YOUR LINK TO

by **RON BOLZE,** *director of genetic programs, Certified Angus Beef LLC*

Milk, for all it's worth

It's tough to decide which production traits to select for and how much emphasis each deserves. That's because there are so many, and their relative importance varies with environmental, management and economic conditions.

To make matters worse, some traits are genetically antagonistic – if you improve one, another deteriorates. That means negotiating compromise, which does not come easy. Using a question-and-answer format, let's explore the genetic antagonisms of milk production vs. reproduction and maintenance requirements.

***Q:** What is the relative economic importance of reproduction in beef production?*

***A:** R.A. Long (1993), while at Texas Tech University, answered that by listing the traits of an ideal cow: (1) reaches sexual maturity early, (2) cycles and conceives early, (3) calves unassisted by her second birthday, (4) calves every 12 months thereafter for at least 10 years (longevity), (5) fleshes easily on minimal feedstuffs, and (6) weans sufficient pounds of calf to exceed annual cow cost. The first five are closely tied to reproduction; the last, to milk production.*

In the competitive world of high-quality protein production, the slow rate of reproduction in cattle is the greatest handicap, and it is difficult to find cows that produce a calf every 12 months for 10 years.

Nearly 30 years ago, Richard Willham, Iowa State University, reported an economic relationship ratio of 10-to-5-to-1 for reproduction, growth and carcass cutability. That may differ today [2-to-1-to-1 (Melton, 1995) or 4-to-2-to-1 (Schiefelbein, 1998)] as the industry responds to emerging value-based marketing concepts. While Angus producers continue to place selection emphasis on growth, opportunities lie in the other two areas: reproduction through maternal efficiency and carcass merit driven by pricing grids with significant premiums for Certified Angus Beef ™ (CAB®) acceptance.

***Q:** Do heavier-milking cows produce heavier calves at weaning?*

***A:** Of course, but beef cows only produce as much milk as calves consume. Milk-producing potential decreases until the calf can consume all the cow produces. The cow's maximum production is controlled by calf intake early in lactation, so few beef cows produce milk to their maximum genetic potential. In other words, there's a practical limit to the potential of genetic selection for changing beef-cow milk production.*

***Q:** Do heavier-milking cows have lower reproductive efficiency (longer postpartum intervals and lower fertility)?*

***A:** That depends on your resources and the cows. Peak lactation occurs four to six weeks postcalving – right when cows must return to estrus and rebreed to maintain a 365-day calving interval. If the milk output raises a cow's nutrient requirement beyond what she can eat to maintain both body weight and milk production, she will mobilize fat reserves for maintenance. Cows losing weight have longer postpartum intervals and lower conception rates than cows gaining weight prior to breeding.*

Peak milk production for most beef cows is less than 26 pounds (lb.)/day, and that doesn't exceed the cows' limit for feed intake in most environments. However, there is potential for trouble in certain cases, such as inadequate supplementation, overgrazing or drought.

More milk is associated with greater inherent fertility; it's just that heavier-milking cows have greater demands placed upon them, in competition for the energy needed for good fertility. Nebraska research indicated the level of milk production had no effect on reproductive performance. The environment (grazing and stored feeds) fulfilled the nutritional requirements of all three milk groups in that study to allow similar expression of reproductive efficiency. If the environment falls short, extra energy can be provided through supplementation, but producers must consider its cost-effectiveness.

***Q:** Do heavier-milking cows have higher nutritional requirements?*

***A:** Obviously they require more feed. Table 1 indicates an extra 1.5 lb./day total digestible nutrients (TDN) are required when peak milk production increases from 12 lb. to 18 lb./day.*

Increasing peak milk potential of a 1,100-lb. cow from 10 lb./day (average) to 20 lb./day (superior) raises her daily requirement for energy by 25%, for protein by 30%, for phosphorous by 25% and for calcium by 40% [National Research Council (NRC), 1984]. Simply increasing intake will generally meet the needs of bigger cows, but meeting the needs of increased milk production may require increasing both intake and diet quality (see Table 2).

***Q:** Do heavier-milking cows have increased maintenance requirements?*

***A:** Yes. Up to 75% of all feed energy for beef production (cow-calf, backgrounding and feedlot) is used for maintenance. The cow herd alone uses up to 75% of this energy, so about 50% of energy required for beef production is used for cow maintenance. In the previously cited Nebraska research, high-milk cows required more energy to maintain body weight, not only during lactation, but also during the dry period (see Table 3). That's largely because of the greater mass of their viscera.*

Even though high-milk cows weaned 40-lb.-heavier calves, the increased energy

Table 1: Relationship of frame score and hip height to mature cow weight and energy requirements following weaning and during peak lactation

			TDN, lb./day		
				Lactation	
Frame score	Cow height, in.	Mature cow weight, lb.	Postweaning	12 lb./day	18 lb./day
1	44	880	7.4	11.6	13.2
2	46	955	7.9	12.0	13.7
3	48	1,030	8.3	12.6	14.2
4	50	1,100	8.7	13.1	14.7
5	52	1,175	9.2	13.6	15.2
6	54	1,250	9.6	14.1	15.7
7	56	1,320	10.1	14.6	16.1
8	58	1,395	10.5	15.0	16.6
9	60	1,470	10.9	15.5	17.0

Source: adapted from Fox et. al., 1988.

requirements made them less efficient per pound of weaned calf than the low-milk type.

