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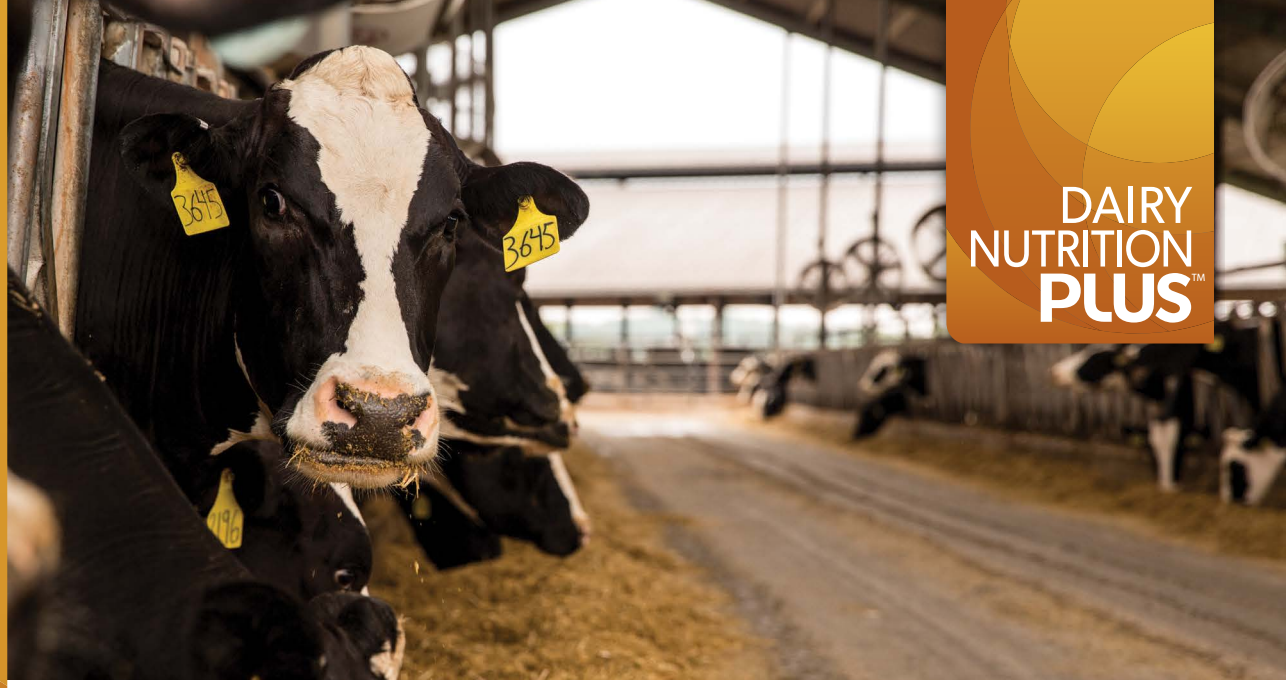

DAIRY NUTRITION PLUS™

"GOLDILOCKS" DIET STILL JUST RIGHT FOR DRY COWS

When it comes to feeding dry cows, several different strategies have been tried over the years. But during the last 10 years, controlled-energy diets, also called the "Goldilocks" diet, have proven to deliver consistent and beneficial results.

When University of Illinois researchers first reported the benefits of feeding a controlled-energy diet to dry cows, it was met with a great deal of skepticism, says James Drackley, professor of dairy nutrition at the University of Illinois. Today, dry cows around the world are fed controlled-energy diets with considerable success.

"The foundation of this approach is that dry cows and close-up cows should be fed to meet their requirements for energy, without underfeeding or allowing cows to consume an excess of energy. By using bulky, low-energy forages to dilute higher energy corn silage, cows can still consume feed ad libitum and eat to a maximum as defined by rumen fill," explains Drackley. Research has shown that when dry cows and close-up cows overconsume energy, it is counterproductive to trouble-free transitions.

The simplest and most easily defended principle of nutrition for dry cows is to feed to meet, but not greatly exceed, NRC requirements (Drackley and Dann 2008). Numerous research trials have demonstrated that feeding dry cows a controlled-energy diet leads to better transition outcomes.

In contrast, cows fed a moderate-energy diet (1.50 to 1.60 Mcal NE_L/kg of DM) consume about 40 to 80% more energy than required (Dann et al., 2005, 2006; Douglas et al., 2006; Janovick and Drackley, 2010). No evidence indicates that extra energy intake during the dry period is beneficial in any way, says Drackley. Instead, negative results have been observed. Lower dry matter intakes after calving, slower starts in milk production, higher levels of non-esterified fatty acids (NEFA) in blood and higher levels of triglycerides in the liver after calving are all negative impacts that can occur when dry cows are overfed energy.

