TECH NOTES

Supplemental Fat in Forage-Based Diets

Supplemental fat is often looked on as an energy source – even when it is fed at such low levels it can't make any meaningful impact on total dietary calories. Beyond this, though, fatty acid supply can also have a significant impact on rumen fermentation, and in some cases stimulate 'nutriceutic' effects. Unsaturated fatty acids in particular have anti-microbial properties, and when relatively high levels are fed, the bacterial population in the rumen shifts away from more susceptible – and in favor of more tolerant – species. This change (along with actual physical coating of roughage particles by feed fat) can negatively impact fiber digestion, alter end products of fermentation, and lead to the presence of specific fat intermediates that are biologically active.

Dietary fat as an energy source?

Fats and oils do contain at least twice the energy as an equal amount of digestible carbohydrate or protein, so fat inclusion does increase the energy density of the overall diet. However, a cow's energy supply is driven by both the amount of gross energy she consumes, and how well it is digested so that energy becomes available for her use. So anything that impacts intake or digestibility can have as much to do with plane of nutrition as the diet make-up.

A review of research presented at the 2009 Florida Ruminant Nutrition Symposium showed that:

- ✓ Fat begins substituting for forage (i.e., the animal eats less) if it is fed at more than 2% of the diet;
- ✓ If supplemental fat is >4% of the diet, the combined effects of decreased forage intake and reduced fiber digestibility will completely offset the "additional" energy brought by the fat.

At lower levels, the question is whether enough additional calories are being provided to really make a difference. If, for example, a cow eats two pounds of a 5% supplement, she is taking in just one-tenth of a pound of fat. In a liquid supplement, that fat is likely taking the place of molasses, so the only gain is the *difference* in energy contained in 1/10 of a pound of fat vs. the same small amount of molasses. That calculates out to about 0.14 mcal, which simply isn't much.

Specific Study Examples:

Oklahoma State University, 2011. Journal of Animal Science 89:3718

Cannulated steers (1400 lb) were fed hay and either no supplement, a soyhull supplement, or approximately 2.25 lb per day of high-linoleic or high-oleic sunflower seeds, which resulted in total diet fat levels of 2.0, 2.3, 6.2 and 5.5%. Dry matter intake was higher with the soyhulls than the sunflower seeds, and the high-fat supplementation resulted in decreases in fiber digestion. ADF

digestibility was 44.2% for the positive control (soyhulls) and 35.4 and 32.8% for the two high-fat treatments. Similarly, NDF digestibility was reduced from 45.4% to 40.2 and 37.9%.

University of Georgia, 2007. Journal of Animal Science 85:1330

Angus steers were supplemented with 0, 0.7, or 1.4 lb of corn oil per day (carried on cottonseed hulls) while grazing. These amounts correlated to 0.75 and 1.5 g of oil/kg body weight. Animals were fed individually with Calan gates. A marker was used to estimate dry matter intake and diet digestibility. Intake was depressed linearly (i.e., the more oil, the greater the decrease) for forage, total dry matter, and total digestible energy. The substitution rate of oil for forage was greater than one, meaning each unit of oil intake decreased grass intake by a greater amount. Digestibility of fiber and the overall diet was depressed by oil supplementation. The combination of reduced intake and digestion resulted in a 45% drop in digestible nutrients supplied by the forage when comparing the control to the higher oil feeding level.

	Corn Oil Level		
	None	**Medium**	**High**
Forage intake, lb	21.8	19.1	13.9
Total intake, lb (grass, hulls, oil)	28.8	27.9	23.1
Dry matter digestibility, %	57.65	55.14	51.24
NDF (fiber) digestibility, %	49.77	46.64	43.60

<u>Effects on reproduction: Feeding Fat Pre-partum</u>

A number of research trials have demonstrated improved reproductive performance (i.e., more cows cycling and breeding earlier) when low levels of fat were fed during late pregnancy. There have also been numerous reports that showed no response. The difference seems to be the status of the herd going into that last trimester. If cows are in borderline body condition, or have been stressed, the dietary fat appears to help jump start the system. Most positive responses seem to be found with fats that are high in linoleic acid (e.g. soybean, sunflower, corn, safflower), which is known to stimulate prostaglandin production. One role of prostaglandin is to help the uterus recover and prepare for subsequent rebreeding after calving.

<u>Effects on reproduction: Feeding Fat Postpartum</u>

In contrast, research suggests that feeding high-linoleic acid sources may be detrimental as the cow moves closer to breeding. Keep in mind that once a cow is settled, the embryo must secrete enough interferon to suppress prostaglandin production. Otherwise the pregnancy isn't recognized, and early embryonic loss results. While feeding fat after calving has had no impact on reproduction in most research, there have been several reports where pregnancy rates were actually reduced in cows receiving relatively high levels of dietary sources of linoleic acid prior to and during breeding.