***Q:** Do heavier-milking cows differ in biological or economic efficiency?*

***A:** A Colorado State University (1987) computer model consistently predicts low-milk cows as more biologically and economically efficient. In Nebraska research comparing these efficiencies for low-, medium- and high-milking cows to weaning and to harvest, low-milk cows were the most efficient, especially when based on harvest (total pounds) of finished calves.*

***Q:** Do heavier-milking cows affect stocking rates under range conditions?*

***A:** A given area of land can support only so much nutrient demand. Table 4 shows suggested variations in herd sizes for cows differing in weight and peak milk production.*

If larger, heavier-milking cows wean proportionally heavier calves, total beef production per acre may remain constant; but with lower value per pound, total beef-per-acre value drops.

***Q:** Does it make sense to match genetic milk potential to environmental resources?*

***A:** Yes and no. Diverse cows will rerank themselves for efficiency and profitability in different production environments. Producers must find cows with the milk potential that performs most economically in their own system. This implies that high-milk types fit better in high-rainfall environments that provide abundant grazeable and inexpensive stored-forage resources. In contrast, low-milk types are the only ones that will perform in desert conditions requiring extensive travel for sufficient intake.*

A single, uniform genotype for milk potential may fit a broader area, considering the industry's response to emerging value-based marketing concepts. Except for portions of the South and in desert regions where a degree of Brahman influence or extreme low-maintenance cattle may be required, most of the continental United States could justify using the same genotype with mere adjustments in stocking rate to account for differences in feedstuff availability. Reducing genetic variation in this manner would have immeasurable positive effects on industrywide attempts to produce greater uniformity, consistency and consumer acceptance of beef.

***Q:** What are some of the indicators that cows are mismatched with the environment for their genetic potential for milk production?*

***A:** Look at measures of reproductive efficiency and cow body-condition scores (BCS):*

1. *Decreased pregnancy rate over time, assuming a defined breeding season for reproductive pressure, and constant nutrition (supplementation could mask a mismatch);*
2. *Later conception dates resulting in later-born calves and lighter weaning weights;*
3. *Shift in calving sequence with increasing percentage of calves born during later 21-day periods of the calving season;*
4. *Excessive loss of young females from the herd due to reproductive failure;*
5. *Failure of heifers to reach puberty prior to their yearling breeding season and subsequent failure to breed early, resulting in reproductively risky, late-calving 2-year-olds; and*
6. *Failure of mature cows to maintain flesh (BCS) under adverse conditions (drought).*

Summary

Reproduction is at least twice as important as growth or carcass characteristics – every cow must wean a calf every year.

Heavier-milking cows

- *produce heavier calves at weaning;*
- *have similar reproductive efficiency if nutrients are available;*
- *have higher nutritional needs that could require supplementation;*
- *have higher maintenance requirements year-round (viscera);*
- *tend to be less biologically and economically efficient, especially if calves are retained until harvest; and*
- *demand reduced stocking rates to fulfill nutritional requirements. Increased calf weaning weight from heavier-milking cows may not justify the cost of additional supplementation.*

End-product uniformity, predictability and consumer acceptability may demand reduced genetic variation through less genotypic diversity.

Table 2: Effect of cow size and milk-production level on feed intake [dry-matter intake (DMI)] and feed quality (%TDN)

Cow weight, lb.	Avg. milk DMI	Avg. milk % TDN	High milk DMI	High milk % TDN
1,000	20.2	57	20.6	67
1,200	23.0	56	23.8	64
1,400	25.6	55	26.7	62

Source: NRC, 1984.

Table 3: Maintenance requirements of high- and low-milk beef cows

	Low-milk	High-milk
Milk production	18.8 lb./day	23.2 lb./day
Adjusted body weight	1,140 lb.	1,102 lb.
Maintenance requirement (kcal ME/kg 75/d)		
During lactation	130.5	143.5
Dry period	108.5	118.5

Table 4: Effect of cow size and milk on herd size and production for given land area[a]

Cow weight, lb.	Peak milk	Herd size	Calf wt., lb.[b]	% of cow wt.
1,030	18	100	510	49.5
1,170	18	92	553	47.3
1,320	18	86	596	45.2
1,170	24	84	605	51.7
1,320	24	79	646	48.9

a Source: adapted from Fox, 1988.

b This measurement was needed to equal production from a 100-cow herd of 1,030-lb. cows weaning 510-lb. calves. It assumes 90% calf crop for all weights and levels of milk.