When cows consume more energy than needed it must be dissipated as heat or stored as fat. Illinois research shows that while cows that were moderately overfed energy may not become noticeably over-conditioned, they often encounter the same health problems as overly fat cows.

In addition, cows moderately overfed energy deposit more of that fat in their belly area (Drackley et al., 2014). This visceral adipose tissue releases NEFA and signaling molecules that go directly to the liver (Ji et al., 2014). This in turn may cause fatty liver, subclinical ketosis and other secondary problems with liver function. "The mechanisms we have been studying in dry cows are similar to the mechanisms for disease in humans which leads to obesity, type II diabetes and insulin resistance," explains Drackley.

BENEFITS OF THE GOLDILOCKS DIET

Formulate controlled-energy diets to deliver 1.30 to 1.38 Mcal NE_L/kg DM. Rations that are low-energy, high fiber allow cows to eat to their fill without greatly exceeding their energy requirements. Research at Illinois combined with observations in the field show that feeding low-energy, high-bulk total mixed rations to dry cows can virtually eliminate the occurrence of displaced abomasums and provide a marked reduction in BHBA concentrations during the early postpartum period. In addition, field survey data from 27,000 cows in the United Kingdom, Ireland, France and Sweden showed dry cows fed a controlled-energy diet had fewer assisted calvings and had decreased incidence of milk fevers, retained placentas, displaced abomasums and ketosis (Colman et al., 2011). Their results also showed improved reproductive performance.

While the data is limited, it appears that milk production for cows fed controlled-energy diets is similar to dry cows fed higher-energy close-up diets. Field results from producers indicate that cows fed controlled-energy diets may have greater lactation persistency, but slightly lower peaks. So when evaluating a change to dry cow rations, look at total lactation milk yield, daily milk and persistency of lactation, not just peak milk.

Reproduction is another area where controlled-energy diets provide benefits. Research by Cardoso et al., 2013; showed that overfeeding energy during late pregnancy does not improve milk production, increases the risk of metabolic disorders and hinders reproductive success.

Another benefit of controlled-energy diets is that dry matter intakes remain more constant as cows approach calving, and producers who prefer to use far off and close-up groups can feed essentially the same diet. If producers feed a negative

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dietary cation anion difference (DCAD) diet to close-up cows, all they have to do is add their chosen anionic product. And for dairies that utilize a shorter dry period or are smaller in size, one dry cow diet works well.

GETTING IT RIGHT

The optimal high-forage, low-energy dry cow diet should contain the primary forages fed in the lactation diet, but be diluted with straw or low-quality forage to achieve a lower energy density. This helps the rumen remain adapted to the types of ingredients that will be fed after calving but without the extra energy.

Controlled-energy rations generally contain roughly one-third of the dry matter (DM) as corn silage, one-third as chopped straw (wheat straw is preferred) and the remaining third split between some other hay or silage and a small amount of concentrate to meet protein, mineral and vitamin requirements. The NE_L requirement for a 1,500 lb. Holstein dry cow is between 14.5 and 15 Mcals per day (NRC 2001). The following are suggested guidelines for formulating controlled-energy diets for your dairy.

- DMI – 26.5 to 27.5 lbs./day.
- Energy Density – 1.30 to 1.38 Mcal NE_L/kg DM.
- Protein – 12 to 15% of DM as crude protein or >1,000 grams/day of metabolizable protein as predicted by NRC (2001) model or CNCPS Dairy Model. This generally requires addition of high RUP sources such as heat-treated soybean meal or blood meal.
- Amino Acids – Supplement with a lysine:methionine ratio of <3.1. Use rumen protected methionine.
- Starch – 12 to 16% of DM. If starch is poorly fermentable use the upper end of the range.
- Forage NDF – 40 to 50% of total DM, or 10 to 12 lbs./day (0.7 to 0.8% of body weight).
- Total Ration DM – 45 to 48% (add water if necessary to achieve).
- Vitamins and Minerals – Follow standard NRC guidelines.
- Rumensin – Include in the ration at 300 mg/d to help increase milk production.

Controlling energy intake is exciting for its potential to markedly improve health during the transition period, says Drackley. Provided that high-bulk, low-energy rations are formulated, mixed and delivered properly, results have been positive and consistent.

HAPPENINGS

Landus Cooperative Hosts Soy Dairy Study

Landus Cooperative partnered with the U.S. Soybean Export Council to host representatives from China's dairy industry with the U.S. Soy Bypass Dairy Mission in April. Dairy industry representatives traveled from China to learn about Landus Cooperative, local agriculture and dairy nutrition practices in the United States. This weeklong mission showcased the quality and care that go into growing Iowa soybeans and brought to light local growers' concerns regarding international trade uncertainties.

