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Evaluating Selection Direction

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Genetic selection involves evaluating a wide variety of traits in beef cattle. Average performance for each trait within a breed changes over time. These genetic trends indicate the direction of selection within a breed. They show where a breed has been and where it is headed with performance for specific traits. Trait trends also show the speed with which genetic improvement (or not) is taking place.

Genetic Trends

In many beef cattle breeds, traits changed very little until the 1970's. This shift to remarkable genetic improvement coincided with a rise in performance data collection and use. The advent and continued adoption of EPDs for individual animal selection has been critical to notable genetic improvement in U.S. beef breeds.

Genetic trends for average yearling weight EPD for the 3 largest beef breed registries in the U.S. are illustrated in Figure 1. The level of the lines (height from the bottom axis) in this graph are not comparable (essentially meaningless) because EPDs cannot be directly compared among breeds. The important point this graph makes is the slope of the lines. It shows a steady increase in yearling weight EPD values for all 3 breeds over the last 20 years. This trend is actually well documented for the past 40 years. It indicates that selection emphasis for increased yearling weight has been effective and a priority for breeders of these breeds. Similar yearling weight trends are seen in other breeds as well.

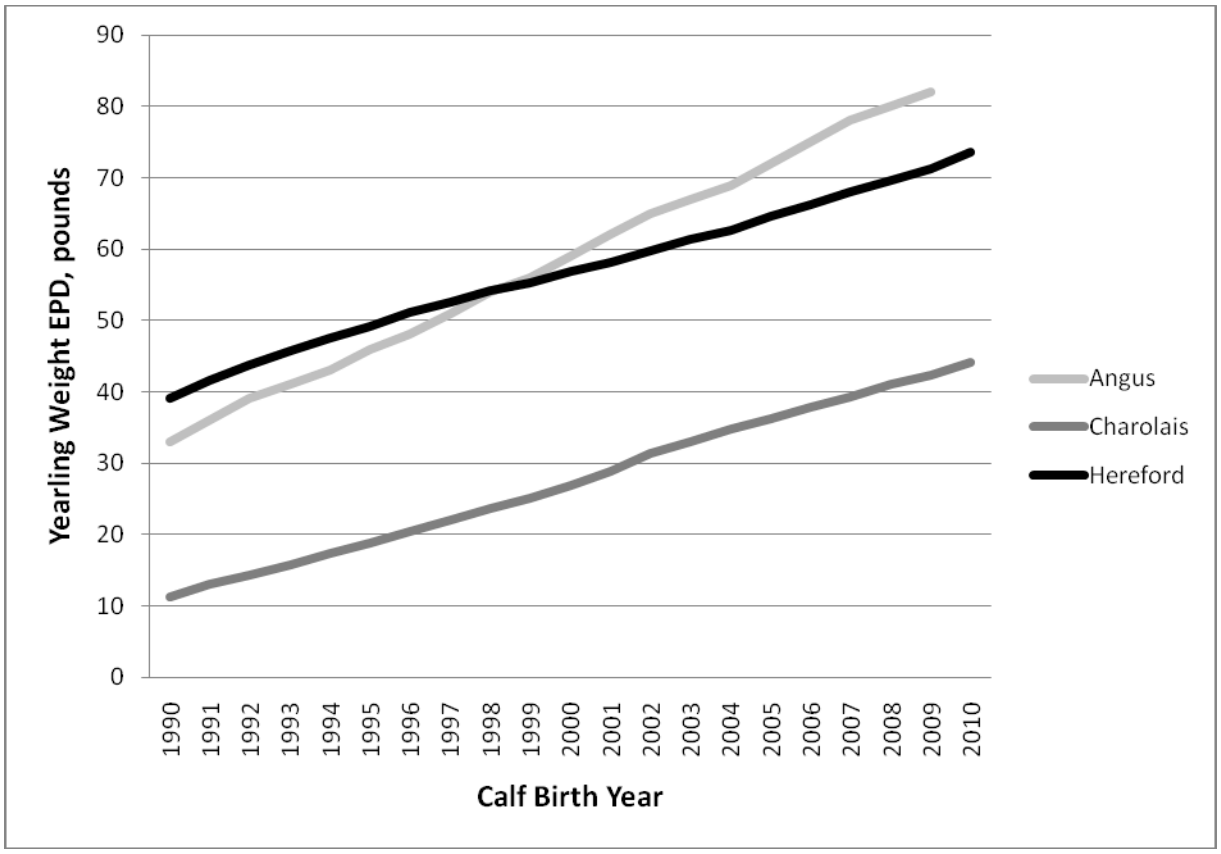

Figure 1. Yearling Weight Genetic Trends

Within a breed, significant genetic improvement may occur over time for some traits, while other traits change at a more gradual rate. For example, in Brangus cattle from 1970 to 2010, weaning weight and yearling weight increased by about 0.6 pounds and 1.1 pounds per year, respectively. At the same time calf birth weight increased at a much slower rate, an average of 0.05 pounds per year. Other breeds have managed, despite genetic antagonisms, to decrease calf birth weight over time while simultaneously dramatically increasing weaning and yearling weights.

