Dairy Research, Teaching, and Extension
UNIVERSITY OF DELAWARE

March 2015

DELAWARE DAIRY NEWSLETTER

Minimizing Your Chances of First Cutting Going Clostridial By Limin Kung	1
Assessing Milk Quality By Dan Severson	2
Strategies to Improve Energy Metabolism in Fresh Cows By Maris M. McCarthy	4
Iodine: Are you forgetting a key trace mineral? By Daryl Kleinschmit	7
Thank You	9

Minimizing Your Chances of First Cutting Going Clostridial

Limin Kung, Jr.
Dept. of Animal & Food Sciences
University of Delaware

One of the worse fermentations that can occur to a forage crop is one dominated by *Clostridia*. These organisms are naturally present in soil and manure and under anaerobic conditions in the silo, can sometimes dominate the fermentation and lead to large losses of nutrients and dry matter. There is nothing much worse than the smell of clostrdial silage being tracked into the house! The awful smell is due to a combination of butyric acid, amines and ammonia. In addition, animals fed clostridial silages often have reduced intakes and may become ketotic if they consume too much butyric acid. The table below lists what factors may favor a clostridial fermentation and those factors that might help us avoid it from happening.

In brief, alfalfa and other legumes are most prone to clostridial fermentations because they have high buffering capacities resulting in slow- and less-extensive drops in pH when compared to whole-plant corn. Alfalfa harvested below 30% DM has a high probability of becoming clostridial because *Clostridia* thrive in wet conditions. Low concentrations of sugars, due to cloudy days and or prolonged wilts also increases the chance of a clostridial fermentation. The two biggest deterrents to a clostridial fermentation are a fast and low drop in pH and high dry matter content. *Clostridia* don't like a low pH or dry conditions. The critical pH for inhibiting *Clostridia* is lower when the moisture content is high (low DM). For example at a DM of 25%, the critical pH to prevent clostridial growth is about 4.4-4.5. However, at a DM of 40% the critical pH is about 5.5. Thus, consider width swathing for first cutting, wilting the crop to more than 35% DM and using a research-proven microbial inoculant based on homolactic acid bacteria to drop the pH quickly.

Factors that *Increase* the Chance of Clostridial Fermentations	Factors that *Decrease* the Chance of Clostridial Fermentations
Crops with high buffering capacity (e.g., legumes) and high moisture (<30% DM)	Crops with low-buffering capacity; (e.g., corn silage)
Poor packing density	Fast packing with high packing density
Prolonged wilts (low sugars); Uneven drying in windrows leading to high moisture sections in the silo	Fast, even dry downs
Slow drop in pH during fermentation	Fast drop in pH during fermentation
Harvesting and wilting crops under cloudy conditions (low sugars)	In most silo types, wilt above 35% DM
Leaving chopped forage in the wagon overnight	Using a research proven inoculant with homolactic acid bacteria
Silage at bunker walls with rain water contamination	
Contamination with soil or manure during harvest	
Adding manure/slurry to fields close to harvest	
Forage in bunker that is rained on during silo filling	
A wilting crop that is rained on	

Assessing Milk Quality

Dan Severson
University of Delaware
severson@udel.edu

Introduction

As consumers are becoming more concerned with how their food is handled and where it comes from, producers should continue to put a positive light on the dairy industry. Dairy farmers take great pride in their work and for that reason one of the missions of any dairy farm should be to produce high quality milk. Poor quality milk will cause a decrease in milk yield, the milk to have off flavors, shorter shelf life and decreased yield in manufactured products. Like I said before, earning extra income in the form of quality bonuses is never a bad thing.

Somatic Cells

Because milk is approximately 87% water, it creates an ideal place for bacteria to grow and thrive. The presence of bacteria may cause an infection in the mammary gland, which will cause the number of somatic cells in the cow's milk to increase. Somatic cells are predominantly leukocytes (white blood cells) whose main job is to combat infection. Somatic cells are measured by the number of cells per milliliter (ml) of milk. As you are well aware, the current regulatory limit for somatic cells in the United States is 750,000 cells per ml. However, there is always pressure to lower the limit to 400,000 cells per ml.

