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Understanding your milk culture reports

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Often times milk culture reports are received and we have a hard-enough time pronouncing the bacterial names much less knowing where the bacteria originate. This is becoming increasingly more common as culture laboratories switch to using more robust bacterial characterization methods. Traditionally, laboratories have relied on biochemical and physiological tests to identify bacteria but those are both time-consuming and costly. Newer systems, like the MALDI-TOF (Matrix-assisted laser desorption/ionization-time of flight) are a widely used technique for both the rapid and accurate identification of bacteria, mycobacteria, and some fungi. The results from this system are then compared to a referent database to determine the bacterial ID. The continually improving and evolving referent database has a diverse population of bacteria, thus often times the results generated are not the typical bacterial pathogens we think of in milk samples which can make interpretation of results difficult. So how do we make sense of these results?

One of the first things to think about is whether the samples were from bulk tank milk or individual cow samples. If you think about a bulk tank milk sample, the sources of bacteria represented in that sample can vary greatly. Bacteria in bulk tank milk samples could come from within the gland of the cow, the skin of the cow, debris on the udder of the cow, from inside the pipeline or anywhere in between. Trouble-shooting high bacteria counts from bulk tank samples can be difficult for these reasons, to say the least. However, the results can give you a starting point for identifying problem areas. When unusual bacteria pop up, I start by identifying whether these bacteria are likely to come from the gland or the environment. In most situations the odd-balls come from the environment. The next important question is whether these environmental bacteria are also causing a problem in the gland. To answer this, I recommend culturing high somatic cell count (SCC) cows. By combining the results of a series of bulk tank samples with those from high SCC cows, we can begin to identify problem areas on the farm and then look for ways to reduce the counts.

A few key things to remember about dealing with (and preventing) environmental pathogens, especially from individual cow samples:

- importance of milking time hygiene;
- cleanliness of bedding;
- availability of fresh feed after milking to allow the teat sphincter to close; and
- use of a barrier teat dip.

To avoid the spread to herd mates when contagious pathogens are the predominant pathogen identified:

- scrupulously follow proper milking prep procedures;
- post-dip application is critical;
- identify positive cows, and treat and segregate when appropriate and possible.

The use of bulk tank samples can help us identify bacterial predominance in a herd. For example, if a herd has a high proportion of contagious pathogens on repeated bulk tank samples, it is recommended to start identifying individual cows contributing to these counts. This can be done by sampling strings of cows or going directly to sampling individual cows. The use of a California Mastitis Test (CMT) can help to identify suspect cows to sample. This same recommendation is made when bulk tank samples are predominantly environmental pathogens that are typically mastitis-causing, such as streptococci. However, there are situations where the predominant environmental pathogens do not appear to be standard mastitis-causing bacteria in which case the recommendation is to start looking for environmental sources leading to contaminated milk. These could be from poor prep procedures in the parlor or improperly cleaned milking equipment, to mention a couple.

As always, the option to culture both bulk tank samples and individual cow samples are available through our milk culture laboratory at Virginia Tech. If you need help identifying where to start your sampling, don't hesitate to reach out to me by email at milk@vt.edu or by phone at 540-231-4767.

The influence of climate change-induced nutritional stress on dairy cattle

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For the past few decades, global warming and climate change have been trending topics of concern. One controversial argument is livestock production's role in contributing to this phenomenon. Though this may be true, dairy cattle contribute to less than 1% of total greenhouse gas emissions through enteric fermentation. Rather than looking into dairy cattle's impact on global climate change, a better question may be "What is climate change's impact on dairy cattle?"

It is projected that due to climate change, by the year 2040 the average duration of individual heat stress events in dairy cattle will increase by one hour and the number of events will increase to approximately 6% of all summer hours in a year. By 2100, it is estimated that the average duration of heat stress events will increase to three hours and the number of heat stress events could increase up to 27% of all summer hours in a year. This could have serious implications on dairy cattle profitability through decreased milk production and quality as well as reproductive efficiency. However, climate change-induced heat stress may also impact dairy cow production via lesser-known mechanisms, such as nutritional stress. Here, we explore the effect of climate change-induced nutritional stress on dairy cattle.

