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by **Steve Suther**

If you want your calves to be all they can be, you have to start early and think at the cellular level. Genetics can make it easier or more difficult to hit a high-quality target. But, growing evidence suggests the environment may be five times more important.

Animal scientists at Ohio State University (OSU) and the University of Illinois (U of I) make a case for getting calves on a high-grain diet not merely for their last 100 days, but starting after their first 100 days.

As young calves grow, says Steve Loerch of OSU, their environment determines how many potential fat cells (preadipocytes) are switched on, how large those adipocytes grow, and whether they become intramuscular (marbling) or external and seam fat.

Marbling begins much earlier than the traditional models convey, says Larry Berger, U of I ruminant nutritionist. “Early animal nutrition is a key to better beef. We need to change the dogma that says fat development must be in the order of internal, subcutaneous, intermuscular and, only then, intramuscular. There are things we can do to alter that.”

One of those things is early weaning and swift transition to a feedlot ration that is at least 75% grain-based. Feeding more grain encourages the rumen to produce more propionate, a volatile fatty acid that is converted to glucose in the liver. Insulin production is stimulated

in the pancreas by increased levels of propionate and glucose. Insulin helps reduce fat release from body fat stores; thus, more intramuscular fat deposition is likely to occur.

“It is crucial to start and keep a high-propionate fermentation going in those calves to generate glucose early and often,” Berger says. Rumen fermentation yields volatile fatty acids, mostly acetate from forage, but twice as much propionate from grain.

Why propionate?

More than 20 years ago, research established that acetate is responsible for 75% of the subcutaneous fat, but only about 20% of marbling. Conversely, glucose from propionate reactions accounts for no more than 10% of backfat, but up to 75% of marbling deposition.

Marbling is maximized when the greatest possible numbers of potential fat cells are converted to adipocytes by propionate rather than acetate. The die is cast well before the average age when calves enter feedlots, and if acetate created most of the fat cells, they will grow as waste fat rather than marbling, Berger explains.

“Growing cattle on pasture or silage won’t increase later marbling

scores, but could set a course for external fat growth,” he notes. What’s more, Illinois

research published last year suggests the high levels of vitamin A and D₃ that cattle take in from summer-grazing programs also limit marbling deposition.

Comparisons of early-weaned calves with their long-yearling siblings, as well as creep-feeding studies, support the existence of an early window for marbling deposition, given proper nutrition. Real-time ultrasound studies also point to higher propionate fermentation in early-weaned calves, compared to calves that were weaned traditionally, Berger says. But, much depends upon postweaning nutrition — it takes high starch, not just high energy. Not even lush grass will foster the propionate reactions needed for early marbling deposition.

“If, after weaning, traditional 7-month-old calves go on to a lower plane of nutrition, studies suggest the calves go backwards in marbling as adipocytes are depleted,” Berger adds. Go-slow growing programs could be a waste of time and marbling potential. Evidence does not support theories that calves need more age to grade. “Calf-feds had 0.2 inch less backfat at the same marbling score,” he says, “or a full marbling score better at the same yield grade as yearlings.”

In the beginning

Nutrition and health management factors start with the pregnant cow. “Colostrum intake the first two days provides for passive immunity until about 5 months of age,” Loerch says. “The vaccination program on the cow is critical for her ability to pass that along to her calf in colostral immunoglobulin.”

Early weaning allows for a transition to

CONTINUED ON PAGE 170



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High-Propionate Glow CONTINUED FROM PAGE 169

independent living while still under that immunity umbrella, but special care must be taken to manage stress. Loerch sets the scene.

“As calves leave the pasture where they are deriving most of their nutrition from their mamas and grazing, they have to find new sources of feed and water. Many have never been exposed to corn, distillers’ grains or other feed — they have no idea what those things are. We have commingling in most situations, exposure to new pathogens, transportation and its associated environmental stress.”

Fortunately, most early-weaned calves are retained by their owner. “There is very little incentive to wean at three or four months and send them off to sell,” Loerch says. “They may have some pathogen exposure, but they avoid the stress associated with marketing and transportation, and they generally have some preconditioning, vaccination and bunk-breaking.” Facilities may need remodeling to work well for smaller animals, he adds.

Producers may worry about the efficacy of vaccinating young calves because of maternal antibody interference. “That should not be an excuse to forego preconditioning vaccinations in early weaning,” Loerch says. “The effect is mainly at 2 months of age, and if they don’t get the full benefit the first time, they will get it from the booster at weaning — it is always a good idea to vaccinate prestress.”

Early weaning has not resulted in a need for more treatment than conventional weaning, Loerch says. “But, when you do need to treat, it only takes half the dose for a 300-pound calf compared to a 600-pounder,” he notes. Calves should get another booster at 7 months of age if they will be exposed to calves from another facility. The booster should be administered a couple of weeks prior to commingling.