Dairy mission participants were introduced to local farmer and Landus Cooperative board member Craig Heineman on his central Iowa farm. He showcased the family history of his operation and detailed the evolution of farming practices as the farm has transitioned from one generation to the next. Heineman is just one of more than 6,000 farmer-members growing soybeans for Landus Cooperative. More than 40 percent of all soybeans grown for Landus Cooperative become SoyPlus.

The dairy mission took visitors beyond the farm to the next steps in the Landus Cooperative supply chain, first with a stop at a grain facility to see how incoming grain is handled and stored. They then learned how locally-grown soybeans are transformed into SoyPlus, a value-added dairy feed ingredient that can benefit dairy cows worldwide. The final stop on the supply chain tour was a dairy feeding SoyPlus and selling milk to area processors. Landus Cooperative farmers and employees were excited to showcase their local touch to a global audience with the important part they each play in the Landus Cooperative supply chain.

To learn more about the local touch and global reach of Landus Cooperative, visit blog.dairynutritionplus.com.

FROM THE MATERNITY PEN

Controlled-energy Diets Can Boost IgG

Ten years ago research on controlled-energy diets changed the way we feed dry cows. Benefits for the cow include lower postpartum concentrations of non-esterified fatty acids, fewer ketone bodies and less incidence of metabolic disease. But does this feeding strategy alter colostrum quality, too?

The answer is yes. Cornell University research, conducted by Sabine Mann, assistant professor, College of Veterinary Medicine, compared cows fed three different levels of energy prepartum. The controlled-energy group was fed a TMR to meet, but not greatly exceed, requirements. Cows in the high-energy group were fed at 150% of their energy requirement. And an intermediate group received the controlled-energy diet for the first 28 days after dry off and then was switched to a diet formulated at 125% of their energy needs until calving. All dry cow diets were formulated to deliver 1,280 g/d of metabolizable protein.

Results show that cows fed a controlled-energy diet for the entire dry period had the highest levels of immunoglobulin G (IgG) in colostrum. Controlled-energy cows produced colostrum with an IgG level of 96.1 g/L; compared to IgG levels of 72.4 g/L for cows fed a high-energy diet and 88.2 g/L for cows fed the intermediate energy diet. Colostrum yield was not significantly different between the groups: 13 lbs., 16 lbs. and 15.5 lbs. respectively (Mann et al., 2016a).

The researchers also noted differences in the insulin concentration, fat content, fat yield and the composition of fatty acids in colostrum. Cows that were overfed energy produced colostrum with higher concentrations of insulin, higher fat levels and higher levels of de novo fatty acids compared to controlled-energy cows. Prepartum diet does influence the composition and quality of colostrum produced. To read the full paper, go to: http://dx.doi.org/10.3168/jds.2015-9926.

CONSULTANTS CORNER

Hypocalcemia Prevention 101

JESSE GOFF
Iowa State University

Hypocalcemia—both clinical and subclinical—can easily be prevented. Yet according to Reinhardt et al., 2011, more than half of multiparous cows develop subclinical hypocalcemia (blood Ca <8.0 mg/dl) shortly after calving. We can do better. Prevention of hypocalcemia should be a primary goal for all transition-cow management and feeding programs. But first you must understand it.

Calcium homeostasis is primarily controlled by the parathyroid glands. When blood calcium declines, these glands secrete more parathyroid hormone (PTH) which triggers action in the bone cells and the kidneys. The bone cells release calcium. The kidneys reduce calcium losses through urine and boost production of a hormone made from vitamin D that instructs intestinal cells to enhance their absorption of calcium. Normally a small decline in blood calcium occurs at the onset of lactation and calcium homeostasis kicks into high gear and blood calcium levels return to normal in a few hours. When the system fails, problems can occur.

Research shows that preventing metabolic alkalosis, as triggered by close-up diets high in potassium, is key. In a study we conducted at USDA (Goff et al., 2014), late gestation cows were fed an alkalinizing diet (high DCAD) or an acidifying diet (low DCAD) and treated with synthetic exogenous PTH. Cows fed the alkalinizing diet had a poor response to the supplemental PTH; at 21 hours after PTH administration plasma calcium concentration was not significantly changed. Their kidneys did not produce as much of the hormone to enhance intestinal absorption of calcium and blood calcium did not rise as quickly. In comparison, cows fed an acidifying diet had a strong response to the supplemental PTH; at 6 hours after PTH administration cows showed a significant change in plasma calcium concentration and normal blood calcium levels were quickly restored.

