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NUTRITION PLUS NEWSLETTER

DAIRY NUTRITION PLUS™

HOW MUCH DIETARY CALCIUM DO TRANSITION COWS REALLY NEED?

Depending on what you read, or who you listen to, recommendations for dietary calcium in the close-up diet ranges from as low as you can achieve with the forages you feed—generally about 0.5% of diet dry matter (DM)—to 2% of diet DM. That's a pretty wide range. And research has not yet identified the best level of dietary calcium to feed late-gestation cows in order to prepare them for lactation.

However, success has been achieved with negative DCAD diets across a wide range of dietary calcium intake, both in research and on farm. The research has demonstrated that a negative DCAD diet has a consistent and profound effect on calcium metabolism. But that same research also has failed to show that feeding different amounts of calcium has much impact on actual calcium metabolism, or positive impact on transition cow health or milk production. With that in mind, "the amount of calcium in negative DCAD diets may be one of the least important factors for success" explains Tim Brown, director of technical support for SoyChlor. "At a time when intake is depressed and every bite a cows take needs to be nutrient dense, do you really want to waste ration space on limestone if it isn't necessary, if it doesn't benefit the cow?"

CALCIUM HOMEOSTASIS AND CALCIUM FLUX

For the sake of simplicity, calcium homeostasis refers to the body's quest to maintain blood calcium levels within a certain range, roughly between 8 and 9 mg/dl for cows. Calcium flux refers to the movement of calcium into and out of the blood. With non-acidified dry cows (no anionic supplement or salts), the metabolic calcium demand is very low, so too is calcium flux. When the cow suddenly starts making colostrum, calcium demand spikes and the mammary gland pulls the calcium it needs from the blood.

Calcium flux does begin to ramp up in order to meet the increased demand and restore calcium homeostasis, but because metabolic demand was so low before, there is a lag in response time. Homeostasis is lost and hypocalcemia results.

But when dry cows are fed a negative DCAD diet, the resulting mild metabolic acidosis increases calcium flux even before colostrum production begins. With calcium flux activated, extra calcium is already being mobilized from storage sites in bone or possibly being absorbed from the digestive track. If the extra calcium entering the blood pushes the upper boundary of homeostasis, the kidneys remove the extra calcium and excrete it in urine. Consequently, urinary calcium excretion increases when cows are fed a negative DCAD diet.

The result of increased calcium flux is that the mammary gland's rapid extraction of calcium from the blood as calving approaches doesn't deplete blood calcium as badly. Having the cow's metabolic machinery already activated means there is less lag time in response. The cow is less likely to develop hypocalcemia at calving, and hypocalcemia that does develop may be less severe, and/or persist for a shorter time.

A meta-analysis by Santos et al. (2019) reviewed years of research and found that cows that are metabolically acidified during the last 21-days of gestation have reduced incidence of milk fever, subclinical hypocalcemia, retained placenta and metritis. In addition, in multiparous cows, feeding negative DCAD diets prepartum also increased milk production and fat-corrected milk. The researchers concluded that negative DCAD diets work, but that manipulating dietary calcium content had little or no effect on health or performance of metabolically acidified cows.

continued on page 2

IN THIS **ISSUE**

continued from page 1

HOW MUCH DIETARY CALCIUM DO TRANSITION COWS REALLY NEED?

UNDERSTANDING CALCIUM RESEARCH

When evaluating research where differing levels of dietary calcium have been used in prepartum diets, you have to look at more than just the amount of calcium in the diet. You also have to take into account the metabolic acid-base status of the cows. When it comes to calcium metabolism, metabolically acidified and metabolically alkalotic cows are two totally different animals, explains Brown. Data obtained with alkalotic cows is rarely applicable to acidified cows, and vice versa.

Several recent studies have used cows fed negative DCAD diets with differing levels of dietary calcium. This removes one variable—alkalotic vs acidotic cows. Melendez and Poock (2017) reported that blood total calcium level within 24 hours after calving was the same (2.11 mM/l) for metabolically-acidified cows fed a diet with either 0.94% or 1.3% calcium. Diehl et al. (2018) concluded that feeding diets with 1.8% calcium increased blood ionized calcium (8.1 vs. 7.5 mg/dL, respectively) only on day 1 post calving compared to feeding diets with 1.3% calcium. Cows fed the diet with more calcium also consumed less feed prepartum, and produced lower quality colostrum. Lean et al. (2019) analyzed previously published literature and concluded that "the lower-DCAD diets markedly reduced the risks of clinical hypocalcemia, retained placenta, metritis, and overall disease in the periparturient period. There was no evidence to support a particular level of Ca intake."

