



PROTEIN AND AMINO ACID REQUIREMENTS FOR CLOSE-UP DRY COWS

In the last 20 years research has demonstrated how much dry cow nutrition can negatively affect cow health, milk production and reproduction. As a result, dry cow nutrition has evolved from management by neglect to diets that are tailored to prevent negative energy balance and the many metabolic problems that once plagued transition cows. Despite this transformation, there is still more that can be done to improve transition cow health and performance.

Metabolizable protein (MP) and amino acid supply are the new frontiers of close-up dry cow nutrition, says Robert Van Saun, extension veterinarian at Penn State University. Research to define the protein needs of transition cows is ongoing. But we now know that when formulating close up diets we must take into account the body protein that cows mobilize to support early lactation, the protein and amino acid needs of the growing fetus and the protein needed to maintain the cows' labile protein reserve.

Fetal Growth Requirements

More than 70% of fetal growth occurs in the last 60 to 70 days of pregnancy. This places the greatest nutritional burden of pregnancy on the close-up dry cow just weeks before parturition when feed intake can be highly variable. Current feeding models for pregnant cows are based on end points of calf birth weight and fetal composition; and they do not address the potential loss of maternal body protein to support fetal requirements. Additionally, current requirements do not account for mammary gland growth and development.

The mobilization of body tissue doesn't stop at parturition either. Research by van der Drift et al, 2012, showed that muscle mobilization occurred prepartum through four weeks postpartum for dry cows fed a diet containing 12.6% crude protein.

There is much interest and anecdotal evidence that suggest some benefit from feeding prepartum diets with a MP of 1,100 grams/day or more, explains Van Saun. This observed response may be due to an underestimation of the prepartum cows' MP requirements, or from providing an essential amino acid or acids that the diet lacks, or because it allows for adequate MP intake for cows with lower feed intake, or some combination of these factors.

Amino Acids

Lower milk protein content may signal inadequate dietary MP supply and a repartitioning of amino acids to support immune response or glucose production in the liver. In reviewing lactation performance across many herds I have found that cows with low milk true protein of <2.7% on first or second test day had lower first service to conception and lower overall conception risks. In contrast, cows consuming more MP prepartum, >1,350 g/d, had improved reproductive performance.

All cows experience a period of negative protein balance in early lactation that seems somewhat independent of prepartum protein feeding. However, research by Ji and Dann, 2013, shows that when tissue protein mobilization does occur the reservoir of labile protein used in early lactation may be compromised resulting in greater risk for impaired health, productive efficiency, and reproductive performance.

Today protein must be defined as MP and amino acid requirements. These are the actual building blocks needed by the cow for tissue protein synthesis, gluconeogenesis, and other metabolic mediators. So far research has shown benefits from adding methionine, lysine and histidine to the diet. There also may be other essential and non-

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essential amino acids that can benefit the transition cow. Most amino acid research done so far has focused on milk production and milk composition response in early to mid-lactation.

Defining Dry Cow Protein Needs

Given our current understanding of transition cow nutrition, we should formulate close-up dry cow diets in two stages. The first stage is feeding the rumen to generate microbial mass, a significant source of MP. The second stage is feeding the cow over and above what nutrients are not provided by the rumen outflow. The same way lactating cow diets are formulated.

In addition, the dry cows being fed must be better defined. Cow size, body condition score and the size of calf born must be considered to determine nutrient requirements. Expected birth weight can significantly influence nutritional requirements for the cow and must be accounted for. The biggest challenge will be in mixed groups of primiparous and multiparous cows. Obviously some animals may be overfed, but more importantly we want to minimize the number of cows that may be underfed, stresses Van Saun.

Another challenge is deciding the appropriate intake level. When we formulate a diet for a group's average intake, up to 50% of individuals in that group will consume less. Phillips et al, 2003, summarized prepartum intake

data for multiparous Holstein cows. The average DMI was 27.1 +/- 5.5 lbs/day for the last 21 days before calving. They found that 15% of cows had a DMI of less than 22 lbs/day. Because of this underfeeding, the researchers recommended that close-up diets should contain 1,300 to 1,400 g/d of MP as a safety factor to ensure adequate numbers of cows consume the desired 1,080 g/d of MP from the diet.

