Fat Feeding Facts

9. Evaluating Fat Supplements

A re-read of ***Fat Feeding Facts 1. Definitions*** would be helpful in better understanding the types of fat supplements. There are basically 3 types: triglycerides (TG) which have a glycerol to which are attached 3 fatty acids (FA), free fatty acids (FFA) which are detached or free of glycerol, and mineral salts of fatty acids (SFA). There can also be combinations of these categories present in a fat supplement. A number of analytical laboratories can do analyses to ferret out these types of supplements. Feed Tags may or may not be fully representative of the type or content of supplements. Why does this matter? Because energy content and that utilizable by dairy cows will be affected by fat supplement composition.

Triglycerides contain glycerol and 3 FA attached to them. Fat has 2.25 times the energy content of protein and carbohydrates. Since glycerol is an alcohol and it falls into the carbohydrate energy content, it has a lower energy content in a TG than its FA. Consequently, a TG may be about 8% lower in energy than a FFA product, dependent on the chain length of FA present in the TG. The dairy cow digestion system is designed to primarily digest and absorb FA. And if those FA are saturated, the TG will have a high melting point. Rumen bacteria typically hydrolyze TG to FFA. These FFA then flow out of the rumen into the small intestine where they are absorbed. If the TG have a high melting point, they cannot be melted and hydrolyzed very well by the rumen bacteria. Thus their digestion and absorption will be reduced. Vegetable oils have highly unsaturated FA, which is why they are liquid at room temperature. But unsaturated FA are toxic to rumen microbes, so they must first hydrolyze the TG to FFA, and then biohydrogenate or saturate those unsaturated FA for the microbes own benefit as well as for the cow's benefit. Biohydrogeantion is about 85% effective and thus there is incomplete or intermediate FA which can lead to milk fat depression and lower dry matter intake.

Free fatty acids are FA which are not attached to glycerol in the form of TG. Free fatty acids have been hydrolyzed or "freed" from a triglyceride. Thus they are already in the form that the cow can absorb in the small intestine. Those FFA may be saturated, unsaturated ,or a mix of both. If unsaturated, these FA must be saturated by rumen microbes as discussed above in order to minimize or eliminate reduced milk fat and intake. Likewise, unsaturated FFA have lower melting points. Another category of FFA are high in palmitic FA ~85%. While this type of fat supplement can help increase milk fat percentage, it has also been shown to reduce intake and may mobilize body fat.

Mineral Salts of Fatty Acids (SFA) are created by reacting a TG with an alkaline mineral. Traditionally, soap was made by reacting used cooking oil or animal fats (TG) and lye or sodium hydroxide. This made a soluble SFA which also contained the freed glycerol from the TG. But for feeding a fat supplement to dairy cows, it was desired to have an insoluble dry fat supplement. Thus calcium hydroxide was used and made an insoluble fat supplement. Lower cost fat sources than tallow or grease were sourced and used to make SFA, most commonly palm fatty acid distillate or other vegetable fat sources. Since these fat sources were more unsaturated, mineral salts from such sources can also contribute to lower milk fat and intake.

Feed Tags may contain information on total FA, FFA, and FA sources and levels. If total FA are considerably less than 100% of a fat supplement, there are other nonfat components present in the fat supplement. For example, mineral SFA may only have about 82 to 85% total FA because of the mineral content contributed by the mineral alkali source used to make the

mineral SFA. While these products may be lower cost per ton compared to other fat supplements, the price should be adjusted using the actual lower fat content. Triglycerides also have a lower fat content than FFA, and also a lower digestibility and absorption than FFA.

Laboratory Analyses can reveal the following about fat supplements: total FA, FFA %, individual FA, degree of unsaturation (iodine value), individual FA, and mineral content (total ash, and even individual minerals and levels). The vast majority of FA present in a fat supplement for dairy cows should be comprised of stearic (18 carbon length and saturated) and palmitic (16 carbon length and saturated). A university study with early lactation cows in which intake and flow out of the tumen were measured and FA profiled, found that about 85% of total FA intake were from stearic and palmitic. In other studies, of total lipids leaving the rumen, 85 to 90% were as FFA with 2/3rd being stearic and 1/3rd palmitic.

The more **ideal fat supplement** would have nearly all TFA with little nonfat content, nearly all FFA with no TG, mostly saturated FA, and comprised of mainly stearic and palmitic FA.