Glosson et al. (2018a) reported no difference in blood ionized calcium (iCa) of cows fed a negative DCAD diet (urine pH 5.7) with either 0.4 or 2.0% dietary calcium. Actual calcium intakes averaged 44 grams/day and 226 grams/day for the low-calcium and high-calcium diets, respectively. In the same trial, Glosson et al. (2018b) also measured the amount of calcium excreted in the urine. Cows fed the higher-calcium diet excreted more calcium in the urine (13.4 grams/day compared to 8.4 grams/day) than cows fed the low-calcium diet. This is one of only a few reports of increased urinary calcium excretion, an indicator of increased calcium flux, being related to dietary calcium level. Despite the extreme difference in calcium intake, no differences in immune function or milk production were found.

Goff & Koszewski (2018) fed negative DCAD diets with either 0.46 or 0.72% calcium in the diet DM. They also fed a positive DCAD diet with 0.46% calcium. Cows fed the negative DCAD diets had higher blood total calcium on day of calving than cows fed the positive DCAD diet, but the amount of dietary Ca did not affect blood calcium concentrations of these moderately acidified cows.

So, given this new research, why do some still recommend supplementing cows with extreme amounts of calcium in the diet? Currently there is little or no scientific evidence that the amount of dietary calcium affects transition cow health or performance. Perhaps future research may reveal otherwise, but until then, it is safe and practical to stick with what delivers proven results—a negative DCAD diet with a moderate amount of calcium.

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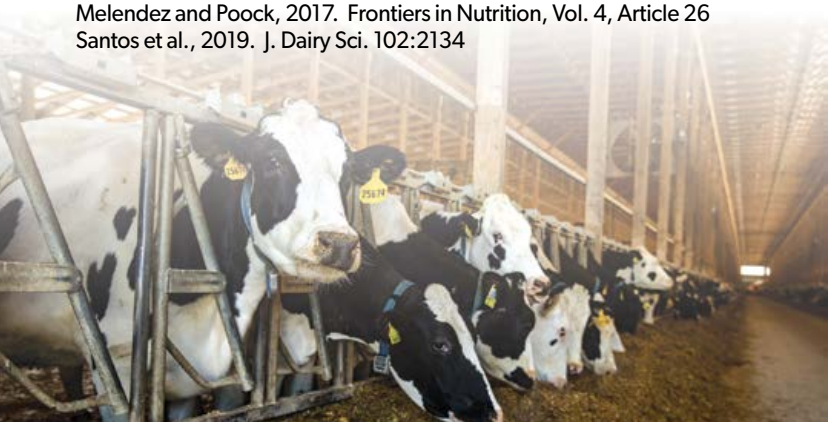


FROM THE MATERNITY PEN

Prepartum Nutritional Demands

If you want cows to have a healthy transition, breed back quickly and produce a lot of milk you have to get prepartum nutrition right. On average, 30 to 35% of transition cows are affected by disease within the first 3 weeks of lactation, Ribeiro et al. (2016). And if cows lose 1 unit or more of body condition from calving to 65 days in milk they are much less likely to become pregnant at first service, Santos et al. (2009) Anim. Reprod.Sci.

Recent research has sought to better define the nutritional needs of prepartum cows—for health, reproduction and milk production. José Santos, professor of animal sciences at the University of Florida, outlined the following guidelines for prepartum nutrition at the Florida Dairy Production Conference in September.

- All cows should receive a specialized prepartum diet during the last 21 days before calving.
- Prepartum cows need approximately 17 Mcal of net energy for lactation/day (a diet with 1.45 Mcal/kg or 0.66 Mcal/lb) to meet the needs for maintenance, fetal growth, and some tissue deposition.
- Supplement rumen-protected choline pre- and early postpartum (at least 13 grams of choline ion).
- Formulate prepartum diets with a DCAD of about -100 mEq/kg for parous cows. Research has not yet determined if nulliparous cows benefit from acidogenic diets or the level of DCAD needed.
- While the recommendation for metabolizable protein (MP) has been 1,100 to 1,300 grams/day for all close-up cows, a new meta-analysis by Husnain and Santos (2019) showed the protein needs of parous and nulliparous cows differ. Nulliparous cows need at least 1,100 grams/day (2.4 lbs/day) of MP which can be achieved with 14 to 15% crude protein in the diet. Parous cows only need 800 to 900 g/day (2 lbs/day) of MP which can be achieved with 12 to 13% CP.
- Formulate prepartum diets using 70 to 75% forage, 45 to 50% NDF, 15 to 18% starch, 25 to 30% NFC and 3% fatty acids.
- In the last 21 days of gestation, prepartum nulliparous cows are expected to eat approximately 24 lbs of dry matter (DM) daily, whereas multiparous cows typically average 27.5 lbs of DM daily.
- In early lactation, supplement fatty acids to improve fertility at 1 to 1.5% diet DM, such that the final diet contains no more than 3 to 4% total fatty acids. Effects will differ with the source of fatty acid fed. Fat sources rich in omega-6 and omega-3 fatty acids seem to be the most bioactive to improve fertility, but they might also increase the risk of milk fat depression. Provide sufficient forage NDF to avoid issues with milk fat depression and maintain rumen health.