Observational performance on farms suggests that protein content and protein source in the close-up dry cow diet is a critical factor to ensure cows transition smoothly. To further improve transition cow health and performance, we must better define dry cows to improve dietary formulation. Adjust dietary MP content to account for variability in feed intake. The goal should be for all close-up dry cows to consume a minimum of 1,000 g/d of MP. And I recommend feeding a close-up diet that contains 90-100 g of MP per kg of dry matter to meet the MP needs of a greater proportion of the dry cows in the group.

Robert Van Saun presented the paper, "Protein and Amino Acid Requirements of the Close-up Dry Cow" at the Western Canadian Dairy Seminar. You can read it online at: <http://www.wcds.ca/proc/2016/Manuscripts/p%20301%20-%20314%20Van%20Saun.pdf>



BEYOND BYPASS

Histidine is Limiting Amino Acid

New research reported in the June issue of the *Journal of Dairy Science* confirms that histidine is a limiting amino acid in lactating dairy cows fed a diet slightly deficient in metabolizable protein (MP).

Lactating dairy cows only convert about 25% to 35% of dietary crude protein into milk protein and excrete the remaining nitrogen into manure, Chase et al, 2012. Changes in environmental regulations, consumer concerns and the need to feed an ever-growing world sustainably has led researchers to look for ways to decrease the amount of crude protein fed, and decrease N excretion without sacrificing milk production. Supplementing low-protein diets with specific amino acids (AA) is a promising strategy to counteract the negative effect that feeding diets deficient in MP can have on dairy cow productivity, explains Alex Hristov, professor of dairy nutrition at Penn State University. Methionine and lysine have already been identified as the two most limiting amino acids for milk protein production. However, the response has been inconsistent which suggests that another essential amino acid may be a limiting factor.

In this study, researchers examined the effects of supplementing a diet slightly deficient in MP with rumen protected methionine, rumen protected lysine, and rumen protected histidine each individually. They also examined the effect of supplementing a MP deficient diet with all three AA on cow

productivity. As expected, lactating cows fed a MP-deficient diet had decreased DMI, feed efficiency and yields of milk and milk components compared to cows fed a diet adequate in MP. Research results include:

- Cows fed a diet deficient in MP and supplemented with rumen protected histidine alone, or in combination with rumen-protected methionine and rumen-protected lysine had dry matter intakes similar to cows fed a diet adequate in MP (62.8 lbs/day vs. 63.9 lbs/day). Cows fed a diet deficient in MP without AA supplementation had a DMI of 61 lbs/day.
- Cows fed a diet deficient in MP and supplemented with all three AA together had higher milk protein (3.14% vs. 3.02%) than cows fed a diet with adequate MP.
- Cows fed a diet deficient in MP and supplemented with the three AA also had improved energy corrected milk (ECM) and ECM efficiency.
- The observed DMI, milk composition and plasma AA responses in this study confirmed that histidine is a limiting AA in cows fed a diet slightly deficient in MP.

You can read the full article "Effects of Rumen-Protected Methionine, Lysine and Histidine on Lactation Performance of Dairy Cows," in the June 2016 issue of *Journal of Dairy Science*.

TESTIMONIAL: MEET GODFREY DAIRY

When Godfrey Dairy owner Dave Clark got his start in the dairy business at 17 he had 40 cows. Now his Madison, GA dairy is milking 1,050 Holsteins. Herd manager Cuyler Johnson, who has worked with Clark for 22 years, attributes the dairy's ongoing success to hard work, common sense, and the drive to continually improve.

A lifetime spent around cows has taught Johnson and Clark the impact of good nutrition on the bottom line. And there's one thing they've come to accept as necessary to the ongoing success they've experienced: negative DCAD for close-up dry cows.

Nutritionist Barry Dye, of Elberton, GA, has been feeding SoyChlor in Godfrey Dairy's close-up rations for more than a decade now. Dye was first drawn to SoyChlor because in addition to being a palatable anionic supplement, it also contributed calcium and magnesium to the diet and did not contain the high levels of NPN found in other anionic supplements. He continued feeding SoyChlor because it worked, and it worked consistently.

"With SoyChlor we are able to keep cows eating and we can count on it to be dependable in titrating urine pHs the right way. It's pretty nice to deal with a product that gives you the confidence it's going to give the end result you're looking for. That, and it's palatable," Dye said.

Dye and Johnson have developed a consistent routine for monitoring urine pHs, measuring 10% of the eligible cows once a week with a pH meter. They measure midstream at the same time each week and shoot for maintaining a pH of approximately 6.2. Dye's top priority when feeding SoyChlor is to

eliminate milk fevers. Secondly, he is aiming to avoid all of the subclinical-hypocalcemia related issues. And the achievability of these goals is apparent in the success of Godfrey's well-managed herd.

