

CONSULTANT'S DIGEST

She's Carrying A Calf Sooner, Thanks to Fat

Reproductive performance has declined significantly as average milk yield per cow has increased. The reason for lowered breeding efficiency: high milk yield's negative effect on energy balance. Cows tend not to ovulate and conceive during negative energy balance. The impairment of reproduction by negative energy balance continues for 60 days after cows reestablish positive energy balance.

Negative energy balance causes the mobilization of body fat which results in the accumulation of fat in the liver of early lactation cows. Field research has demonstrated that increased milk production does not result in reduced reproductive performance if fat does not accumulate in the liver¹.

Loss of more than 1.0 body condition score units during the first five weeks of lactation results in: 11-day increase in days to first ovulation (42 vs. 31), 26-day increase in days to conception (116 vs. 90), 36% decrease in first service conception rates (17% vs. 53%), and 19% decrease in conception rates for all services (42% vs. 61%)².

Research shows dietary fats, particularly digestible fats high in stearic acid,³ reduce body condition loss in early lactation and promote increased rates of body condition gain after peak lactation. If cows have proper body condition at calving and are provided a palatable, well-balanced diet to ensure maximum dry matter intake (DMI), chances for normal reproductive functioning are significantly enhanced.

Effect of Energy Booster 100® on Reproduction		
	Control (no added fat)	Treated (1.1 lb. added fat/cow/day)
Number of cows	138	115
Services/Conception	1.96	1.57*
Days Open	96.2	91.9
Days to First Service	80.9	80.4
First Service Conception Rate	42.6%	59.1%**
Conception Rate – All Services	40.7%	59.3%**

Adapted from Ferguson, et al., 1990. J Dairy Sci. 73:2864.
*Significantly different from control; $P < 0.05$.
**Significantly different from control; $P < 0.005$.

More research is needed to determine dietary fat's effect on hormones. All fatty acids result in increased progesterone which helps maintain pregnancy and prevent early embryonic loss. Some theories suggest that specific fatty acids may either decrease or increase prostaglandin $F_{2\alpha}$ levels. Increased prostaglandin $F_{2\alpha}$ can be detrimental to maintaining pregnancy while reduced prostaglandin $F_{2\alpha}$ can be detrimental to uterine involution and the reestablishment of normal ovarian cycling. Additionally, fat's effect on insulin secretion may enhance ovarian follicular development and fertility. So while more information is needed to clearly determine dietary fat's impact on hormones, the benefits seem to outweigh any negative effect.

Effects of Fats on Reproduction			
Fat Type	Amount	Pregnancy Rate, %	
		Control	Fat Fed
"Inert" fat	1 lb.	52	86
Energy Booster 100®	2.2%	86	93*
Calcium soaps	2.6%	62	82
	3%	45	10
Tallow	3%	44	62

Adapted from Table 2 in Staples et al., 1998. J Dairy Sci. 81:856. Includes all trials with significant effects on pregnancy rates except trials where fat source was fish meal. *Fat fed cows were 2.2 times more likely to become pregnant per breeding than control cows due to much higher conception rates for all services.

Absorption of Any Fatty Acid Appears to Account For All Reproductive Benefits

Some speculate that calcium soaps may offer more reproductive benefits than other types of dry fats due to a higher linoleic acid content. However, the same amount of linoleic acid is delivered to the duodenum for absorption regardless of the form (vegetable fat, free fatty acid, or calcium soaps) in which linoleic acid is added to the diet⁴.

Limited research suggests that specific fatty acids, primarily certain 20 carbon fish oil fatty acids but probably not linoleic acid, may have unique effects on hormone secretion. However, the benefits of these effects upon reproductive performance have not been demonstrated, the amount needed to be fed is outside of levels achievable with dry fats, and the effects observed may be due to other fatty acids⁵.

Improved reproductive performance from fat supplementation appears to result from the absorption of *any* fatty acid rather than the result of increased circulating linoleic acid.

Linoleic acid is not an essential nutrient for ruminants because ruminal bacteria synthesize more than what the cow needs. In fact, dietary linoleic acid is toxic to cows, resulting in reduced ruminal fermentation, reduced DMI, and impaired metabolic processes such as milk fat synthesis.

Fat Fast Facts

- Fat supplementation improves fertility through improved energy balance and possibly through modification of hormone secretion.
- Based on research to date, reproductive performance benefits from the absorption of *any* fatty acid rather than specific fatty acids. Fatty acid profile does not seem to make a difference.

¹Jorritsma et al., 2000. Theriogenology 54:1065.

²Butler and Smith, 1989. J Dairy Sci 72:767.

³Harvartine and Allen, 2002. J Dairy Sci. 85 (Suppl. 1):141.

⁴Fatouhi and Jenkins, 1992. J Anim Sci 70:3607.

⁵Staples et al., 1998. J Dairy Sci. 81:856.