Strategies for Attaining Marbling

The market needs twice as much premium Choice and Prime beef. How can we produce it?

Commentary by
HARLAN RITCHIE

Research tells us marbling is a key to beef's eating quality. Maybe that's why, in a recent study, consumers were willing to pay 50% more for USDA Prime steaks than for lesser-marbled Select-grade steaks [$3.66 per pound (lb.) vs. $2.44 per lb.].

The pricing signals have reached producers. Feedyards pay more for cattle known to have the potential to grade mid-Choice or higher. That's because packers pay more for such cattle.

Demand for highly marbled beef for upscale restaurants and retail stores may account for 30% of the U.S. beef market. All of this begs the question, "What can producers do to hit this high-quality market target?" Let's address it by topic.

Breed/biological type

The scientific literature is clear: British breeds have a greater ability to marble than Continental- and Brahman-influenced breeds. Among British breeds, Angus, Red Angus and Shorthorn lead in that ability. The only breed that can beat them in marbling is the Japanese Wagyu.

Recent research showed that as Angus breeding increased from 25% or less to more than 75%, the share of cattle qualifying for mid-Choice or higher premiums increased markedly from 11.4% to 37.1%. That increase was worth $37.29 per head. Similar marbling results would be expected with Red Angus or Shorthorn breeding.

Extremes in biological type are difficult to fit into the high-quality beef market. Very large-framed, late-maturing biotypes are apt to produce overweight carcasses by the time they reach mid-Choice, resulting in severe discounts. Some small-framed, early-maturing biotypes may produce underweight, overfat carcasses.

Feedyards pay more for cattle known to have the potential to grade mid-Choice or higher. That's because packers pay more for such cattle.

Genetic selection

Marbling is moderately to highly heritable, so you can make significant progress within breeds using expected progeny differences (EPDs). By selecting sires with marbling EPDs well above breed average, a couple of generations can make a noticeable difference — especially using highly proven sires.

When selecting for a specific trait, consider if any other important traits are antagonistically correlated. Science finds no major antagonisms between marbling and growth traits. In fact, some studies have shown a positive correlation.

On the carcass side, increased marbling may be correlated with increased external fat and a higher numeric yield grade, which would be an antagonism. On the other hand, marbling may be related to "easier-keeping" cows, especially advantageous where feed resources are limited.

Extreme single-trait selection for marbling could eventually result in cattle that are lighter-muscled, fatter and have a lower percentage of retail product. This can be avoided by the strategic use of balanced EPDs.

Health and disposition

Iowa State University (ISU) reports based on the Tri-County Steer Carcass Futurity (TCSCF) measure the dollar effect of calf

Table 1: Partial list of growth implants classified by relative potency[a,c]

Potency Level[b]	Animal application	Days	Physiological effect
Low potency:			
Ralgro®	steers, heifers, calves	50-75	estrogenic
Synovex® C	calves	50-75	estrogenic
Component® E-C	calves	50-75	estrogenic
Moderate potency:			
Compudose®	steers, heifers, steer calves	150-120	estrogenic
Encore®	steers, heifers, steer calves	400	estrogenic
Component® E-S	steers	80-120	estrogenic
Synovex® S	steers	80-120	estrogenic
Component® E-H	heifers	80-120	estrogenic & androgenic
Synovex® H	heifers	80-120	estrogenic & androgenic
Magnum™	steers	80-120	estrogenic
Revalor®-G	pasture steers, heifers	60-80	estrogenic & androgenic
Finaplix®-H	heifers	60-100	androgenic
Component® T-H	heifers	60-100	androgenic
Component® T-S	steers	60-100	androgenic
High potency:			
Component® TE-S	steers	80-120	estrogenic & androgenic
Revalor®-S	steers	80-120	estrogenic & androgenic
Synovex® Plus™	steers, heifers	100-140	estrogenic & androgenic
Revalor®-H	heifers	80-120	estrogenic & androgenic

[a]Adapted from Pritchard (2005).

[b]Relative classification based primarily on dosage.