In general, individual somatic cell count (SCC) above 200,000 per ml indicates that the mammary gland is infected and has prompted an inflammatory response which will cause milk yield loss. Therefore, SCC can be used as an indicator of udder health, degree of inflammation and loss of milk production for that particular cow. The Bulk Tank SCC (BTSCC) can be used to measure the udder health of the entire dairy herd.

An increase in the BTSCC indicates an increase in the amount of mammary infections in the herd, as well as an economic impact due to the loss of milk production. However, the industry does have other methods to assess milk quality and to help diagnose high bacteria counts.

Standard Plate Count

The Standard Plate Count (SPC) of raw milk measures the total number of bacteria present in the milk. Milk samples are plated onto a nutrient media and incubated for 48 hours at 90˚F. Then, the number of bacteria colony forming units per milliliter of milk (cfu/ml) is counted. Federal regulations mandate that the SPC of milk not exceed 100,000 cfu/ml. However, because farms are adapting proper milking and cleaning practices, levels less than 10,000 cfu/ml are normal. The most frequent cause of an elevated SPC is poor cleaning of the milking system or a delay in cooling milk to less than 40˚F.

Preliminary Incubation Count

In general, the Preliminary Incubation Count (PIC) is a reflection of milk production practices. High PICs are linked to poor milking procedures, i.e. cows that have not been properly cleaned prior to milking or inadequate equipment cleaning and sanitizing methods. To determine the PIC, the milk sample is held at 55˚F for 18 hours prior to being plated and counted similar to the SPC. The PIC measures the number of psychrotrophic bacteria, or bacteria that are capable of surviving in a cold environment. The PIC is commonly higher than the SPC. The theory behind the low temperature is that the normal microbial population of the cow will not grow well during the holding period. Currently PIC is not regulated, but an achievable goal for PIC should be below 25,000 cfu/ml with 10,000 cfu/ml not out of reach. The best use for the PIC is the relation of PIC to SPC. For example, a PIC that is three times the SPC can be indicative of poor udder preparation. On the other hand, a high PIC coupled with a high SPC may point to a mastitis issue. There is still an ongoing debate on whether or not PIC affects shelf life or the flavor quality of milk.

Laboratory Pasteurization Count

The Laboratory Pasteurization Count (LPC) is a measure of the number of bacteria that can survive after the pasteurization process of 143˚F for 30 minutes. This test is not regulated but milk processors use the LPC to assess milk quality. An LPC over 100 cfu/ml is considered high while an LPC of less than 10 cfu/ml is considered excellent. Faulty milking equipment such as worn out parts, cracked or worn rubber gaskets, worn out inflations, and cleaning problems are often the culprit of a high LPC. The bacteria that survive are termed thermodurics since they create a protective form called a spore that is resistant to heat and sanitization. The spores will grow and multiply, reducing the quality of the finished product.

Coliform Count

The Coliform Count (CC) is a reflection of cow cleanliness. Milk samples are plated in a special growth media that is incubated for 48 hours at 32˚F after which the colonies are counted. A CC over 100 cfu/ml is considered high while less than 10 cfu/ml is considered excellent. A high CC is suggestive of poor milking practices, dirty equipment or contaminated water. If counts continue to run in the high range, milking practices and cleaning practices should be evaluated.