CONSULTANTS CORNER

Cost of Transition Cow Disease is More Than You Realize

MICHAEL OVERTON
Elanco Animal Health

During the transition period dairy cows seem to walk a tight rope between disease and a healthy transition. While continued research has improved our understanding of cows' nutritional needs and of how best to manage them, we still routinely see cows that just don't transition as well as expected. But unless a cow shows clinical signs of disease and receives treatment, she's probably not recorded in the farm records.

Not tracking disease because it didn't warrant treatment makes it very difficult to get an accurate picture of clinical and subclinical disease rates in your transition cows. That also means you probably don't have a good handle on the actual cost of disease on your farm—lost milk production, reduced reproductive performance, increased involuntary culling, morbidity, mortality and treatment. The total cost is greater than most producers realize.

Clinical disease that gets treated and reported in herd records is just a small part of the overall disease picture. Subclinical ketosis and subclinical hypocalcemia routinely impact cows, but rarely gets recorded. Using just subclinical hypocalcemia as an example, research has repeatedly shown incidence rates ranging from 50 to 80% in multiparous cows. And according to Rodriguez et al. (2017), subclinical hypocalcemia increases the odds that cows will develop displaced abomasum, ketosis, metritis and retained placenta. Accurately recording disease occurrence, even when it is mild and doesn't warrant treatment, is critical in order to understand the financial impact of disease on the dairy.

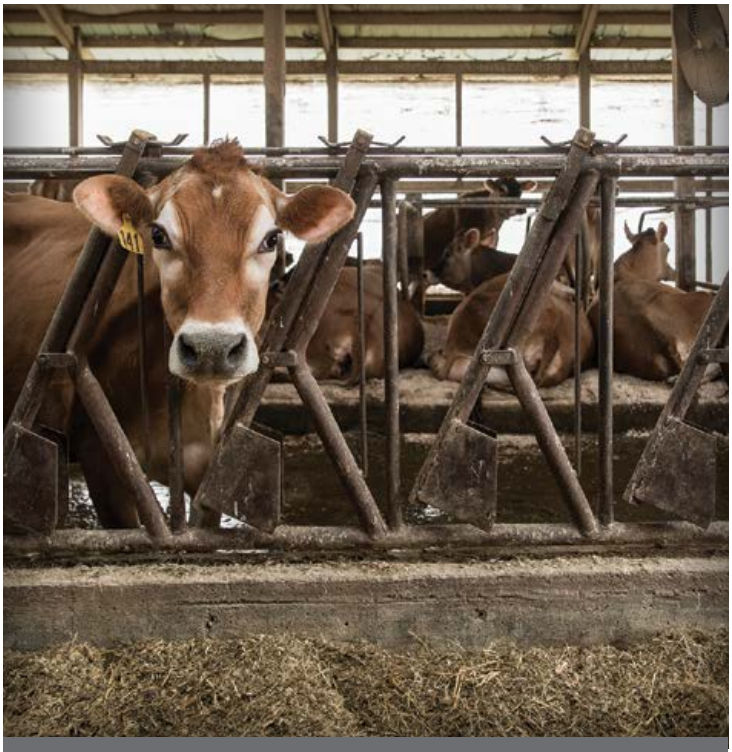
Take for example a study we conducted on a dairy that does an excellent job of recording metritis incidence and severity (McCarthy & Overton 2018). A case of mild metritis was associated with 847 fewer pounds of milk (2nd test 305-day mature equivalent) and a case of severe metritis was associated with 1,867 fewer pounds of milk (2nd305-dME) compared to healthy herd mates. There were 3,277 cows in the study and incidence rates of mild and severe metritis were 24.7% and 3.5% respectively. Milk production losses totaled 898,826 lbs for one lactation or $110,427.

Using this data we then calculated the impact of misclassification where 45% of mild cases were recorded as having no disease. Records now showed that total milk production losses from metritis were only $61,568. That means $48,859 in actual milk production losses were not accounted for by the records due to underreporting of disease. If none of the mild cases were reported, the amount of milk losses that are unaccounted for climbs to $89,426. As you can see, it's hard to make good decisions when you don't have an accurate assessment of disease and its cost.

This example is for just metritis. But it demonstrates that accurate disease records are extremely valuable. They help us quantify the cost of disease, monitor for improvement after a change and work toward healthier transitions. The cost of both clinical and subclinical disease is higher than you might imagine. That means there is a huge opportunity for most dairies to improve performance and profitability by simply improving disease detection, recording disease information including mild cases, and using those records to get a clear picture of disease incidence and make decisions to improve.