Avoiding stress

From the standpoint of immune competency, traditional weaning is “the absolute worst time,” Loerch says. “Earlier in life, calves are protected by passive immunity. Once you get to 9 months, the calves have been exposed to more pathogens and have a more rugged immune system. Natural immunity has developed, so they are less susceptible to bovine respiratory disease (BRD).”

Weaned at any age, calves perform relatively poorly the first week. OSU fistulated calves to discover why. “We thought it could be lower rumen microbial

numbers, resulting in a lower percentage digestion,” Loerch says. “But the opposite was true. We found 73% digestion efficiency at Day 7, down to 60% at Day 21. It was because intake was increasing. The main problem that first week is low feed intake.”

That means there is no reason to “limit-feed” calves, but bunks must be clean each day. Whole-shell corn works well as the basic component in rations for early-weaned calves, Loerch says. “We have not had problems with overeating or acidosis.

“We don’t know if grain processing would affect the results, but whole-shell corn is more readily consumed and seems to act like a time capsule, releasing starch to the rumen more slowly,” he continues. Higher crude protein (CP), even 20%, can be justified that first week for weanlings of any age, he adds.

To lessen the stress of weaning while kick-starting propionate fermentation, beef specialists suggest providing creep feed or general grain supplementation where cows can show this source of feed to their calves. Trainer cows penned with calves at weaning also have a calming effect the first few days.



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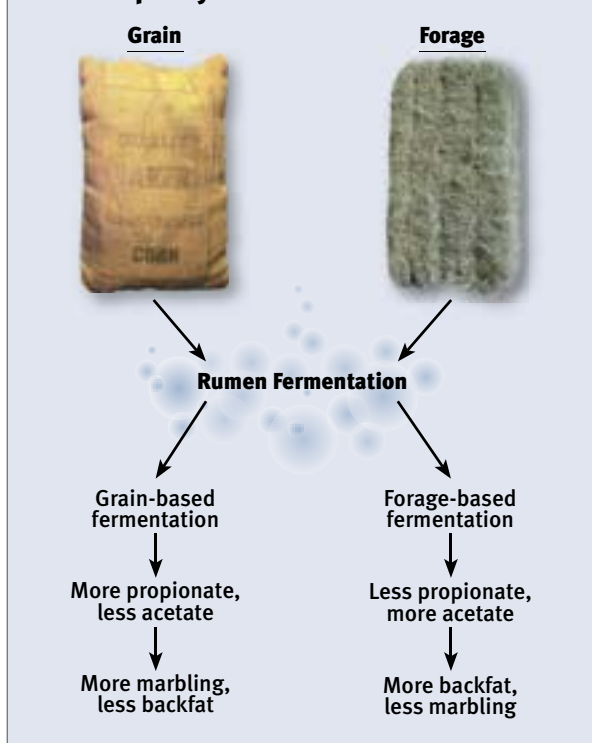
Creep ideas

“There has been some resistance among producers to the idea of early weaning, so we have looked at alternative strategies,” says Dan Faulkner, U of I Extension beef specialist. “We know that, on average, you can add a full marbling score with 100 days of high-propionate fermentation. Creep-feeding can provide that.”

But not just any creep feed.

U of I researchers looked at varying protein and starch levels in creep feed and their subsequent effects. There were feedlot and carcass advantages to feeding Angus-cross calves 20% and even 30% CP creep vs. 10% protein — but all creeped calves beat the control test group. “These were excellent-quality calves, and all made about 95% Choice,” Faulkner says. But, the calves that never received creep feed achieved 49% Certified Angus Beef® (CAB®)-acceptance rates, while the other groups averaged more than 70% CAB and Prime.

Fig. 1: Effects of grain and forage diets on carcass quality



It is important to use a corn base rather than soy hulls or other alternative to high concentrate, Faulkner says. “We tried one ‘corn-based’ creep that was only 25% corn,” he notes. “We were not surprised to see no effect.”

Starch is the most important input needed to improve quality grade, Faulkner stressed. “But, we see some benefit from higher protein creep as well; calves on 13% crude protein creep made 41% CAB, and those on 16% protein made 65% CAB,” he says.

Overall, the use of creep feed did not reduce feedlot performance, but resulted in heavier final carcass weights and higher quality grade. Some of that could be due to far superior health. A two-year study of three management systems showed only 1.2% morbidity in early-weaned calves. It showed a comparable 3.6% morbidity in creep-fed calves weaned at 7 to 8 months. But, there was 28.6% morbidity in the control calves that received no creep.

“We don’t know how long you need to creep-feed to get that health benefit, which will be increasingly important in ‘natural’ beef programs,” Faulkner says. But again, 100 days on a high-grain creep can move calves up by a full marbling score.

Author’s Note: For more on how to feed beef cattle for high-quality targets, visit <http://adsa.asas.org/recordings/2005/midwestern/#>. This site contains the audio and PowerPoint® presentations of a symposium sponsored by CAB at the 2005 American Society of Animal Science Midwestern Section meeting in Des Moines, Iowa.