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# Molasses in dairy rations

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**for *The Progressive Dairyman***

Molasses is quite a versatile component of dairy rations. While many people view it only as a source of sugar, uses for molasses extend from its value as a carrier for micro-ingredients to its potential to bind the total mixed ration (TMR) and reduce sorting. Historically, molasses has been used to provide sugars to the cow and, subsequently, to improve the palatability of the ration. The list of benefits of feeding molasses has now expanded to include benefits to the rumen microbial population.

In most dairy cattle diets, carbohydrates account for 65 to 70 percent of the nutrients. Carbohydrates from feedstuffs can be classified into cell wall and non-cell wall components (fiber and non-fiber carbohydrate). Non-fiber carbohydrate (NFC) consists of starch, sugars and pectin. Sugars are a component of NFC and provide a rapidly rumen-available carbohydrate source to support rumen microbial growth.

According to Dr. Mike Allen, "the goal of formulating diets for carbohydrates is to provide low fill, highly fermentable diets that result in consistent fermentation over time." When sugars are fed along with rapidly degraded proteins, the rumen microbes are provided with the balance of energy and protein needed for optimal microbial growth. Feeding sugars will generally increase microbial protein production. Microbial protein is high quality bypass protein and is an excellent source of the amino acids required for milk production. Caution must be taken in adding sugars to dairy rations, particularly considering the tremendous variation in sugar content of feedstuffs and by-products. When sugars are degraded too rapidly, they can depress rumen pH. When fed at high levels, sugars may decrease ruminal fiber digestion. Nutritionists should use caution to ensure that adequate levels of effective fiber and rumen degradable protein are available before adding sugars to the ration.

Basal ration sugar levels are typically two to four percent, although the ideal sugar level is four to six percent. Response to feeding sugar supplements at high levels is greatest with high-silage rations, lower quality dry hays, forages with low-fiber digestibility, high levels of soluble or degradable protein or high-producing cows.

Results from research on feeding molasses and other sugar supplements have been highly variable. Adding sugars to dairy rations can potentially increase milk production and fiber digestibility, increase milk fat or milk protein content, increase microbial protein production and lower milk urea nitrogen (MUN). A recent study by Broderick and Radloff found that adding cane molasses at three percent of dry matter intake, yield of milk protein, increased percent milk protein and solids non-fat and lowered MUN. Feeding higher levels tended to decrease overall performance.

Molasses is an economical source of supplemental sugars for dairy diets. Animal feed is the main market for molasses. Molasses is quite variable in terms of nutrient content, flavor, color, and viscosity. In addition to providing soluble carbohydrates, both cane and beet molasses are excellent sources of minerals. Generally, cane molasses is higher than beet molasses in calcium, phosphorus and chlorine content. On the other hand, beet molasses is higher in both potassium and sodium but lower in calcium.

Molasses can be used to replace a portion of the energy provided by starch. The rapidly digested nature of the sugars in molasses increases the animal's ability to utilize soluble proteins increasing microbial growth and maximizing microbial protein production. Further, it increases the palatability of the ration, reduces dustiness and serves as an economical carrier for many micro-ingredients. Liquid feed supplements are an excellent delivery vehicle for minerals, vitamins and other feed additives.

Finally, adding molasses or liquid feed supplements to a TMR can also reduce ration sorting. The moisture and viscosity of the molasses makes smaller feed particles stick to the larger forage particles, thereby making it more difficult for cows to sort. ***PD***

*References omitted due to space, but available upon request.*

AGRI-VIEW

# SARA Concerns Producers

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By Abby Huibregtse,
Special to Agri-View

The link between Sub-Acute Rumen Acidosis and laminitis is an area of concern for farmers and nutritionists, according to Dr. Randy Shaver, UW- Madison Extension dairy nutrition specialist.

"The link between SARA and laminitis has been a hot topic the past 10 years," he said. Sub-Acute Rumen Acidosis, or SARA, is characterized by low pH in the rumen.

"Low rumen pH can be brought about by high intakes of high digestible feeds by today's high producing cows," Shaver explained. Low rumen pH can lead to several problems, including depressed butterfat test. One of the most prevalent problems is the link between SARA and laminitis in cattle.