Summary

Milk quality begins at the farm. The goal is to minimize the number of bacteria entering the milk tank. This is accomplished by providing a clean stress free environment for the cow. Proper cleaning of the cow and the milking system are imperative to achieving low test counts. The ability to cool the milk rapidly after harvest is another key to reducing bacterial growth. By placing a greater emphasis on management strategies to reduce bacteria contamination, higher quality milk will be produced. Most of the strategies are easy to implement and do not incur added cost. On the other hand, some high counts may be attributed to poor sampling techniques, improper sample storage or negligence – be sure to follow up with the proper

individuals if you are concerned about any unusually high counts. Consumers increasingly demand a higher quality product and milk quality standards are a necessity for a safe, wholesome dairy product.
So take the time to evaluate your test counts and employ techniques to insure that milk stays nature's perfect food.

References are available upon request.

Strategies to Improve Energy Metabolism in Fresh Cows

This article is being republished with the approval of Dairy Business East

Study examines feeding strategies to increase fresh cow liver glucose output.

By Maris M. McCarthy, Gerald D. Mechor and Thomas Overton

Many metabolic disorders that occur after calving result from not enough energy intake in the first weeks after calving. During this period, dry matter intake (DMI) isn't sufficient to support the high milk production demands of early lactation and leads to a state of negative energy balance (EB). This negative EB results in increased release of nonesterified fatty acids (NEFA) from body fat stores into circulation to be metabolized by the liver. Higher energy intake after calving generally results in lower circulating NEFA and is associated with improved health, performance and less severe postpartum negative EB.

The fresh cow needs to make glucose

The fermentation of starch in the rumen results in the production of propionate, which is the main substrate used to make glucose in the liver. Maintaining a continuous supply of glucose, especially in early lactation, is important for making milk lactose in the mammary gland. Lactose is an important osmoregulator and is highly correlated with milk yield, so if the amount of glucose that the cow has available for making lactose is increased, she should be able to increase early lactation milk yield, and get off to a better start in lactation. Monensin supplementation increases ruminal propionate, and cows fed higher energy diets after calving and/or monensin during the transition period have improvements in both milk production and postcalving energy metabolism.

It appears that in early lactation, when propionate supply to the liver is increased, the liver is more likely to convert that propionate to glucose rather than oxidize it to supply energy for the liver. Animal non-structural carbohydrate intake (mostly starch) in the immediate postcalving period is positively correlated with the efficiency of in vitro propionate conversion to glucose in liver biopsy slice experiments.Together, this suggests that the liver has the capacity to direct additional propionate supply to make glucose during the early lactation period.

More glucose, less negative energy balance

The plasma metabolites NEFA and beta-hydroxybutyrate (BHBA) can be used as markers of negative EB. Allen and co-workers at Michigan State suggest that feeding dairy cows diets that increase ruminal propionate production (e.g., diets high in fermentable starch, monensin supplementation) immediately after calving reduces postpartum feed intake, leading to greater risk of negative EB (e.g. elevated NEFA and BHBA). However, propionate use demand for glucose synthesis elevates during the postcalving period. Liver energy requirements also increase dramatically at the onset of lactation and NEFA mobilization increases. Thus, the intake-reducing effect of propionate is likely to be much less in early lactation than at other stages of lactation because of the large increases in liver energy demands and the increase in NEFA supply with the onset of lactation. However, the effect of propiogenic early lactation diets on energy metabolism are not well studied, which was the impetus for this research.

The research

The objectives of this study were to evaluate the effect of dietary starch content during the immediate postpartum period and transition period monensin inclusion in diets of differing starch levels on:

1. plasma markers of energy metabolism
2. in vitro hepatic gluconeogenesis

We hypothesized that increasing starch level and/or feeding monensin during the immediate postpartum period would increase liver gluconeogenesis as well as improve measures of energy metabolism, and that the effects of monensin on metabolism would be independent of dietary starch level in the postcalving diet.

Heifers (n = 21) and multiparous (n = 49) Holstein cows were fed a high starch (HS; 26.2% starch, 34.3% NDF, 22.7% ADF, 15.5% CP) or low starch (LS; 21.5% starch, 36.9% NDF, 25.2% ADF, 15.4% CP) TMR beginning at calving until three weeks (wk) after calving with a topdress pellet containing either 0 (Con) or 450 mg/d monensin (M) in a completely randomized design with a 2 × 2 factorial arrangement of treatments. Prior to calving, all cows were fed a common controlled-energy diet with daily topdress of either 0 or 400 mg/d M consistent with postpartum M treatment. From week four through nine post calving, all cows were fed HS and continued with assigned topdress treatment until d 63.