The most noticeable and dramatic effect while feeding SoyChlor was a significant reduction in milk fever. The dairy has also enjoyed a very low rate of displaced abomasum, retained placentas, and metritis. And over the last four years they've gained 14-15 pounds of peak milk, while summit milk is up 10-12 pounds. Their cows are also able to get back into capacity to breed back well; their DH pregnancy rate is at 28 percent, creeping closer to their goal of 30 percent.

"We attribute much of these successes to solid transitions. We judge how well we do as a whole by how well we're doing in our pre-fresh and post-fresh pens," Dye said.

Over the years, Godfrey has tried twice to do without SoyChlor and reduce input costs by moving away from a negative DCAD program. But each time clinical milk fevers resulted within a couple of weeks, and Dye and Johnson knew that meant other costly problems were on the way. "When you talk about transition cows and all the stress and diseases, if you've got problems why wouldn't you try to do something about it," Johnson said.

"Every time we stopped feeding a DCAD ration we just couldn't make it work," Johnson said. "I hear people say they can't afford to implement a DCAD program, but I tell them you can't afford not to. When you're investing in your transition cows, you're investing in your future milk."



CONSULTANTS CORNER

Top 10 List for Healthy, Productive Transition Cows



BY THOMAS R. OVERTON
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Transition cow success is attainable.

In the last 10 to 15 years we have learned a lot about what transition cows need and how to meet those needs. But success doesn't come from just changing the diet. Success comes from paying attention to several non-nutritional factors, implementing monitoring programs, and meeting the cows' nutritional needs. It takes an intensity of management to pay attention to all of the small details. But producers who have committed to this approach have seen improvements in milk production and reproductive performance in the next lactation.

Based on the research available and my experience, I have developed a top 10 list of things to do for healthy and productive transition cows.

1. Manage macro mineral nutrition/DCAD for dry cows.

While clinical milk fever is rare on many farms, there is still a lot to be gained from preventing subclinical hypocalcemia and subclinical ketosis. Balancing transition cow diets for DCAD – especially during the last 2 to 3 weeks before calving – can help.

Talk with your nutritionist about implementing a dietary cation-anion difference (DCAD) diet for transition cows. The level of acidification you use will, in part, depend on the feeds available in your area, and the level of management available. When using partial DCAD, or full DCAD, always monitor urine pH weekly and adjust DCAD levels accordingly.

In addition, feed supplemental magnesium at ~ 0.45% and supplemental phosphorus at 0.35 to 0.42%. The research shows good consensus here.

2. Control energy intake in both the far-off and close-up cows.

- In the far-off diet, keep energy down. 0.59 to 0.63 Mcal/lb; 1.30 to 1.39 Mcal/kg of NEL; 110% to 120% of energy requirements. <13% starch.
- In the close-up diet use low to moderate energy. 0.64 to 0.66 Mcal/lb; 1.4 to 1.45 Mcal/kg of NEL; 110% to 130% of energy requirements; 16% - 18% starch.

3. Supply enough metabolizable protein before calving.

Focus pre-fresh protein supplementation on RUP sources with additional AA supplemented. The numbers listed below will vary a bit depending upon the ration model used. The key is to look at protein supply on a metabolizable protein basis and optimize amino acids starting before calving.

- Target 1,200 to 1,400 g/d MP.
- Lysine \geq 6.8 to 7.2% of MP.
- Methionine \geq 2.6 to 2.8% of MP.

4. Get feeding management right every day.

Too long of chop length of bulky forages and too low of moisture content are the most common problems found on farm. To minimize sorting, particle size of straw and hay should be < 1.5 inches. The moisture content of the TMR should be 46 to 48 DM %. If necessary, add water or other wet ingredients to hit that target.

5. Provide clean and comfortable housing and fresh water.

Whether in freestalls or open lots, cows need a clean, comfortable place to lie down and access to clean water. With headlocks the current recommendation on stocking density is 80%.

6. Manage social interactions/hierarchy.

Heifers need more time to access feed because they eat more slowly than cows. Ideally, work toward scenarios where heifers and cows are in separate groups both before and after calving. Try to minimize the number of pen moves as each move results in cows establishing a new social hierarchy; that means less time spent eating and resting.

7. Manage cold and heat stress.

The research continues to show the importance of cooling dry cows. Failure to use heat abatement strategies for dry cows results in lost milk production, smaller birth weight calves, and less milk production for the heifer calves in their first lactation.