"Both SARA and laminitis cause big economic costs for both treatment and prevention. It can also lead to low milk production, poor reproductive performance, and premature culling," Shaver said. "It's a big issue for the industry."

An important aspect in minimizing the risk of SARA is to focus on transition diets. Transition diet management should really be done using a "stair-step approach" for energy, according to Shaver, as cows transition from low energy diets for far-off dry cows to high energy diets for milking cows.

For milking cows, nutritionists must formulate diets that have adequate fiber from forage and that are not too high in starch.

Ration preparation and delivery is also crucial. The proper diets must be mixed on the farm, with the correct dry matter ratio of forage to grain maintained consistently. Sudden changes in feed type or quality, like switching from corn silage to haylage, switching bags of silage, or feeding poorly fermented silage can cause rumen pH to vary, said Shaver.

Delivering well-mixed feed will help to minimize the sorting done by the cows and prevent SARA. Adequate particle length is also necessary to keep cows chewing their cud and maintaining a healthy rumen.

Cow comfort plays a large role in preventing laminitis. "There's quite an interaction between SARA, laminitis, and cow comfort," explained Shaver.

Ideally, cows should be lying in stalls and not standing on concrete. Studies have shown that cows spending more time on concrete have an increased risk of laminitis.

A farmer may be doing a reasonable job with ration management, but if cow comfort is lacking, cows will not lie down and the risk of lameness will increase.

"Some producers may focus on one area and ignore another, but it really is an interaction between nutrition management and cow comfort."

Some areas are easily corrected, while others are not. Things like diet can be changed quickly, while issues with facilities take longer and are more expensive to change.

Feed additives can decrease the risk of SARA. Sodium bicarbonate buffers help stabilize rumen pH and "are called for in silage-based diets for high-producing cows," according to Shaver.

There are other feed additives which are more experimental in nature at this time that focus on transition cows. However, the use of feed additives should not be expected to solve all the problems if there are major feeding and management issues to overcome.

Consistency of rations from day to day is critical. "We need to nail down a quality control program to minimize the margin of error between the formulated diet, what is mixed and delivered to the group on the farm, and what the cows actually consume," Shaver said.

Cow comfort is also an area to focus on, he said. "We need to keep cows off of their feet."

"All areas are intertwined. All areas need to be assessed on a dairy operation before you can solve the problem and prevent SARA and laminitis," Shaver explained.

Shaver presented his research on the link between SARA and laminitis at the 2005 Cornell Nutrition Conference for Feed Manufacturers in East Syracuse, New York. It was the 67th year this conference was held.

"It is one of the leading conferences in the nutrition industry," according to Shaver, and this was the third time he had spoken there.

Shaver grew up in western Pennsylvania and attended Penn State for his undergraduate studies in dairy science. He completed his Masters' degree at the University of Maryland. He then came to Wisconsin and finished his Doctorate at UW-Madison and U.S. Dairy Forage Research Center.

# Optimize fat, protein production

■ Evaluating your herd's milk and protein yield may help you find potential income opportunities.

*by JoDee Sattler*

**As milk prices decline, you could be** leaving money on the table if your cows are not at their genetic potential for fat and protein production. With most Midwest dairy producers paid on a milk solids basis, take a close look at your milk's fat and protein content.

"One goal is for dairy managers to obtain the genetic milk component base bred in their herd, leading to significant improvements in milk income," stated Michael Hutjens, University of Illinois professor and dairy Extension specialist.

Evaluate your herd's milk components by looking at the protein to fat protein ratios. Look at the ratios within four categories in your herd using DHI records or electronic summaries. The four categories are: overall protein to fat ratio for the entire herd by month, protein to fat ratio based on days in milk (less than 100, 100-200, and more than 200), protein to fat ratio based on lactation number (first, second and third or more), and protein to fat ratio shifts during the last one to three years.

*Table 1* shows normal component levels by breed. "Ideally, these values and ratios should be the same due to lactation number, milk yield, days in milk, and over time," Hutjens noted. "But, they will vary and that's the challenge – to figure out why and if they can be corrected."