The results

Cows fed HS had higher plasma glucose and insulin and lower NEFA than cows fed LS during week one to three postcalving. Cows fed HS had lower BHBA during wk two and three after calving compared to cows fed LS (Figure 1).

Cows fed M had higher plasma glucose compared to Con cows, which was driven by a M × parity interaction, in which primiparous cows fed M had greater plasma glucose concentrations than Con. Cows fed M had lower plasma BHBA compared to Con (Figure 2), which was contributed to by a M × parity interaction in which primiparous cows fed M had lower BHBA concentrations than Con.

There was no effect of starch or M treatment on liver capacity to oxidize propionate to CO_2 in vitro, and effects of starch on gluconeogenesis were not significant. Cows fed M tended to have greater capacity to convert propionate to glucose than Con. The ratio of the rates of conversion of radiolabeled propionate to glucose and CO_2 provide an index of the efficiency of propionate utilization for gluconeogenesis. Monensin supplementation increased the ratio of glucose to CO_2 (Figure 3), which indicated that cows fed M had a greater propensity to convert propionate to glucose.

Take home messages

- Cows fed higher starch rations and monensin had higher plasma glucose concentrations and less negative EB.
- Cows fed monensin had an increased ratio of glucose to CO_2 in early lactation, indicating that they had an increased ability to convert propionate to glucose.

Overall, feeding higher starch diets (26 to 28%) and monensin should increase the cow's ability to make glucose in the liver and improve her energy status after calving. These improvements in energy status should get her off to a better, more productive start to lactation.

Maris McCarthy is a Ph.D. student and **Dr. Thomas Overton** is a Professor of Dairy Management in the Department of Animal Science at Cornell. **Dr. Gerald Mechor** is a Senior Dairy Technical Consultant with Elanco Animal Health.

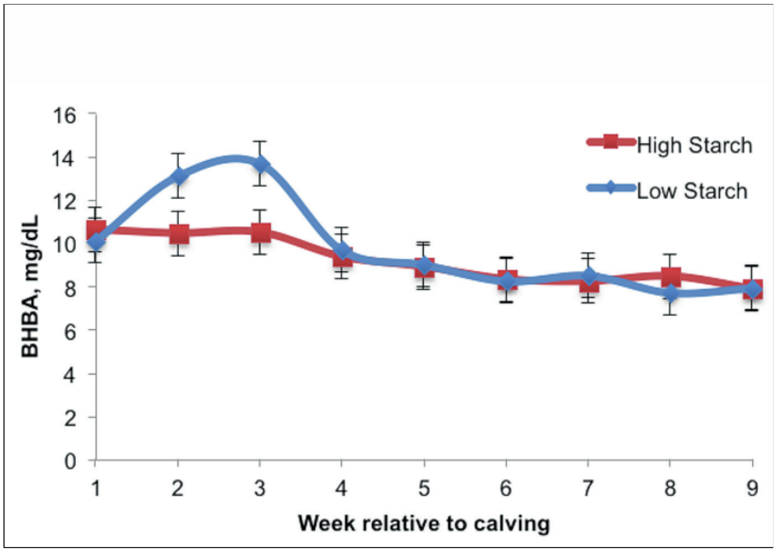

Figure 1. *Feeding early lactation diets with higher starch (26.2%) in the first 3 weeks after calving decreased plasma BHBA concentration compared to cows fed a lower starch diet (21.5%). All animals were fed the higher starch (26.2%) diet from weeks 4 through 9.*