[c]Intended as a reference point when formulating implant strategies for cattle intended for harvest.

Editor's Note: *White paper available at* http://www.cabpartners.com/news/research/index.php.

health and postweaning disease on feedyard performance and carcass traits. Calves that required two treatments were worth $201.16 per head less than healthy calves, and those needing one treatment were worth $85.02 per head less. Differences were in mortality, treatment cost, gain, quality and yield grade, and incidence of dark cutters.

Those variables were also compared by disposition. On arrival at the eight TCSCF Iowa feedyards, calves were classified as docile, restless or aggressive. The most ill-tempered calves were lighter at the start, gained less, had higher mortality rates and treatment costs, and reduced quality grades and *Certified Angus Beef*® (CAB®)-acceptance rates compared to docile and merely restless calves.

Overall, docile calves returned $13.13 per head and $62.19 per head more than restless and aggressive calves, respectively. Only 59% of aggressive calves graded Choice or higher, compared to 74% of docile calves.

Early weaning

Research shows weaning calves early — at 75 to 150 days of age — and placing them on a high-energy, high-starch diet can increase marbling levels compared to calves weaned conventionally. Early-weaned calves are more susceptible to disease than calves weaned conventionally, so they must be closely observed and treated promptly if necessary.

Compared to calves weaned conventionally, early-weaned calves on such a high-energy diet have equal or greater body weight at 205 days of age. Feedlot average daily gain (ADG) and carcass weight tend to be slightly lower, yield grade is similar, and percent of carcasses grading mid-Choice or higher is greater.

An Illinois study showed that early-weaned calves harvested at 16.5 months were 20% more efficient on feed at any marbling end point than calves weaned conventionally and harvested as long yearlings at 29 months. Costs of early weaning may be greater than for conventional weaning, but they are offset by reduced cow feed costs. When early weaning eliminates the stress of lactation, cows gain condition; if weaning is prior to breeding season, pregnancy rates can be increased.

Whole-shelled corn works well in early-weaning diets along with supplements to contain 16% protein until the calves weigh 600 lb., after which protein can be reduced to 12.5%. Ionophores reduce the risk of acidosis and bloat. Calves can be implanted 100 days apart with low-dose estrogenic implants, followed by a combination estrogen-androgen implant for the last 120 days.

Creep-feeding

Extensive studies at the University of Illinois have shown that getting nursing calves to consume a high-energy creep diet as early as possible will enhance marbling deposition. Calves need to be on creep for at least 80 days, and the diet should be based on corn or other high-energy grains, rather than high-fiber feedstuffs. Again, whole-shelled corn works well. In one trial, calves grading mid-Choice or higher were fed as follows: corn-based creep, 55%; soy-hull-based creep, 34%; control, 28%. Corn-based creep also produced the heaviest carcasses.

Note that heifer calves destined for replacements should not be creep-fed, as future milk production may be reduced by 25%.

Calf feds

For many years, it was believed that cattle fed and harvested as yearlings had more marbling and graded higher than calf feds. Recently, a number of studies have shown this does not hold true. In these studies, calf feds have had marbling scores and USDA quality grades that were equal or superior to those of yearlings.

Season

Seasonal effects on quality grade are well-documented. The percentage that grades Choice or higher generally increases in the spring and peaks in April before declining to a low in October. The trend is related to the diets that cattle are fed for four to six months prior to harvest. Cattle harvested in the fall often enter the feedlot after coming off lush pastures that have extremely high concentrations of vitamin A, which can slow down marbling deposition.

High-oil corn

Corn has been developed that contains twice the oil content of conventional corn. A University of Georgia study found that feeding dry-rolled, high-oil corn in finishing diets for 93 days increased marbling score and the percentage of cattle grading Choice from 42% to 72%. Furthermore, the percentage of carcasses that qualified for CAB was greater for high-oil corn than conventional corn (32% vs. 16%, respectively). ISU researchers also observed an increase in the percentage of carcasses grading Choice when whole-shell, high-oil corn was fed (57% with high-oil feed vs. 43% with conventional feed).