A genetic trend is not necessarily genetic improvement if the direction of the trend is undesirable or passes a desirable threshold. Economic incentives to target optimum EPD values for some traits means that selection direction must be monitored and changed as needed to achieve target performance levels. The mentality that more and higher are always better often fails to improve profitability if not considered carefully in production and marketing contexts.

Genetic Variation

Comparing EPDs among breeds can get confusing. For instance, there is approximately a 20-pound difference in weaning weight EPD values for the same level of performance between Beefmaster and Brangus cattle, so comparing these two breeds for weaning weight EPD is like comparing apples to oranges. Looking at it another way, a weaning weight EPD of +25 represents similar performance levels for both Brahman and

Charolais cattle. However, for proven sires, a weaning weight EPD of +25 currently ranks in the top 15% of the Brahman breed and yet is breed average for the Charolais breed.

Because EPDs are computed separately by breed, direct comparisons of EPDs across breeds are not valid without adjustment factors. This can be accomplished by using the annual USMARC (USDA Meat Animal Research Center, Clay Center, NE) across breed EPD table. It is published each year as part of the Beef Improvement Federation annual meeting proceedings and can be useful when considering several different breeds.

A more common approach to comparing breeds is to rank them according to general performance levels using actual and adjusted performance data, such as the weights themselves. These phenotype (what is measured or seen) comparisons among breeds are more easily understood. They give an idea of not only performance differences, but also of performance levels. The association of Continental breeds with high growth and lean yield, for example, comes from historical and current data where phenotypes of calves by sire breed were compared under similar production conditions.

Breed of sire averages (when sires from two different breeds are mated to cows of a third, unrelated breed) for 2008 born calves under conditions at USMARC appear in Table 1. This table shows how bull breeds might compare for their calf performance in a commercial cow-calf setting. These performance differences are average differences among breeds and reveal breed strengths and weaknesses. This can help in selecting appropriate breeds for different production and marketing scenarios.

Table 1. Breed of Sire Averages for 2008 Born Calves under Conditions Similar to USMARC

	Breed of Sire									
Calf Trait	**Angus**	**Beefmaster**	**Brahman**	**Brangus**	**Charolais**	**Gelbvieh**	**Hereford**	**Limousin**	**Red Angus**	**Simmental**
Birth Wt., lb	91.5	97.2	103.7	93.9	99.3	95.0	96.4	95.2	92.3	95.8
Weaning Wt., lb	601.1	605.6	612.6	598.5	622.5	603.2	599.1	600.6	584.9	616.1
Yearling Wt., lb	1020.2	993.7	964.4	1000.6	1031.7	1003.5	993.2	989.9	989.2	1022.7
Maternal Milk, lb of calf	591.6	575.8	601	581.4	580.4	597	569	576.6	582.9	586.9
Marbling Score*	5.62				4.88		4.97	4.52	5.27	4.85
Ribeye Area, sq. in.	12.58				13.33		12.46	13.82	12.4	13.45
Fat Thickness, in.	0.538				0.293		0.477		0.474	0.311

**Marbling score units: 4.00 = SI00; 5.00 = Sm00*

Source: Beef Improvement Federation, 2010

Breed selection is a critical part of the selection approach. Individual rank within a breed is also important to assess. A superior bull of Breed A on average might sire calves that outperform calves from an average bull of Breed B for a certain trait even if there is a breed advantage for Breed B for that trait. In other words, choosing the “right” breed for the purpose and then selecting inferior animals within the breed is counterproductive.

A quick glance at EPD ranges can show tremendous variation within a single breed for a given trait. Consider the current Angus yearling weight EPD minimum of -83 and maximum of +151. This is a 234-pound range. Yet the standard deviation for yearling weight EPD is 33 pounds, which means that the vast majority of cattle evaluated will be within a much smaller range. Approximately two-thirds of the cattle evaluated will be within one standard deviation either side of the average EPD value, +43, (range of +10 to +76), and about 95% of them will be within two standard deviations either side of the average EPD value (range of -23 to +109). There is still considerable variation in yearling weight within the breed from which to select and make substantial genetic improvement.

The take home messages here are that 1) breeders determine the direction and speed of genetic trends within their breeds; 2) it is important to stay informed on current breed standing and selection direction for important trait levels; and 3) to improve cattle genetics, choose breeds and select cattle within breeds with an ultimate economic purpose in mind. For more information on beef cattle genetics or related topics, contact an office of the Mississippi State University Extension Service.