In another study we discovered that hypomagnesemia can interfere with normal tissue response to PTH and inhibit the secretion of PTH by the parathyroid glands. Research has shown that boosting calcium levels is not the answer (Goff and Horst, 1997; Beede et al., 2001). In fact, when higher levels of dietary calcium were fed, dry matter intake declined. The degree of hypocalcemia experienced at calving and subsequent milk production were unaffected by diet calcium level.

PREVENTION STARTS HERE

When blood pH and electrolyte balance is normal, cellular functions occur freely. When diet alters the blood pH, cellular functions can experience interference. The difference between the number of cation and anion particles absorbed from the diet determines blood pH. That's why it's important to balance the dietary cation anion difference (DCAD) of prepartum diets.

For prepartum cows, research shows a negative DCAD that induces a slight metabolic acidosis works best. The slight metabolic acidosis restores tissue sensitivity to PTH and allows calcium homeostasis to proceed normally. Getting the minerals in the right balance can prevent milk fever, minimize subclinical hypocalcemia and help cows successfully transition into lactation. Listed below is my recommended mineral profile for close-up diets:

- Calcium concentration of 1% is optimal. Similar to lactating diet calcium.
- Magnesium concentration of 0.35 to 0.4%.
- Phosphorus level at 35 g/d or less improves calcium homeostasis.
- Sulfur must be kept above 0.22% but below 0.4%.
- Keep potassium as close to 1.0% of diet as possible.
- Feed chloride anions at 0.5% less than the concentration of K. For example, if K is 1.3%, feed 0.8% Cl. However, too much of traditional chloride salts will decrease intake. More palatable commercial anion supplements encourage intake and can counteract higher levels of K.
- Aim for a DCAD (Na + K) – (Cl + SO_4) of -50 to -150 mEq/kg.
- Check urine pH to make sure that acidification has occurred. During the last week of gestation, the average urine pH in Holsteins should be between 6.2-6.8 and in Jerseys it should be between 5.8-6.2.

BEYOND BYPASS

More Benefits from Feeding RPM

New research in the January 2018 *Journal of Dairy Science* indicates that feeding rumen-protected methionine (RPM) to transition cows may help improve immune function. RPM is a limiting amino acid that is often supplemented to dairy cows to improve milk protein production.

In the study, University of Illinois researchers used a rumen-protected source of methionine coated with an ethyl-cellulose film. Cows were fed the RPM supplement starting 28 days before expected calving date through 60 days in milk. The only difference in diet between controls and treated cows was the RPM supplementation. Plasma biomarkers of inflammation, oxidative stress and liver function were measured as well as the in vitro function of neutrophils and monocytes.

Examination of the biomarkers of inflammation showed that RPM-treated cows had higher levels of plasma albumin (negative acute-phase protein) and lower levels of haptoglobin (positive acute-phase protein). These changes indicate that RPM-supplemented cows had lower inflammatory response during the postpartum period. Similarly, the higher plasma concentration of cholesterol and paraoxonase after parturition indicate better liver function in the cows that received RPM. The biomarkers of oxidative stress indicate lower concentration of oxidants and higher concentration of antioxidants in RPM-supplemented cows, suggesting a less pronounced oxidative stress in those animals.

Although the in vitro function of monocytes was not affected by treatments, RPM-supply enhanced neutrophil phagocytosis and oxidative burst. Taken together, these results underscore the importance of methionine in the cows' response to fight possible infections around parturition.

This research indicates that feeding RPM may help transition cows mitigate oxidative stress and inflammation, as well as enhance liver and neutrophil function. To read the full study go to: http://doi.org/10.3168/jds.2017-13185.

For more information on RPM please see past articles from the Dairy Nutrition Plus newsletter. "Methionine and Choline Improve Immune Response" from the September 2017 issue and "The Facts About Choline and Methionine for Transition Cows" from the May 2017 issue. Both can be found at: http://www.dairynutritionplus.com/Press-Room/Nutrition-Plus-Newsletters.

LANDUS COOPERATIVE

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True Nutrition with BENITZ DAIRY

The Benitz family always strives to improve. That's why they introduced DCAD to their western Wisconsin dairy. "I knew the potential of our herd, but we weren't going to get there without doing more for our transition cows," said co-owner Tim Benitz. But when they tried an extreme approach to the nutritional practice, problems arose. "Being overly aggressive wasn't working. We were suddenly seeing lots of sick cows," said nutritionist Gary Drinkman. Over supplementation with anions led to over-acidification and unexplainable problems. So Tim and his father Jim tried a new approach with SoyChlor. "DCAD finally became fun," Jim said. Now they keep their cows more moderately acidified with pH levels around 6.2 – 6.5, and they monitor pH less often than their previous program required. Freshening issues have disappeared, and cows are taking off better at calving.

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