Restricted growth

An extended period of slowed growth after weaning has been shown to reduce eventual marbling and quality grade in the carcass. Research has not pinned down the minimum ADG below which marbling is at risk, but it is thought to be 1.0 lb. per day for British and 1.25 lb. per day for Continental breeds. Presence of a growth implant during a slow-growth period would further compromise grading potential.

Growth implants

Growth-promoting implants can improve ADG by as much as 20%, improve feed efficiency by 10%, and increase carcass weight substantially when harvested at a constant age or feeding period. When cattle are harvested at a constant body weight, carcasses from implanted cattle have a greater lean-to-fat-ratio.

However, if appropriate implants are not administered at the appropriate times, there can be a reduction in marbling. Recent studies indicate marbling deposition begins early in life, so implanting should be delayed until an animal is consuming enough energy above maintenance and growth to accommodate marbling deposition. The initial implant should not be a high-potency product (see Table 1).

An extended period of slowed growth after weaning has been shown to reduce eventual marbling and quality grade in the carcass.

South Dakota State University has developed guidelines for implanting cattle destined for high-quality markets.

Backgrounding programs. Where ADG is 1.75 lb. or less, do not use an implant. If ADG is targeted at 1.75-2.25 lb., use a low-potency implant with a payout window of 50 to 80 days. If ADG is greater than 2.5 lb., use a moderate-potency implant with a window of 80 to 110 days. For large-framed steers, increase ADG targets by 0.25 lb.

Previously weaned 575-lb. calves to be fed for 200 days. Use a low-potency implant with a 60- to 70-day window followed by a high-potency implant.

Backgrounded 650-lb. steers to be fed for 150-160 days. In lower energy finishing programs [less than 0.58 megacalories (Mcal.) net energy for growth (NE_g) per lb.], use two moderate-potency implants, at least 75 days apart. For lesser-conditioned cattle, use a low-potency implant (50 days) followed by a high-potency implant. For cattle in good condition, use a moderate-potency implant followed by a high-potency implant.

Young 750-lb. cattle to be fed fewer than 140 days. If cattle are well-fed throughout their lives, implant strategies can be aggressive to increase carcass weight. A strategy using a low-potency implant (50 days) followed by a high-potency implant works well. If cattle are of good flesh, a single high-potency implant could be used.

Older 750-lb.-plus cattle fed fewer than 130 days. If substantial compensatory growth is expected, these cattle may not be suited for a high-quality program. Delay any implanting until cattle are clearly on full feed. With limited days remaining, use a moderate-potency implant.

Organic and natural beef production programs do not permit the use of implants. When considering such programs, weigh the potential premiums against additional costs involved, including that of not implanting. A Colorado State University analysis puts the reduction in returns from not implanting at $25 to $80 per head.

Feed additives

Feeding an ionophore (for example, Rumensin,® Bovatec® or Cattlyst®) is an economical means of improving ADG and feed efficiency, as well as reducing the risk of acidosis and bloat. Cost is a few cents per head per day, but may improve ADG by 3% to 5%, and feed efficiency by an average of 8%. Benefits accrue in addition to any received by implanting. There is no evidence that ionophores have a negative effect on marbling deposition.

Melengestrol acetate (MGA) is a feed additive approved for use in feedlot heifers to suppress heat and improve performance. On average, it will increase ADG by 3%-5% and feed efficiency by 4%-8%. MGA has no influence on marbling deposition.

Ractopamine (Optaflexx®) is approved for feeding during the last 28 to 42 days of finishing, at 100 to 300 milligrams (mg) per head per day. At the recommended level of 200 mg, research shows weights increase with no increase in feed intake, resulting in a 15% improvement in feed efficiency. Ribeye area is increased by 0.4 square inches (sq. in.); fat thickness is not affected so yield grade is slightly lower. Marbling is not affected, nor is tenderness, except at the 300-mg level.

Editor's Note: *Harlan Ritiche is a distinguished professor of animal science at Michigan State University.*