

TIMELY TOPICS

By Nicole Martin

Bacterial endospores in bulk tank raw milk: Challenges and opportunities

Endospore, or “spore” forming bacteria have caused a number of dairy product quality issues for decades. Specifically, psychrotolerant, or cold growing, sporeforming bacteria (i.e., *Paenibacillus*) are implicated in over 50% of fluid milk spoilage, while anaerobic butyric acid sporeforming bacteria (i.e., *Clostridium tyrobutyricum*) cause a defect in certain aged cheeses called “late-blowing,” which renders the product unsaleable. Further, thermophilic, or heat-loving, spores (i.e., *Bacillus licheniformis*) in exported dry dairy ingredients are known barriers to US processors meeting stringent international customer specifications. As dairy processors continue to understand the role that spores play in product quality and marketability, interest in obtaining low spore count raw milk is increasing.

The primary challenge with spores in dairy products is that unlike many other bacterial organisms commonly found in raw milk, these spores are highly resistant to processing techniques aimed at killing microorganisms (i.e., pasteurization). When a bacterial cell that is capable of forming spores senses that the environment it is in has become unfavorable, it enters the spore state where the organism protects its genetic material from damage. Spores are metabolically inactive, meaning that they do not grow, reproduce or utilize nutrients and can potentially persist in the environment for millions of years. When conditions become favorable again, and will support the growth of the bacteria, these organisms can go through a process called “germination” and begin growing again. Using these strategies, spores that enter raw milk are able to survive processing and subsequently grow in, and spoil, a variety of dairy products.

A recent study conducted by the Milk Quality Improvement Program at Cornell University, and funded by the New York Farm Viability Institute, investigated the sources of five broad types of spores commonly responsible for dairy product spoilage in dairy farm environments and their association with bulk tank raw milk.

While spores are common in natural environments, such as dairy farms, little is known about whether certain types of spores are more likely to be found in specific

Impact of farm management practices on bacterial spore levels in raw milk and dairy product quality.

locations on the farm (i.e., bedding, water, manure, etc.) and how they move from those sources into bulk tank raw milk. Results of this work indicate that some types of spores are associated with specific sources on the farm. For instance, those spore types that are found frequently in dry dairy ingredients, like skim milk powder, are associated with spore levels found in parlor equipment. In contrast, spores that are implicated in fluid milk spoilage are more closely associated with spore levels in wash water on the farm. Further,

several on-farm sources are associated with multiple spore types, in particular, feed and teat swabs.

This research, along with other studies aimed at understanding farm management practices and how they associate with spore levels in bulk tank raw milk are critical to give producers the tools to reduce the entry of bacterial spores into the raw milk supply from the farm environment. Further research will build on the results from this work to identify intervention strategies at the farm level. □

Nicole Martin, MS (nhw6@cornell.edu) is Associate Director with the Milk Quality Improvement Program, Department of Food Science, Cornell University.

