TECHNICAL BULLETIN
DAIRY

QLF QUALITY LIQUID FEEDS

OPTIMIZING USE OF HIGHLY AVAILABLE STRACH

Starches in cereal seeds and silages provide valuable energy to rumen microbes. The amount and availability of energy from starch is influenced by grain species, processing, preservation, and storage time. Low-available starches often don't provide enough energy to fuel maximal microbial growth. In contrast, excess highly available starch can cause in low rumen pH, overgrowth of bacteria species that use alternate-pathway biohydrogenation, and milk fat depression.

Because supplemental sugars provided by liquid supplements provide quick energy to rumen microbes, nutritionists often ask "How do supplemental sugars best fit with diets that contain highly available "fast" starch?" Research shows that the answer lies in microbial species that use starches and sugars, and the moderation of diet fermentability and starch level to maximize productivity.

Highly Available Starch Can Lower Milk Fat

When "fast" starch sources are readily available (due to growing season, grain processing, market conditions, etc.) lowering diet starch level is key to preventing milk fat depression. Research conducted at Michigan State University demonstrated that maintaining starch level, while increasing starch availability, lowered milk fat % and fat yield.

	Corn		
Item	DG[a]	HM[b]	*P*
Starch	31.7	32.8	
NDF	26.2	25.3	
NFC	45.0	45.3	
CP	16.5	16.3	
Milk Yield, lb/d	84.9	84.5	0.57
3.5% FCM, lb/d	84.5	80.5	0.17
Milk Fat%	3.50	3.20	0.06
Fat Yield, lb/d	2.95	2.73	0.15
Trans-10 C18:1, % of milk fat	0.47	1.48	<0.01

[a]Dry Ground Corn [b]High Moisture Corn

Bradford & Allen. 2004. JDS 87:3800-3807

In this study, impacts on milk fat are likely due to effect of highly available starch on ruminal biohydrogenation. Some ruminal bacteria species that thrive on highly available starch, or in a low pH environment, such as *Megasphaera elsdenii*, can use alternate-pathway biohydrogenation to add hydrogen atoms to 18-carbon fatty acids from dietary fat sources (Kim et al. 2002). Consequently, large amounts of highly available starch in the diet may increase production of biohydrogenation intermediates that cause milk fat depression. The fatty acid *trans*-10 C18:1, which is often implicated in milk fat depression, was increased 3-fold in milk fat of cows receiving the high moisture corn treatment. This demonstrates that the diet's highly available starch impacted ruminal biohydrogenation, which allowed passage of *trans*-10 C18:1 to lower milk fat production.

Sugars Impact on Biohydrogenation

Although sugars in cane molasses-based liquid supplements are quickly available to rumen microbes, they influence ruminal biohydrogenation in a different manner than highly available starch. Sucrose, the primary sugar found in cane molasses helps keep ruminal biohydrogenation on the normal pathway, thereby helping maintain normal milk fat production.

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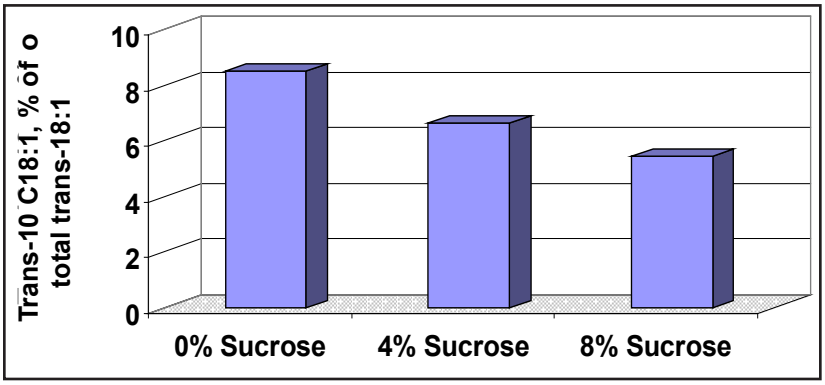

Note 1: Sucrose incubated with alfalfa hay.
Ribeiro et al. 2005. JDS 88:4007-4017.

The graph shows that supplemental sucrose linearly decreased (P = 0.12) the proportion of fatty acid *trans*-10 C18:1 in continuous culture.

The contrast between impact of highly available starch and sucrose on ruminal biohydrogenation is likely due to effects on microbe populations. Sucrose is readily utilized by several microbes which perform important roles in normal pathway biohydrogeneration such as *Butyrivbrio fibrisolvens,* and *Anearovibrio lipolytica* (Jenkins et al., 2008). Providing supplemental sugars through a liquid supplement helps feed the "right" microbes to keep biohydrogenation on the normal path, and optimize milk fat production.

Feeding Liquid Supplement, Moderating Diet Fermentability Enhances Productivity!

Research has shown that lowering diet NFC and starch, and including QLF Dairy TMR 20 at 2.7 lb/day improves production of energy-corrected milk, as shown in the chart below. At high levels of supplemental sugar (>1.9 lb/day) milk fat production was maintained even when Rumensin® was fed, which demonstrates that supplemental sugars in QLF Dairy TMR 20 help keep ruminal biohydrogenation on the normal pathway, to maintain milk fat production. In the study below, researchers formulated diets to two levels of NFC, and altered

Item	40% NFC		37% NFC		
	Control	2.6 lb/d TMR 20	2.7 lb/d TMR 20	5.6 lb/d TMR 20	5.3 lb/d* TMR 20
Starch	27.4	23.9	21.0	18.2	19.0
NFC	41.1	40.3	38.3	37.9	37.7
NDF	32.6	32.9	35.7	35.5	35.5
Supplemental Sugar, Lb/d	0	0.9	0.9	2.0	1.9
DMI, lb/d	52.7^{b}	52.7^{b}	55.6^{ab}	57.1^{a}	54.0^{b}
Milk, lb/d	87.5	88.0	91.7	89.7	88.9
Fat %	3.31	3.42	3.34	3.29	3.31
Fat, lb/d	2.9^{b}	2.8^{b}	3.1^{a}	2.9^{b}	2.9^{b}
ECM, lb/d	83.6^{b}	82.2^{b}	87.5^{a}	84.9^{ab}	83.8^{ab}
ECM/DMI	1.61	1.56	1.64	1.57	1.58

^{a,b} Values in the same row with different superscripts are significantly different P≤0.08
*Rumensin 11.5g/ton DM
Firkins et al., 2008. JDS 91:1969-1984

Liquid supplements provide valuable energy and degradable protein to grow microbes and enhance diet utilization and productivity. In addition, liquid supplements also help improve intake consistency and prevent sorting, which provides consistent amounts of effective fiber, rumen fermentable carbohydrate, and degradable protein to keep rumen microbe populations young, growing, and efficient, and reduce feed wastage. Remember also that lowering diet starch level stretches existing corn supply, and provides flexibility for producers to sell corn if desired.