To learn more, go to http://fourstatedairy.org/proceedings/19_4state_proceedings.pdf

Scroll to page 65 of the proceedings pdf to find my presentation *"The Impact of Transition Cow Disease: Why Its Greater Than We Realize."*



BEYOND BYPASS

RPM Supplementation Decreases Culling During First 60 Days In Milk

While the benefits of feeding rumen-protected methionine (RPM) have been well–documented, new research presented at the ADSA meeting this summer, revealed yet another benefit to feeding RPM to prepartum cows—a significantly lower involuntary culling rate during the first 60 days in milk.

Brazilian researchers compared the performance of 166 Holstein cows all individually fed a control diet or the control diet plus RPM through 60 DIM. Starting at 21-days prepartum, half of the cows received RPM top-dressed at a rate of 8 grams/cow/day. After calving the supplementation rate was increased to 15 grams/cow/day with a lysine to methionine ratio of 2.81:1. At 16 days postpartum all cows, including control cows that were not supplemented before, were fed 15 grams/cow/day of RPM for the duration of the study. Researchers tracked milk yield and components, as well as the incidence of retained placenta, ketosis, mastitis, hypocalcemia, metritis and pneumonia to determine mortality and morbidity during the first 60 days in milk.

Results showed that milk yield, energy-corrected milk, and milk protein did not differ between treatments. Morbidity rates between treatment and control groups were similar. But there was a big difference in the culling rate between RPM-supplemented cows and control cows. The RPM-supplemented cows had much lower involuntary culling rates during the first 60 days in milk—2.41% vs. 12.05%. In a 1,000 cow dairy, that's a difference of culling just 24 cows instead of 120 cows in the first 60 days in milk. RPM supplemented cows also tended to produce more milk fat (4.40% vs. 4.07%). For more information, please see ADSA Abstract #T171.

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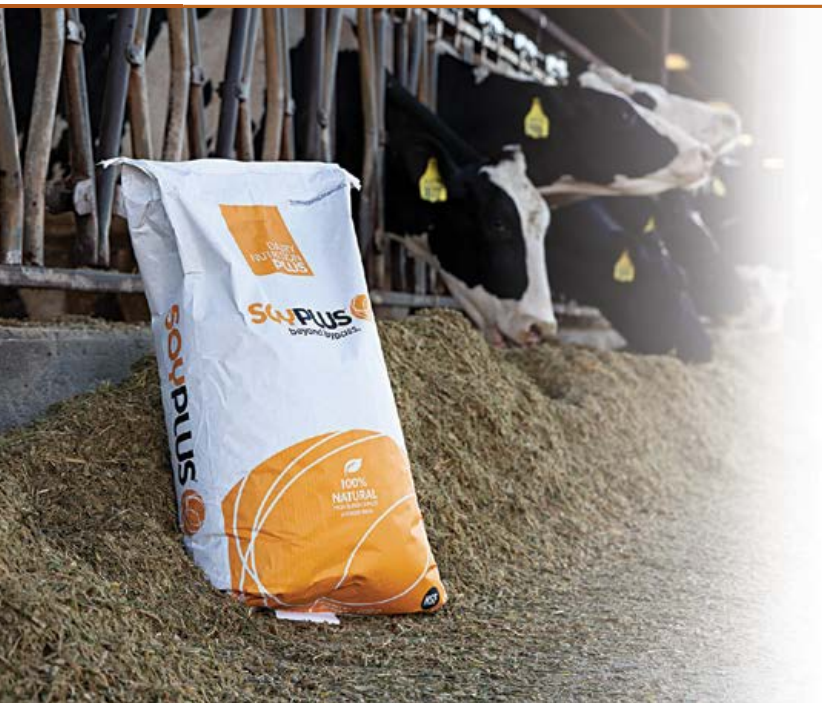

HAPPENINGS

New Research Relies on SoyPlus to Deliver Ideal Protein Profile

New research published in the January *Journal of Dairy Science* utilized SoyPlus to develop a dairy ration with an ideal protein profile. Researchers from South Dakota State University studied the potential impact of feeding phytochemicals as an alternative method of protecting dietary protein from ruminal degradability. They compared performance of a ration containing soybean meal and a mixture of phytochemicals with a ration containing the long-trusted SoyPlus. The SoyPlus diet allowed researchers to feed lower total crude protein while still achieving similar performance compared to higher total crude protein in the phytochemical diet (Grazziontin et al., 2020). Read the full paper here https://doi.org/10.3168/jds.2019-16996

Adequate supply of both CP and MP to meet the requirements of high performing cows can significantly improve the economic return of the herd, and feeding a quality bypass protein will deliver more value for less total protein. For more than 30 years SoyPlus has been recognized as the gold standard in bypass protein for its quality and consistency. It's been used in more than 180 peer-reviewed research trials as a trusted ingredient to test new concepts in protein nutrition.