8. Always use high quality forage and fermentable diets for fresh cows.

As long as physically effective fiber levels are sufficient, more fermentable diets increase feed intakes and improve energy status of early lactation cows.

9. Strategically use feed additives and nutritional tools.

There are a number of feed additives and nutrients that demonstrate positive effects on transition cow health and performance. You don't need to use them all. Instead, discuss with your nutritionist which ones are backed by research, make biological sense, and are most likely to yield a return on investment for your dairy.

10. Implement cow- and herd-level monitoring programs.

Cow-level tests are used to make diagnostic/treatment decisions for individual animals. Herd-level tests provide a periodic evaluation of a representative sample of cows in the sampling window of interest, such as urine pH for managing DCAD diets, monitoring blood ketones, or diagnostic approaches using NEFA to assess negative energy balance. Herd-level tests are a barometer of what's going on in the herd. You need both types of monitoring programs.

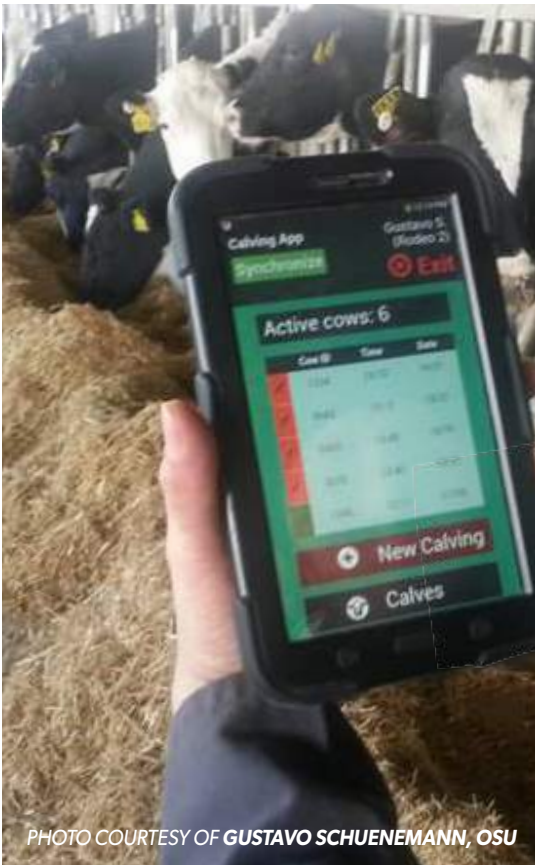


PHOTO COURTESY OF GUSTAVO SCHUENEMANN, OSU

FROM THE MATERNITY PEN

App Designed to Improve Maternity Outcomes, Records

Want to prevent calving related losses? There's an app for that. Veterinarians at the Ohio State University have developed an app that can be used to capture calving-related events, and monitor personnel performance with calving protocols.

The eCalving™ app can be used to track how long each animal is in labor and provide alerts to let employees know that a cow may need assistance based on the amount of time in labor, explains Gustavo Schuenemann, dairy extension veterinarian at the Ohio State University. It also will track if all calves have received colostrum. Employees use the app cow-side to record when stage II labor begins (appearance of the amniotic sac or feet), when a calf is born, level of calving difficulty on a five-point scale, and other pertinent information needed for accurate farm records. Those records can then be used to monitor if all employees are following the farm's protocols, to help determine if more training is needed, or if additional staffing may be necessary.

To test the app, OSU veterinarians conducted on-farm calving management training workshops, including training on how to use the app, for personnel on five large dairies. Employees were given a pre-test and then a post-test after training to assess their knowledge of calving management. On average, they had a 23.7 percentage point increase in knowledge after training. On the app, 91.3% said the app was easy to use; 95.65% reported that they liked the app and 100% reported that they would continue to use the app. The features which personnel reported they found to be the most helpful were the reminders – the color-coded alarm to track the time that heifers and cows spent in labor and the list of calves born.

The eCalving™ app is available for Android devices. It is available in both English and Spanish. You can download it for free at www.ecalving.com. While the app is user-friendly, it does require a brief overview/training. For more information, contact Dr. Schuenemann at schuenemann.5@osu.edu

You can read the full article, "Assessment of an Application for Touchscreen Devices to Record Calving-Related Events in Dairy Herds and Monitor Personnel Performance," in the July 2016 issue of *Journal of Dairy Science*.