*Table 1.*
**Normal milk components by breed**

| Breed | Milk fat | True milk protein | Ratio (protein/fat) |
|---|---|---|---|
| | --------- % | -------- | |
| Ayrshire | 3.91 | 3.21 | 82 |
| Brown Swiss | 4.03 | 3.38 | 84 |
| Guernsey | 4.55 | 3.38 | 74 |
| Holstein | 3.66 | 3.00 | 82 |
| Jersey | 4.76 | 3.62 | 76 |

### Multiple factors influence components

Several factors influence milk components – breed, genetic merit, lactation number, stage of lactation, body condition changes, mastitis and heat stress. The good news is that the heritability of milk components is high. Milk yield, however, has a lower heritability. Unfortunately, the correlation between milk yield and milk fat and milk protein percent is -0.15 to -0.3. Milk fat test drops 0.1% per year as the animal ages; milk protein test drops 0.04% per year as the animal ages. Fat and protein test values are lower one to three months post-partum. Casein and milk fat production declines in cows with mastitis. With heat stress, fat test can drop 0.3% and protein test 0.2%. Rumen pH typically falls 0.2 with heat stress. Providing cow cooling mechanisms under sultry conditions can help alleviate these declines.

### Look at amino acid sources

To optimize milk protein yield, Hutjens recommended evaluating amino acid sources. Amino acids for milk protein come from microbial synthesis, dietary sources and mobilized animal tissue.

**Hutjens offered several strategies to optimize amino acid production.**

■ *Maximize microbial* protein synthesis and passage to the small intestine.

■ *Optimize feed* and energy intake, which drives microbial growth. Do this by feeding adequate physically effective fiber (to avoid rumen acidosis). Provide 24%-26% total starch. Add 2%-4% sugar (total of 4%-6%).

■ *Feed digestible* rumen undegraded protein (RUP) sources.

■ *Consider the first* pound of protein supplement from soybean meal as a source of peptides and amino acids

■ *Blend different* RUP sources to balance amino acid composition and reduce feed variability.

■ *Consider adding* protected amino acids, if suggested by a computer-based amino acid model, such as Dairy NRC 2001, CPM-Dairy (Cornell Penn Miner) or Amino Cow.

■ *Because lysine* and methionine are usually the first limiting amino acids, evaluate the levels of these amino acids. Lysine levels should range from 6.2%-6.6%; methionine levels should range from 2%-2.2%. The lysine to methionine ratio should be 3:1. If you supplement your herd's ration with protected amino acids, milk production and/or milk components can respond within two weeks.

■ *Feed close-up* dry cows proper protein nutrition. Amino acids can be a glucose source, but this practice is not desirable or economical, Hutjens explained.

*FYI*

**■ Mike Hutjens is a dairy nutritionist at the *University of Illinois,* phone: 217-333-2928, e-mail: hutjensm@uiuc.edu.**

**■ Subscribe to the *Illinois Technology & Research:* Allied and Integrated for Livestock Linkages at www.TRAILL.uius.edu.**

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**Watch fat test level**

Evaluate milk fat sources if your herd's milk fat test is too low or too high. Can milk fat test be too high? Yes, according to Hutjens, if it's limiting milk yield and/or if the herd averages more than 200 days in milk.

The mammary gland's main sources to produce milk fat include rumen volatile fatty acids (mostly acetic acid and butyric acid), supplemental fat and oil, and mobilized body fat (chiefly in early lactation). Several practices and conditions can increase/decrease milk fat test. Balancing for starch (24%-26%) will maintain fat test, yet increase milk yield.

**Decreases milk fat test**

- **Feeding polyunsaturated** fatty acids as free oil, which is not contained in a seed cell such as distillers grain.
- **Decreasing forage** particle size or length.
- **Adding high** levels of monensin (more than 400 mg) and/or if rumen conditions are not optimal. (Feeding 250-275 mg of Rumensin maintains fat test under normal rumen conditions.)
- **Higher milk** yield.
- **Starch levels** more than 28%.
- **Shifting from** dry to high-moisture, pelleted or steam-flaked corn (if starch levels are high).
- **Heat** stress.
- **Energy shortage** (along with lower milk protein test).
- **Rumen acidosis** (along with higher milk protein test).
- **Improper milking** procedure.

