Feeding FAT to Cows

Feeding vegetable fats during lactation can increase the number of cows that are cycling by breeding season.

BY HEATHER SMITH THOMAS

Cow nutrition is dependent upon adequate energy, protein, vitamins and minerals in a balanced diet, but research is showing that fat content in a cow's diet can enhance rebreeding success. A number of studies, some still ongoing, have been done on various aspects of feeding fat.

Gary Williams, reproductive physiologist at Texas A&M University, was one of the first to look into how feeding fat would affect beef cow reproduction.

While on the faculty at North Dakota State University (NDSU), Williams started examining how feeding fat affected reproduction. At that time, the focus was on the cholesterol metabolism of dairy heifers.

"During lactation, cholesterol concentrations in the cow's blood go very high — from a baseline of around 100 milligrams per deciliter to maybe as high as 300 milligrams per deciliter," Williams says. "There are some metabolic mechanisms unique to the cow that are probably driving this. It's not seen in other animals, and certainly not seen in humans."

When a cow is fed dietary fat, more cholesterol is synthesized and produced, Williams explains. "So if you feed it during lactation, you not only have the lactation effect in the cow, but you have a fat effect.

"One of the structures on the ovary that is present after ovulation, the *corpus luteum* (CL), is dependent on cholesterol in the blood to make progesterone," Williams continues. "It can't synthesize enough of its own to sustain itself." At NDSU, he and his colleagues were studying that progesterone relationship, thinking they could enhance its function.

"We did elevate circulating levels of progesterone during the luteal phase (or middle of the cycle) when we fed fat continually to cattle, but while it was interesting information, it didn't necessarily answer everything we wanted to know, and it wasn't that earth-shattering," he admits.

PHOTOS BY SHAUNA ROSE HERMEL

Research indicates feeding vegetable fat to cows after they calve will improve follicular development and increase the number cycling at the start of breeding season.

Williams continued his research with beef cattle when he moved to Texas A&M 16 years ago.

Enhancing follicular growth

"The crux of the matter is that, when you feed a vegetable oil (a polyunsaturated fat) to a ruminant — in this case a cow — you create several metabolic changes," he says. For example, you change rumen fermentation patterns to favor propionic acid, a volatile fatty acid. You also elevate the insulin, which is involved in carbohydrate and glucose metabolism.

"The cow doesn't use very much glucose; her circulating glucose levels are fairly low compared with monogastric animals (like humans)," Williams explains. "The cow relies more heavily on fatty acids produced in the rumen, though the central nervous system has to have glucose to function."

But, he adds, insulin has direct effects on reproductive tissues, particularly the ovary. Insulin-like growth factor (IGF-I) — a hormone involved in the development of ovarian follicles' CL function — also is elevated within the ovary when cows are fed vegetable oils long term. Growth hormone is elevated in studies with beef cattle.

"The bottom line, however, is that you enhance the growth of ovarian follicles when feeding vegetable fats," Williams says. "We've measured all these hormonal and metabolic changes. We've taken ovaries out

and grown the cells in culture and done all kinds of fancy things to document the physiology, but the end result is that, if you feed fat to cows in marginal body condition [body condition scores (BCS) of 4 or higher on a scale of 1 to 9], you will generally be able to derive a reproductive benefit. You will enhance ovarian follicular development. If you are feeding this during the rebreeding period, or from the time of calving until the onset of the breeding period, you will see more cows cycling."

Generally the most difficult to get rebred, first- and second-calf heifers usually benefit most from a fat supplement before their breeding season.

Not just energy

Williams says it is important to realize the difference between the energy value and the metabolic effects of fat. While dietary fat can provide energy to an animal in poor condition, that's not the effect he is describing. He provides this example: If you feed one group of cows a starch-based supplement (corn) containing the same amount of energy and equal calories as a second group of cows receiving fat, you will see all of the metabolic changes and the enhancement in the fat-supplemented animals that you don't see in the control group.

"So it is the metabolic effects of fat and the hormonal changes you create that seem to be driving these changes at the level of the ovary — and not just the energy," he says, adding that the phenomenon has been confirmed in several other studies in the United States and abroad.

Williams also notes a greater benefit with polyunsaturated fats (vegetable oil) than with saturated fats or highly polyunsaturated fats (like fish oil), though he says there is a benefit to feeding saturated fat.

"With saturated fat you'll get similar effects on growth hormone, but since it's more of a bypass fat (not acted on in the rumen), you are not going to have much effect on rumen fermentation processes unless you simply overload the rumen and disrupt the digestion process," he explains.

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To date, researchers haven't been able to use the metabolic effect of fat to reduce age at puberty in heifers or to increase superovulation rates, Williams says.

Feeding recommendations

He recommends feeding cows or heifers fat levels of about 4% of total dry matter. For a mature, 1,100-pound (lb.) cow, that equals about 0.8-0.9 lb./day, which translates to about 3.5 lb. of whole cottonseed or 1.5-2 lb. of high-oil-sunflower seed. Commercial feed companies also promote high-fat supplements. Whole soybeans will work, but soybean meal or cottonseed meal won't because the oil has been lost in processing.

In discussing supplements, he says everything boils down to economics. Cows calving in excellent body condition or grazing good forage where they are not going to lose condition won't need the supplement.

"Fat supplements are intended for situations where you are definitely going to be supplementing anyway," Williams says.

Don't ignore everything that's known about supplementing cattle on pasture, he warns. Supplements are generally used to allow cattle to utilize a lower-quality product or forage. They've got to contain protein, and perhaps some vitamin-mineral supplement, to allow cattle to do that.

To gain the reproductive benefits indicated in his research for cows of BCS 4 or higher, Williams recommends supplementing fat beginning a month before the breeding season starts and continuing for at least a month into the breeding season.

"It takes at least three weeks of feeding to get the changes to be able to measure metabolic, hormonal and ovarian changes," Williams says. "And it takes six to seven weeks to maximize those benefits."

Depending on the time of year, continuing for a month into the breeding season might not be feasible. If you have a lot of green grass, the cows may not eat the supplement. "If they won't eat it, they don't need it," Williams says.

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"If you want to intensify your breeding management and get as many cows cycling as early as possible, the fat addition to the supplement for a limited period of time is beneficial," Williams says. "We're not promoting that anybody go out and feed high levels of fat to cattle year-round; it's just a limited window of time that it might be beneficial."