Heat stress reduces dry matter intake, decreases ruminal motility and contraction, and affects digestibility and nutrient utilization. Dry matter intake is reduced up to 30% when climate temperatures increase above 30°C. This activity is largely mediated by the hypothalamus, a region of the brain that controls hunger and satiety, in response to the negative energy balance that occurs due to heat abatement by the animal. Dairy cattle also preferentially consume more high-concentrate portions of mixed rations over forage when heat stressed. This negatively impacts fermentation despite improving digestibility. The reduction in forage intake reduces forage turnover within the rumen and increases feed residency time, often leading to ruminal acidosis. These alterations to the rumen environment are shown to have further downstream impacts, such as changing the ruminal microbiome profile.

Studies comparing heat-stressed and non-heat-stressed dairy cows found significant alterations to rumen pH, lactate and acetate concentrations in rumen fluid, and shifts between genres of bacteria. Heat stress results in an increase of lactate-producing bacteria like *Streptococcus* spp. and *Enterobacter* spp., as well as those that utilize soluble carbohydrates as energy like *Ruminobacter* spp., *Treponema* spp., and *Bacteroides* spp. These were paired with a reduction in acetate-producing bacteria abundance. Metabolite shifts in rumen fluid by the changing bacterial composition may decrease energy availability for the animal and further impair health. It is thought that these microbial alterations and subsequent metabolomic differences between heat-stressed and non-heat-stressed animals in part explain milk production decreases often seen due to heat stress.

A common solution to overcome negative energy balance and decreased production due to heat stress is through nutritional management. It is recommended to feed mixed rations with increased crude protein and a few high-quality forages. However, climate change's influence on forages may make nutritional management of heat stress more difficult in the coming years. A long-term database containing 21,000 measurements of cattle fecal chemistry over 14 years was used to evaluate the relationship between climate and the crude protein and digestible organic matter of forages in various regions of the United States. The analysis revealed that among regions, protein concentrations decreased at an approximate rate of 2.8 mg/g per °C increase in temperature and digestible organic matter concentration decreased by 1.7 mg/g per °C increase in temperature. This means that if temperatures increase by 1.5°C on average by 2040, as is predicted, the protein concentration of forages will decrease by 4.2 mg/g and the digestible organic matter will decrease by 2.6 mg/g. As such, additional supplemental feed may be required to improve the nutritional quality of diets affected by climate change in the future. Though, this can be costly and still ineffective if dry matter intake is not improved in heat-stressed dairy cattle.

In summary, it is projected that heat stress duration and the number of events will drastically increase over the century due to climate change. This may have serious implications for dairy cattle profitability due to decreased milk production that may be modulated by lesser-known nutritional stress. Heat stress affects ruminal fermentation through decreased dry matter intake, animals preferentially sorting for concentrate, and alterations to the microbial consortium to increase lactate production and decrease acetate production which may increase acidosis prevalence. It's commonly said that nutritional management may reduce the effects of heat stress, however, this will become a challenge in the coming years due to decreasing energy and crude protein availability from forages due to climate change. It is essential that other mitigation strategies be considered, such as genetic selection of resistant animals or genetic modifications of forages to preserve forage quality in the face of climate change.

Upcoming Events

Fall Pasture Program
TBD (Franklin County)

World Dairy Expo
October 2-7, 2022 (Madison, WI)

National 4-H Dairy Judging Contest
October 2, 2022 (Madison, WI)

Cattle WISE/Equipment WISE-Women in Ag
October 21-22, 2022 (Blacksburg, VA)

National 4-H Dairy Quiz Bowl
November 5, 2022 (Louisville, KY)

Dairy Sustainability Summit, Dayton
December 8, 2022 (Dayton, VA)

If you are a person with a disability and require any auxiliary aids, services or other accommodations for any Extension event, please discuss your accommodation needs with the Extension staff at your local Extension office at least 1 week prior to the event.

For more information on Dairy Extension or to learn about current programs, visit us at VTDairy—Home of the Dairy Extension Program online at www.vtdairy.dasc.vt.edu.

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