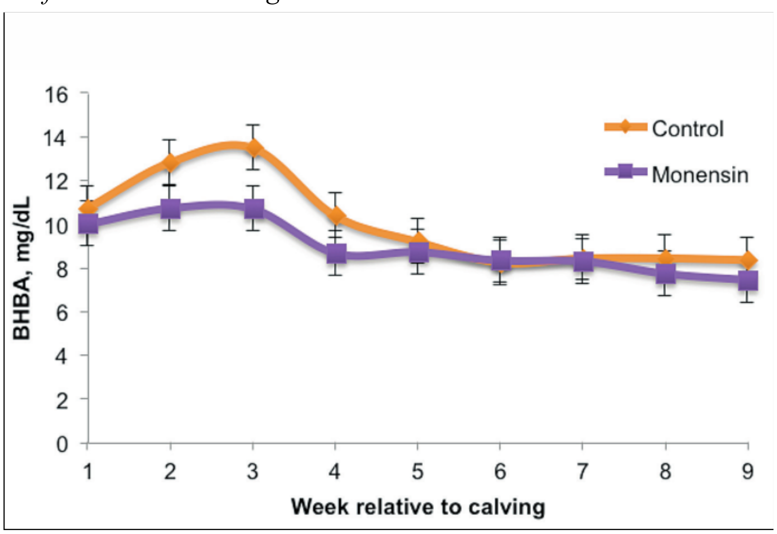

Figure 2. *Feeding monensin through the transition period decreased postcalving plasma BHBA concentration compared to Control cows.*

Iodine: Are you forgetting a key trace mineral?

By Daryl Kleinschmit, Ph.D.
Zinpro Corporation
dkleinschmit@zinpro.com

Reprinted by permission of Dairy Herd Management

When thinking about the trace minerals needed in a dairy herd's diet, the focus is often on zinc, manganese, copper, cobalt or selenium. Meanwhile, an important mineral – iodine – goes relatively overlooked. Iodine plays a key role in dairy cattle energy metabolism and immunity, impacting overall performance. It's also important to recognize that iodine has potential to be either under or over fortified in diets.

Functions of iodine

We know iodine is necessary in human diets – so necessary that iodized table salt is found on kitchen tables everywhere. In cows, iodine is necessary for the production of thyroid-produced hormones essential for metabolic rate regulation, as well as cell differentiation, growth and development in growing animals. Iodine also plays a role in various immune system functions, including movement of immune cells to the site of injury or attack, consumption of bacteria by immune cells and bacteria killing ability. Historically, iodine has been effective in controlling foot rot in feedlot cattle, and it may also have a role in controlling digital dermatitis in both dairy and beef cattle. Foot rot and digital dermatitis are two common infectious claw lesions.

Common signs of subclinical iodine deficiency in breeding females include suppressed estrus, reproductive failure, abortion, stillbirth, increased incidence of retained placenta and longer gestation periods.

Requirements and legal limits

The NRC (2001) guideline is an iodine dietary concentration of 0.5 ppm [dry matter (DM) basis], or about 12 mg/ head/day for a 1,500-lb. cow, milking 77 lbs./day and eating approximately 52 lbs. DM/day. This guideline was established to achieve normal animal performance levels when consuming diets low in antagonists and under minimal stress.

In addition, goitrogenic compounds found in some common feedstuffs – such as canola, raw soybeans, turnips and nitrates – reduce iodine uptake.

Thus, the amount of iodine recommended by the NRC (2001) may be insufficient to achieve optimal enzyme functions and animal growth, immunity and performance. Depending on dairy herd stressors and rations, supplementing dairy cattle diets with 0.7 to 1.1 ppm (DM basis) iodine, depending on lactation stage, is frequently recommended.

