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Nutrition and Reproduction: New Insights

In the great juggling act of dairy production today, reproduction remains one of the most challenging balls to keep in the air.

The relationship between nutrition and reproduction has been explored recently through research at the University of Wisconsin-Madison. "We know that there is a strong correlation between cows 'working harder' and decreased reproductive efficiency," says Kent Weigel, PhD, Associate Professor of Dairy Science at the University. "Through our research, we hoped to more precisely pinpoint the causes and mechanisms of nutritional factors that affect reproduction, and how they can potentially be addressed in a production setting."

Bunk space

Weigel and his colleagues conducted one study to simultaneously determine the management factors most related to reproductive performance. Of the 341 variables included in the evaluation, one of the most prominent factors was the amount of bunk space per cow in the breeding pen. The predicted percentage of cows that were pregnant by 150 days in milk (DIM) tended to increase linearly (from 35% to 70%) as bunk space increased from 30 to 60 cm. "Cows that were in an overcrowded pen (<36 cm of bunk space per cow) at breeding time had a much lower percentage of pregnancies by 150 DIM compared to cows with more bunk space," says Weigel.

Idaho-based nutrition consultant Scott Bittner, PhD, says this finding confirms the observations he has made related to animal dominance and competition for bunk space. Bittner, who counsels herds in the West ranging from 200 to 5,000 cows, says, "first-calf heifers, in particular, need to be in a separate pen, if possible, with ample bunk space. They will do much better in terms of metabolic health, milk production and rebreeding."

Body condition score

Previous studies have proven a relationship

Stage of lactation

BCS

between body condition score (BCS) and fertility, and it is theorized that there may be a genetic component to this relationship. Multiple assessments of BCS throughout lactation also have shown to provide more value in predicting that relationship than a one-time evaluation. “Given this background knowledge, we wanted to develop a BCS ‘fault’ system to predict reproductive performance both at the herd level and individual-cow level,” explains Weigel. “We also hoped to compare the predictive ability of BCS faults (or lack thereof) on the day of insemination, with BCS treated as a continuous variable.”

(DIM)	(1-5 scale)
Dry	3.22
30	2.88
50	2.70
80	2.75
200	2.85

Figure 1. Body condition score at various days in milk (DIM) for 17,587 lactation records from 9,516 cows that calved from 2000 to 2004.

The team utilized reproductive data from 153 large (613 ± 36 cows), commercial U.S. dairies participating in a genetic progeny testing program. Using BCS scores from a subset of the 9,516 cows in the study, they determined average values of BCS for cows at different stages of lactation. This allowed them to set a “normal” value for BCS for the entire data set, then determine the “BCS status” of each herd, and examine the incidence of BCS faults (excessively low or high BCS) in each herd. Mean BCS for the study at various stages of lactation is shown in Figure 1. Stage of lactation (DIM) BCS (1-5 scale) DRY 3.22 30 2.88 50 2.70 80 2.75 200 2.85

The herds in the study ranged from nearly 0 to more than 60% BCS faults. According to Weigel, the proportion of cows pregnant by 150 DIM decreased linearly as the percentage of BCS faults increased. The probability of pregnancy by 150 DIM was 0.80 for herds with 15% BCS faults, compared to 0.53 for herds with at least 45% faults. Evaluation at the individual-cow level showed a similar relationship. “This system has proven to be a valuable diagnostic tool when we evaluate a herd with poor reproductive performance,” says Weigel. “It allows us to quickly assess whether BCS faults are contributing to the problem, or if other factors should be given higher consideration.”

Bittner says he would like to see more herds regularly performing and utilizing a BCS system, as the data can be used as a bellwether over time. “In addition to reproduction, BCS numbers can reflect the impact of herd variables, including ration changes, climate swings and different housing scenarios,” he says.

CONSULTANT'S CORNER

Rescuing Reproduction



By Scott Bittner, PhD, private dairy nutrition consultant, Paris, Idaho

After working more than 25 years as an independent dairy nutrition consultant in the West, my observations of dairy reproduction concur with the trends revealed in national data. In the past two-plus decades, dairy reproduction has stayed the same at best, in most herds, it has gotten worse.

Genetics play no small role in this issue. In general, the Holstein breed has selected for milk production, not fertility or strength and stamina. Couple that high milk production with the resultant effects on body condition and hormone metabolism, and you've got a perfect

recipe for reproductive recession. When BST is in use, the scenario becomes even more complex.

One of the interesting things about reproduction as it relates to nutrition is that there is not an absolute correlation between the two. In some herds, the cows may be milking very heavily, in marginal body condition, yet still become pregnant fairly efficiently. But, for the most part, when I walk into a new herd with reproduction problems, the first tell-tale observation is thin cows. Acidosis is often an issue in these herds as well, which can lead to foot problems and DAs—all major deterrents of good fertility. Helping to improve a herd's reproduction success often requires an incremental approach, because so many factors can contribute to the problem. Any factor that causes stress can potentially impact estrous expression and detection, conception and pregnancy maintenance.

Of course the most pressing issue on virtually every dairyman's mind these days is escalating feed costs. Phosphate, for instance, is becoming very high-priced, and dairies already are starting to cut back on phosphorus in their rations, which could affect reproduction.

It's an important time for us as nutritionists to help our clients navigate this critical issue without sacrificing performance. It will require us to be flexible and innovative. Of course we should cut feed costs where we can, but I'd like to caution that we are doing our clients no favors when those cuts start to sacrifice nutritional integrity. You cannot achieve higher milk production or greater fertility by cutting back on feeds or feed ingredients. In fact, success in an era of high feed costs is going to require that dairies have excellent milk production and a highly efficient replacement-generating component of their enterprises.

