovation. For other forms of plastic that are not generally recycled due to the lack of infrastructure and consumer education, there is also little PCR available for use in dairy products.

U.S. dairy companies are working with suppliers to increase the domestic availability of PCR plastics, but an adequate commercial supply is years away based on current estimates. In recent years, there has been an increase in investment to recycle PP, which is technically recyclable, but the infrastructure necessary to collect, sort and recycle these materials continues to develop. As investment increases, the likelihood of recycled PP, and food-grade PCR, will increase. Notwithstanding these challenges, dairy companies and suppliers are committed to increasing recyclability and use of PCR in dairy product packaging.

Plastic Alternatives

It is also important to consider that within the scope of plastics, dairy manufacturers do not yet have many alternatives to the current plastics used in dairy packaging, although many companies are investing in sustainable innovation research in order to improve opportunities for the use of plastic alternatives.

Outside of plastics, there are few alternatives that currently meet the intersection of consumer and customer needs, FDA's food safety standards, and function. Assuming metal packaging could provide the food safety and functional performance, metal packaging is more costly, and would result in higher transportation costs because of the added weight. Glass has similar cost and concerns with weight, in addition to the risks of breakage. Added weight in freight operations has additional environmental impacts on roads, emissions to haul the additional weight, and marine traffic that should be considered prior to implementing requirements related to heavier packaging alternatives. Another alternative material is paper, which alone lacks the food safety and functional barrier performance of plastic. Those dairy packaging applications that use paperboard also include plastic barriers to hold liquid and moisture.

Considering these challenges with alternatives and in recognition of the need to develop innovations to reduce plastic use and the recycling infrastructure to deal with essential applications, U.S. dairy is dedicating significant focus to responsible management of plastic waste while minimizing dairy's environmental impact, including by measuring and managing plastics use. With a history of safety that consumers have come to expect founded on the packaging innovations the industry has made over the last 100 years, sustainability is critical but the first and foremost responsibility of the dairy producer and company is to protect the health and safety of consumers. U.S. dairy producers take pride in providing consumers in the U.S. and around the world with safe, high-quality, nutrient-dense dairy foods and are committed to working with other food systems stakeholders to address plastic waste without compromising our core responsibilities and values.

The International Dairy Foods Association (IDFA) represents the United States' dairy manufacturing and marketing industry, which supports more than 3 million jobs that generate \$159 billion in wages and \$620 billion in overall economic impact. IDFA's diverse membership ranges from multinational organizations to single-plant companies, from dairy companies and cooperatives to food retailers and suppliers, all on the cutting edge of innovation and sustainable business practices. Together, they represent 90 percent of the dairy products that are produced and marketed in the United States and sold throughout the world.

The U.S. Dairy Export Council is a non-profit, independent membership organization that represents the global trade interests of U.S. dairy producers, proprietary processors and cooperatives, ingredient suppliers and export traders. Its mission is to enhance U.S. global competitiveness and assist the U.S. industry to increase its global dairy ingredient sales and exports of U.S. dairy products. USDEC accomplishes this through programs in market development that build global demand for U.S. dairy products, resolve market access barriers and advance industry trade policy goals. USDEC is supported by staff across the United States and overseas in Mexico, South America, Asia, Middle East and Europe. The U.S. Dairy Export Council prohibits discrimination on the basis of age, disability, national origin, race, color, religion, creed, gender, sexual orientation, political beliefs, marital status, military status, and arrest or conviction record. www.usdec.org.