Milk iodine levels

It is important to note that the National Dairy Council has an established maximum milk iodine level of 500 ppb. If milk iodine levels exceed this limit, the milk is considered adulterated and is unsalable.
Iodine transfer from blood into milk is very efficient, especially when supplemented in the form of ethylenediamine dihydroiodide (EDDI). The U.S. Food & Drug Administration has established a maximum limit of 49.9 mg of EDDI/day due to its high transfer efficiency into both tissue and milk compared to inorganic iodine sources.
Providing more than 1.3 ppm (DM basis) supplemental iodine in lactating dairy diets, especially when combined with improper use of iodine teat dips, sprays or backwash systems, may result in excess levels of iodine in milk (> 500 ppb). Other factors that may impact milk iodine levels include milk yield (dilution), total iodine intake and the presence of goitrogenic compounds.

With this in mind, it is recommended that producers perform periodic testing of iodine levels in milk tank samples, especially when feeding a significant amount (> 10% DM basis) of canola meal, using iodine-based teat dips or feeding diets to lactating cows containing more than 1.3 ppm iodine. This will aid in evaluating optimal iodine fortification for an individual herd.

- Iodine plays a key role in dairy cattle energy metabolism and immunity.
- Iodine's ability to enhance immunity has been shown to be effective in controlling foot rot.
- Goitrogenic compounds found in some common feedstuffs – such as canola, raw soybeans, turnips and
- nitrates – reduce iodine uptake.
- Milk with iodine levels exceeding 500 ppb is considered adulterated and is unsalable.

For more information on iodine and its impact on dairy herd health, go to www.zinpro.com or talk with your nutritionist.

Daryl Klenschmidt and Maris McCarthy are former University of Delaware Graduate Assistants. Daryl worked in Limin Kung's lab studying the effect of Lactobacillus buchneri on the fermentation and aerobic stability of corn silage. Maris evaluated the effect of adding exogenous amylase on production and diet digestibility in dairy cows while working in Tayna Gressley's lab.

Thank you to the 2015 Delmarva Dairy Day Sponsors and Exhibitors

Animal Medic
Balchem
Cargill
Central Life Sciences
Chemgro Seeds
Clark Seeds, Inc.
Dairy One Cooperative, Inc.
David Szelestei Hoof Care
Delmarva Feed & Farm Service
Frey Bros. Inc.
Growmark FS, LLC
King Crop Insurance, Inc.
Lancaster Farming
Land O'Lakes
Maryland-Delaware Forage Council
Meyer Manufacturing
Mid-Atlantic Dairy Association
Mid-Atlantic Farm Credit
Mycogen Seeds
Natural Way Feeds
Papillon Agriculture Co.
Paradise Energy Solutions
Penn Jersey Products, Inc.
Renaissance Nutrition, Inc.
T.A. Seeds
USDA/NASS
USDA Rural Development

The 2015 Annual Delmarva Dairy Day Program was held in Hartly, Delaware a few weeks ago. We had a good turnout considering the early snow that fell that morning. We had almost 70 people in total attendance. The highlights of the program were talks by Dr. Pat Hoffman, Professor Emeritus, University of Wisconsin and Mr. Tom Kilcer, Advanced Ag Systems. The proceedings are currently posted on our web site. Of course, the Fire Hall folks provided another excellent meal and we finished off all of the UD black raspberry and peach ice cream leaving only a few scoops of cookies and cream!

Department of Animal & Food Sciences
Cooperative Extension
University of Delaware
Newark, DE 19716

Contacts:
Dan Severson, Agriculture Agent:
302 831-2506
severson@udel.edu

Limin Kung, Jr., Professor:
302 831 –2524
lksilage@udel.edu

We're on the Web!
Dairy Research - http://ag.udel.edu/dairy/index.html
Department of Anim. & Food Sci. - http://ag.udel.edu/anfs
http://extension.udel.edu/animalscienceblog/
UD Creamery - http://ag.udel.edu/creamery
Publications - http://ag.udel.edu/anfs/faculty/kung/Publications.htm

College of Agriculture and Natural Resources
Department of Animal and Food Sciences
531 S. College Avenue
044 Townsend Hall
Newark, DE 19716