Selection for Growth, Milk and Beef Performance

by Larry A. Nelson, Animal Sciences Department, Purdue University

A cattle breeder recently asked if milk and beef traits were correlated. Unfortunately, we do not have well-documented answers regarding the genetic correlations between milk and beef traits in cattle, but we can probably "ballpark" them as given in Table 1.

A "+" correlation indicates a positive genetic relationship between two traits, i.e., an increase in milk yield is associated with an increase in quantity of lean. On the other hand a "−" correlation indicates that as growth rate increases, quality tends to decrease slightly. Carcass quantity is defined as the amount of retail cuts (salable meat) per day of age in the carcass. Carcass "quality" is synonymous with U.S. beef grades,

TABLE 1. GENETIC CORRELATIONS

Trait	Carcass		Mature size	Growth rate
	Quantity	Quality		
Milk yield	+	0	+	+
Growth rate	+ +	−	+ + +	
Mature size	+ +	−		

+, slight positive; + +, moderate positive, + + +, large positive; −, slight negative; 0, zero correlation.

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which are highly associated with marbling (intramuscular deposits of fat). Oftentimes when selecting for greater milk yield, we indirectly select for slightly faster growth rate, larger mature size, slightly lower fertility, more pounds of lean, lower fat content of the meat and an animal that appears to be "less beefy," less muscular, more "dairy like," or however you wish to say it. On the other hand, if one selects for "beef character" (greater apparent thickness), the usual correlated responses are less rapid growth, smaller mature size, fewer pounds of salable meat at a constant age, higher fat content of the lean at a constant live weight and lower milk yield.

Much of the confusion stems from our human inability to visually evaluate muscle (lean) content of the live animal. Tall animals appear to be more thinly-muscled (more "dairy like") because their muscles are stretched over a larger skeletal frame. Just the opposite is true with a shorter-bodied animal that is not as tall. They appear to have more "beef character" because their muscles are shorter. However, when you slaughter both animals, research has shown very little difference in percentage salable meat of carcasses from "dairy type" versus "beef type" animals. Also, muscle distribution within the carcasses of cattle of widely diverse types is nearly identical. Data from the Roman L. Hruska U.S. Meat Animal Research Center (1982) revealed that steers of 15 different breed crosses all had 24 to 25 percent of the retail product in the rib and loin (the highest-priced cuts) at a constant carcass weight. The sketches in Figure 1 demonstrate some of these points.

In the past 25 to 30 years in the U.S., breeders have selected for larger-framed cattle that grow more rapidly to 1,100 lb. liveweight and have leaner carcasses. Also, a concerted effort has been made to increase milk production in commercial beef herds. To accomplish these goals quickly, crossbreeding has been utilized. Some breeders and livestock judges have emphasized extremely large frame size. The consequences are increased dystocia (calving difficulty), lower percentage calves weaned, larger cows of higher milk yield, higher maintenance costs of cow herds, and some steers that weigh 1,500 lb. before they are properly finished for slaughter. Some breeders are selecting cattle on one trait—height, which will lead to economic disaster!

In general, the relationships presented in Table 2 are true although exceptions to any generalization can be found.

"Dual-purpose" breeds have different characteristics than do "beef" breeds. For example, heifers of breeds with higher milk yields tend to reach puberty at younger ages than in breeds with below average milk production. Also, bulls from higher-milking breeds tend to have larger scrotal circumference than bulls of the same age within low milk-yield breeds. Thus, breeders can indirectly select for earlier age at puberty in heifers by directly selecting bulls with larger scrotal circumference.

Economically, reproduction is by far the most important complex of traits. Next is growth rate and mature size.

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TABLE 2. RELATIONSHIPS BETWEEN TYPE AND CERTAIN TRAITS

	Beef Cattle Type	
Trait	**Early Maturing**	**Late Maturing**
Dystocia as a sire breed	Low	High
Growth rate to 1,100 lb.	Below average	Above average
Scrotal circumference at 12 mos.	Above average	Below average
Heifers reaching puberty by 12 mos., %	High	Low
Hip height at 12 mos.	Low	High

Between 1983 and 2000 A.D., it's my prediction that progressive breeders of cattle will put much more emphasis on traits associated with reproduction, calving and calf livability. Economically, reproduction is by far the most important complex of traits. Next in economic importance is growth rate and mature size. The composition of the carcass is a very distant third in economic importance in the beef industry. Breeders will use Estimated Breeding Values (EBVs) which include the performance of close relatives to improve their accuracy of selection as compared with selection based on individual performance alone. We will see breeders using selection indexes such as the one proposed by Dr. G.E. Dickerson nearly 10 years ago. He proposed I = Yearling Wt. – 3.2 (Birth Wt.) to emphasize rapid growth to one year of age rather than heavy birth weights and high yearling weights.

Much attention will be paid to scrotal circumference of bulls because of its correlation with greater semen volume, larger number of females served and conceived, and earlier pubertal age of heifers that are close relatives. Breeders cannot use scrotal circumference of bulls as their only selection criterion though. If they do, they may be selecting early-maturing bulls and be in nearly as much trouble as breeders who now use height as their single goal. By the year 2000, breeders will be using selection indexes that include EBVs for each animal for two or more important economic traits. For example, one index might include EBVs for growth rate, scrotal circumference and calving ease to emphasize reproduction and growth. But, use of EBVs as a selection tool will require complete and accurate pedigree and performance records and computer processing of those records.

My advice to cattle breeders is don't try to make all cattle as large as some continental breeds such as Charolais, Maine-Anjou or Simmental. Also, don't select for increased milk production in breeds and herds already noted for superior milk yields. Large, heavy-milking cows require supplemental energy in order to wean a good calf every 12 months. Use performance and progeny records to select cattle that possess early sexual maturity, calving ease, high percent calf crop, good milk production, moderately rapid growth to 15 months of age, moderate mature size, desirable disposition and yield grade 2 carcasses. Cattle that have these qualities will be in demand by commercial cattlemen who will utilize them in their crossbreeding systems for many decades. AJ

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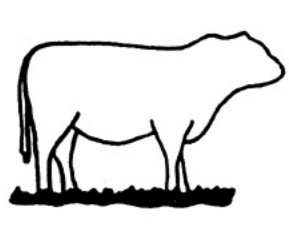
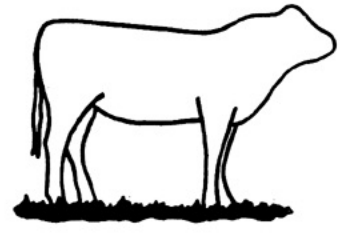
FIGURE 1



- Early maturing
- Slower growth rate
- Small mature size
- Appears thickly muscled
- High carcass fat content at 1,100 lb. liveweight



- Late maturing
- Faster growth rate
- Large mature size
- Appears thinly muscled
- Low carcass fat content at 1,100 lb. liveweight