Alberta Dairy Management
PREPARED FOR AND DISTRIBUTED BY THE DAIRY EXTENSION ADVISORY GROUP

Profitable Fat Feeding

Cows with high production potential normally experience a period of negative energy balance in early lactation. When milk energy output exceeds feed energy intake, they are forced to mobilize body reserves. Weight loss exceeding about 1 kg/day over more than 7-8 weeks can prolong the rebreeding interval and reduce persistency. To minimize loss of body condition, energy intake must be maximized by :

- formulating a ration which provides the maximum level of fermentable energy with the minimum amount of chewable fibre required to promote rumen digestion and feed passage rate (see article **1N1**), and;
- maximizing ration intake (see article **1I1**).

When these two goals have been achieved, it may be profitable to further increase ration energy density by adding fats, in the form of:

- commodity fats such as tallow, yellow grease (often simply called feed fat) or canola oil;
- whole oilseeds;
- rumen inert fat sources, including products like Alifet®, Aristofat®, Energy Booster® and Megalac®.

How much fat can you feed and which of these fat sources is most cost-effective?

Commodity fats

Commodity fats are commonly used both in manufactured feeds and for supplementing on-farm mixed rations. Current prices (June 96) are about 55¢/kg for yellow grease, 59¢/kg for tallow and 87¢/kg for canola oil.

Because canola oil can be kept liquid without heating, it is tempting to use on-farm. However, its high unsaturated fatty acid content (see article **1F1** for an explanation of terminology) can have a negative effect on rumen fermentation and feed intake if it is used at more than about 1.5% of ration dry matter (DM). Yellow grease, which is a variable mixture of recycled animal fats and vegetable oils, also contains a high proportion of unsaturated fatty acids and should not be used at more than about 2.5% of ration DM. Tallow, containing less than 50% unsaturated fatty acids, is relatively rumen inert. It has been used at up to 3.5% of ration DM without affecting feed intake, even in rations which already contain up to 2.8% added fat in the form of whole soybeans or high-oil corn.

Whole oilseeds

Whole oilseeds are not commonly used as fat sources in Western Canada. In British Columbia, some whole cottonseed finds its way into lactating rations, not simply for its fat but as much for its protein and digestible fibre content.

Whole canola seeds can be fed if they are properly rolled. There is a common belief that this is difficult because of their high (40+%) fat content. But, according to Dr. Barry Robinson with Great Northern Livestock Consulting Ltd., selection of the right equipment has enabled several of his clients to include full-fat canola in their lactation rations. He recommends feeding up to 2.5 lbs/cow/day which delivers about 1 lb of fat - roughly 2% of ration DM. Avoid using seed that contains a significant amount of mustard because of its negative effect on palatability.

Assuming that canola seed is worth $410 per tonne, the price of canola meal is $245/tonne and rolling costs $15/tonne, the fat component of full-fat canola has a value of about 67¢/kg.

Rumen inert fat sources

Processed rumen inert fats have been developed in an attempt to minimize the negative effects of unsaturated fatty acids on rumen fermentation and feed intake. Megalac® is composed of calcium salts of relatively unsaturated palm oil fatty acids. It is the combination with calcium that renders it rumen inert. Most of the other commercial products contain commodity fats such as tallow or vegetable oils which have been hydrogenated to increase their degree of saturation. Sold in either prilled or flaked form, they are much easier to handle, but all are significantly more expensive than commodity or oilseed-derived fats - most are priced in the $1.50 - $1.60 per kg range. Since the fat content of these products varies, prices should be converted to a cost per kg of fat basis.

Energy value of supplemental fat

One of the difficulties in assessing the economic value of the various fat sources is the uncertainty about their actual net energy (NE_l) values. Estimates range from 5.84 to 8.03 Mcal NE_l/kg for products which are 99+% fat. This compares with estimates of 1.95 Mcal NE_l/kg for barley and 2.04 Mcal NE_l/kg for wheat and corn.

The two main factors that affect the energy value of a fat source are its fat content (e.g. Megalac® is only 82.5% fat) and the digestibility of the fat. Properties of fat that influence its digestibility include:

- ***Degree of saturation***. The digestibility of fatty acids decrease as their degree of saturation increases - fats containing high proportions of 18:0, in particular, are likely to be less digestible than those containing more 18:1 and 18:2;
- ***Chain length***. Digestibility increases as chain length decreases - 14 and 16 carbon fatty acids are more digestible that those of 18 or more;
- ***Physical properties***. Prilling and flaking may reduce fat digestibility relative to the same fat liquified and blended with feed.

Several studies have demonstrated that intestinal fat digestibility decreases as fat intake increases. Dr. Don Palmquist at Ohio State University showed that the digestibility of the total fat in lactation diets declined from 100% at approximately 1% dietary fat down to 78% digestible at 8% fat. But, as successive 100 gram increments of fat were added to the diet, the digestibility of each increment decreased by 4.4 percentage units. This means that, while the first 100 grams added to the 1% base ration had a digestibility of 95.6%, when 1.3 kg of supplemental fat was fed, the digestibility of the last 100 grams was only 43%. Other dairy and feedlot beef trials in both North America and Europe have also demonstrated reduced fat digestibilities of similar magnitude when total fat levels exceeded 5-6% of ration DM.

Lactation responses

Typical responses that can be expected from the successful addition of a single fat source at 2-4% of ration DM are:

- a change in daily DM intake ranging from a 0.5 kg decrease to a 0.5 kg increase;
- a milk yield increase of 1.5-2 kg/day;
- a fat test increase of 0.05-0.25 percentage units;
- a protein test decrease of 0.05-0.15 % units.

In 13 studies where rumen inert fats were added at 2.0-2.5% of ration DM to rations containing an average 2.3% supplemental fat from soybeans or cottonseed, average responses were as follows:

- DM intake declined by 0.36 kg/day;
- milk yield increased by 0.78 kg/day;
- fat test increased by 0.09 percentage units;
- protein test was depressed 0.07 percentage units.

When tallow, soapstock or safflower oil were added at 2.5-3.0% to rations containing an average 2.4% fat from oilseeds (10 studies), responses were somewhat lower than those for the rumen inert fats.

Adding fats to lactating rations has often failed to increase milk production. When this occurs, three possible explanations should be considered:

- In early lactation cows (first 50 days in milk), higher blood fatty acid levels from supplemental fat may reduce either feed intake or mobilization of body fat, negating the benefit of the added fat;
- Feed intake has been reduced because the fat being used is unpalatable. This can be a particular problem with commodity fats containing high proportions of unsaturated fatty acids because they are subject to oxidative rancidity which produces a very rank flavor and aroma.
- Fats are interfering with rumen fermentation, reducing the rate of feed (particularly forage) breakdown and, therefore, restricting intake. Lower energy intake is offsetting the potential energy contribution from the fat.
- Digestibility of the added fat is lower than expected for one or more of the reasons outlined previously.

Recommendations

At current fat prices, the bottom line for most herds in Alberta is that a profitable response is most likely to be realized from feeding good quality tallow at up to 3.5% of ration DM. Yellow grease at 2.5% or 5% full-fat canola seed are second choices.

Because of their cost, rumen inert fats will always be used as the last increment of added fat. Although they may be quite digestible when used alone, the significant decrease in digestibility likely when they are used as the final increment of added fat will limit their economic value in most rations.

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