**Increases milk fat test**

- **Feeding more** saturated fat sources.
- **Feeding recommended** levels of oilseed – less than 5 lbs.
- **Increasing** forage level.
- **Adding sodium** bicarbonate buffer at 0.75% of ration dry matter, if rumen pH is low.
- **Shifting** to feeding a TMR.
- **Feeding more** frequently and pushing up feed.
- **Reducing** feed sorting.
- **Losing** body condition.
- **Ketosis.**

To provide nutrients in the blood needed by the mammary gland to synthesize milk yield and components for optimal economic responses, dairy managers must manage the ration, rumen and small intestine. *Table 2* illustrates how this can be accomplished. While environment (such as feeding, housing, weather) plays a role in milk and protein production, so does genetics.

**Seek yield, not percent**

Remember, dairy producers shipping milk in federal orders with multiple component pricing systems are paid on pounds of fat and protein – not percentages of fat and protein. *Table 3* lists 2005 monthly values of a pound of protein and milk fat in the Upper Midwest federal order.

As you evaluate AI sires or make feeding changes, put more emphasis on fat and protein yield, rather than fat and protein test. Increasing the percentage of components should not be made at the sacrifice of total milk, fat and protein production.

*Table 2.*
**Relationships among digestion products and milk yield and component changes**

| Products | Yield response (compared to control cows) Milk | Fat | Protein |
|---|---|---|---|
| *Rumen volatile fatty acids* | | | |
| Acetate | ++ | ++ | - |
| Propionate | - | --- | ++ |
| Butyrate | ++ | +++ | + |
| *Small intestine* | | | |
| Glucose | ++ | --- | - |
| Amino acids | ++ | -- | ++ |
| Fatty acids | + | +++ | na |

*Key*

| | |
|---|---|
| + | small positive response |
| +++ | large positive response |
| - | small negative response |
| --- | large negative response |
| na | not applicable |

*Source: University of Illinois*

Under federal order pricing formulas, sacrificing milk production for higher protein and milk fat tests could actually have a negative financial impact ***(see Table 4)***.

For example, based on May 2005 federal order protein and milk fat values in ***Table 3,*** Cow B, producing 85 lbs. of milk at 3.1% protein and 3.5% milk fat, would yield $11.66 per day in component value to the producer. Cow D, producing 80 lbs. of milk per day at 3.2% protein and 3.7% milk fat, would yield $11.24 per day in component value, or 42¢ less than Cow B per day. Finally, Cow F, producing 75 lbs. of milk at 3.3% protein and 3.8% milk fat, would yield $10.87 in component value per day, or 79¢ per day less than Cow B.

*Table 3.*
**2005 monthly protein and milk fat value, Upper Midwest federal milk marketing order**

| Month | Producer price $ per pound Protein | Milk fat |
|---|---|---|
| January | $2.53 | $1.73 |
| February | $2.66 | $1.78 |
| March | $2.50 | $1.73 |
| April | $2.71 | $1.70 |
| May | $2.60 | $1.55 |
| June | $2.57 | $1.59 |
| July | $2.46 | $1.80 |
| August | $2.16 | $1.82 |
| September | $2.30 | $1.89 |
| October | $2.38 | $1.83 |
| November | $2.27 | $1.61 |
| December | $2.38 | $1.50 |

*Source: USDA*

*Table 4.*
**Milk component production and value, various production levels**

| Daily production | Cow A | Cow B | Cow C | Cow D | Cow E | Cow F |
|---|---|---|---|---|---|---|
| Milk (lbs.) | 85 | 85 | 80 | 80 | 75 | 75 |
| Protein (%) | 2.9 | 3.1 | 3.0 | 3.2 | 3.1 | 3.3 |
| Protein (lbs.) | 2.47 | 2.64 | 2.40 | 2.56 | 2.33 | 2.48 |
| Protein value ($2.60/lb.)* | $6.42 | $6.86 | $6.24 | $6.65 | $6.06 | $6.45 |
| Milk fat (%) | 3.50 | 3.65 | 3.55 | 3.70 | 3.65 | 3.80 |
| Milk fat (lbs.) | 2.98 | 3.10 | 2.84 | 2.96 | 2.74 | 2.85 |
| Milk fat value ($1.55/lb.)* | $4.62 | $4.81 | $4.40 | $4.59 | $4.25 | $4.42 |
| Component value (protein + milk fat) | $11.04 | $11.66 | $10.64 | $11.24 | $10.31 | $10.87 |

**/ Average market value per pound, Upper Midwest federal milk marketing order, May 2005*

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