FROM THE MATERNITY PEN

Curbing dystocia deaths

Calves are the future of every dairy herd, and of the industry as a whole. But that future is compromised when they do not survive to adulthood.

While the dairy industry places much emphasis on calf mortality and diligently works to lower it, a group of researchers at Colorado State University's (CSU) Integrated Livestock Management team believes that calf survival could be improved greatly with more attention focused on birthing and newborn calf care.

Stillbirth is commonly defined by the industry as death at delivery or within the first 48 hours of life. Franklyn Garry, DVM, MS, leader of the CSU team, says stillbirth losses are less carefully tracked than general calthood mortality, but that current reports suggest a stillbirth rate of 6 to 12 percent. "Those are animals that don't even make it into the overall calf loss statistics," says Garry. "It's a problem few producers monitor or manage, yet addressing it could have a huge impact on our industry."

Garry and his fellow researchers recently conducted a study examining the impacts of dystocia on calf health and survival, which included dairies with overall dystocia rates above 30 percent. While the cause of dystocia itself may prove difficult to solve, the CSU researchers have proven that calf survivability can be improved by 50 percent or greater by training dairy workers on protocols for calf delivery, newborn calf assessment and monitoring.

Because most dairy calves are removed from their dams within a few hours of birth, Garry reminds that basic mothering, such as drying the calf off, feeding colostrum, and providing a warm, draft-free post-delivery environment, must be delivered by human caregivers.

A [set of teaching materials](#) developed by Garry's team can be accessed on the Integrated

Livestock Management Web site at Colorado State University.

BEYOND BYPASS

Mycotoxin Damage Control

There is no such thing as a “perfect” crop year, and industry estimates indicate that mold—and its poisonous byproduct, mycotoxin—annually affects about 25 percent of crops worldwide.

North Carolina State University nutrition researcher Lon Whitlow, PhD, says mold growth and the production of mycotoxins usually are associated with extremes in weather conditions (leading to plant stress or hydration of feedstuffs), insect damage, poor storage practices, low feedstuff quality, and inadequate feeding conditions.

“Dairy cattle have a certain degree of greater protection from mycotoxins than monogastric animals like swine because of mycotoxin degradation in the rumen,” says Whitlow, “However, dairy cows tend to be more susceptible to mycotoxin-induced disease problems compared to beef cattle, because of greater feed consumption and production stresses.”

Whitlow says a single, large dose of mycotoxin can cause acute toxicity in cattle, but it is more likely that the effects are chronic, caused by low-level consumption over time. Mycotoxins can be responsible for the following symptoms in dairy herds:

- Reduced feed intake or feed refusal
- Reduced nutrient absorption and impaired metabolism
- Altered endocrine and exocrine systems
- Suppressed immune function
- Suboptimal milk production
- Poor reproductive performance
- Altered microbial growth

A mycosis (mold infection) transferred via contaminated feedstuffs can occur in various locations such as the lungs, mammary gland, uterus or intestine. Some researchers theorize that intestinal involvement may be a key, contributing factor to hemorrhagic bowel syndrome (HBS). “A mycosis is most likely to occur when cows are immune suppressed during stressful periods,” says Whitlow.

Mold spores always are present in the environment, and virtually all feedstuffs are susceptible to mold infestation if conditions are right. When preventative measures fail, producers may find themselves with feedstuffs containing unacceptably high levels of mycotoxins.

Those feed products may be salvaged by the use of binders as feed additives. “The addition of mycotoxin binders to contaminated diets has been considered the most promising dietary approach to reduce the effects of mycotoxins,” says Whitlow. Because binders decontaminate mycotoxins in the feed by binding them strongly enough to prevent toxic interactions and mycotoxin absorption, they are considered to be preventative rather than therapeutic. Materials used as binders include charcoal or activated carbon, aluminosilicates (such as clay and bentonite), complex indigestible carbohydrates (yeast cell wall extracts), organic polymers and synthetic polymers.

No binders effectively deactivate all individual mycotoxins, and currently none are approved for commercial use, though Whitlow is hopeful that they soon will be, as evaluation methods and quality control are improved.

QUALITY CORNER

Between Jan. 1 and June 30, 2008, 50 samples of SoyPLUS were submitted to a commercial lab (Eurofins) for analysis. Results are expressed as the mean + the standard error of the mean % on an "as fed" basis.

% Moisture	% Fat	% Crude protein
10.92	5.85	43.29
+ .12	+ .06	+ .11

HAPPENINGS

West Central Celebrates 75 Years

West Central is celebrating 75 years of business in 2008. With that, the organization is also celebrating a long history of value-added research, technology and development. West Central began processing soybeans in 1942 in Ralston, Iowa. During the '80s, its soybean protein meal, SoyPLUS[®] was fed to area beef cattle. Research was invested into this product, and it was realized that SoyPLUS offered supreme bypass potential for dairy cattle. Since 1984, West Central has been marketing its SoyPLUS product around the country, and world. In 1994, West Central introduced SoyChlor, a feed supplement designed to minimize clinical and sub-clinical cases of hypocalcemia. That product was produced in Adair, Iowa, until 2005, when a larger, more state-of-the-art facility was constructed in Jefferson. Today, Jefferson is home to the SoyChlor manufacturing facility.



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