Technical Review of the *Genetic Merit Scorecard®*

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Preface - The Process of Quality Assurance is Taking Root in the Beef Industry

Significant progress has been made in the beef industry in the past decade as it relates to information on feeder calves passing forward from cow-calf producers to feedlots. The reverse is also true as more feedlots sell cattle on grids and recover carcass data, which is more frequently passed back to cow-calf producers – at least to those that have more than an anonymous relationship with their feedlot customers.

In particular, cow-calf producers have increasingly embraced integrated preconditioning programs. Programs such as VAC-45 have been shown to improve profitability for both the calf seller and buyer. Progressive animal health companies and service companies have trademarked the names of their integrated programs and provide certificates to producers who then forward the certificates to the buyers of their calves. Everyone should agree that this is a marked improvement over the predecessor claim of "*they've had all their shots*."

In response to the demands from foreign beef customers (notably Japan), thousands of cow-calf producers participated in Source and Age Verification (SAV) programs, thus creating a trail of documentation from the ranch forward to the feedlot and packing plant. Even when Japan raised the age limit of cattle eligible for beef export, thus making SAV programs less imperative, many producers and feedlots have maintained various verification programs in recognition of the trend toward more transparency in the entire food production system – where consumers want to know more and more about where their food comes from.

While the different segments of the beef cattle industry still (and always will) haggle over price and terms of sale, it is encouraging to see the increased flow of information across segments. It proves that competing segments of the industry, when challenged by a common cause, can work together for mutual benefit. In short, whether consciously or otherwise, with or without a master plan, the beef industry is engaged in an evolving process of ***quality assurance*** and deserves to be congratulated for its effort. It is true that some producers remain unaware of this evolution, but it is also true that no industry as large and diverse as the beef industry can turn on a dime. Leaders always lead and the entire curve eventually shifts to the right – inch-by-inch if necessary.

What's next? The answer isn't simple. Is it conceivable that ranches or feedlots will someday receive a "sustainability score" based on their responsible use of natural resources? Is it conceivable that cow-calf producers will receive a comprehensive score on the genetic merit of their calf crop, thus allowing more objective pricing of their calves to feedlots? The answer to the latter question is yes. The balance of this paper is an explanation and technical review of the Genetic Merit Scorecard®.

Genetic Merit Scorecard® – the base hypothesis

It is postulated that the difference in relative market value of feeder calves from different herds can be estimated by compiling basic genetic information on sires used in each herd over time. A proprietary mathematical method utilizes Expected Progeny Differences (EPDs) of sires used in a herd over the ten year period immediately preceding the production of the calf crop whose relative value is being estimated.

It is further postulated that the purchasers of feeder calves (feedlots) can utilize the resulting estimate of genetic value to differentially price feeder calves offered in the marketplace, and that the estimated value differences (based solely on the genetic history of the herd) will be realized as cattle move through the feeding and harvest phases of production.

The Genetic Merit Scorecard®, illustrated below, is comprised of two elements. The first is a genetic rating for six separate traits of economic importance, illustrated with stars below each trait name. The stars exist on a continuous scale, with three full stars representing the national average genetic merit for the indicated trait. The distribution was intentionally skewed to make 5 stars truly elite. A group of calves with 5 FULL shaded stars for a trait is in the top 5% of the national population.

The second element is the overall numerical score expressed in units of dollars per hundred-weight ($/cwt). It is the relative market value of the offering. The method produces a point estimate (e.g. +$19.22/cwt), which is calculated for the actual base weight of the feeder calves being offered for sale.

As a base of reference, a score of +$10/cwt has been established to represent a group of calves sired by national average registered bulls. This national average is calculated by weighting the number of bulls registered in each breed and applying their respective EPDs. Since breed average are different, within breed EPDs must be standardized to a common base. Stated differently, a Limousin bull in the top 20% of that breed for marbling is not the same as an Angus bull in the top 20% of that breed for marbling. Across-breed EPD adjustments are used and are based on published results from USDA's Meat Animal Research Center (MARC) and on results from proprietary across-breed databases. Finally, the mathematical model is applied to the standardized EPDs to determine the national average.

Figure 1. Example Genetic Merit Scorecard®

Genetic Merit Scorecard®		
Bill Henry Big Gulch Ranch Big Sky, MT 98765 2014 Calves		$19.22 Relative Value / CWT
Estimated at a base weight of 650 lbs.		
Average Daily Gain	**Carcass Weight**	**Feed:Gain**
★★★★☆	★★☆☆☆	☆☆☆☆☆
Ribeye Area	**Yield Grade**	**Percentage of Choice**
★★★★☆	★★☆☆☆	★★★★★

It is understood by the developers of this system that different feeding companies may emphasize some traits more than others based upon the carcass grid or formula under which they market fed cattle. Performance traits such as Average Daily Gain and Feed Conversion are universally important to profitability irrespective of grid specifications but traits such as percent choice, carcass weight, yield grade and rib eye area may have different values in different grid marketing schemes. The star system allows feeder cattle buyers to identify cattle that have the genetic potential to hit their specific grid targets.

Consider the examples below showing two hypothetical groups of feeder calves with an identical Relative Value score (both are $19.22/cwt). Evaluation of the star differences illustrates the significant differences between these two groups. The group on the left can be described as having rapid early gain to a lighter endpoint, with a very high percentage Choice and presumably premium Choice and/or Prime carcasses. The group on the right earns most of its added value through heavier carcass weight potential and higher cutability (via better Yield Grade).

Genetic Merit Scorecard®		
Bill Henry Big Gulch Ranch Big Sky, MT 98765 2014 Calves Estimated at a base weight of 650 lbs.		$19.22 Relative Value / CWT
Average Daily Gain	**Carcass Weight**	**Feed:Gain**
★★★★☆	★★☆☆☆	☆☆☆☆☆
Ribeye Area	**Yield Grade**	**Percentage of Choice**
★★★★☆	★★☆☆☆	★★★★★

Genetic Merit Scorecard®		
Bill Henry Big Gulch Ranch Big Sky, MT 98765 2014 Calves Estimated at a base weight of 650 lbs.		$19.22 Relative Value / CWT
Average Daily Gain	**Carcass Weight**	**Feed:Gain**
★★★☆☆	★★★★★	☆☆☆☆☆
Ribeye Area	**Yield Grade**	**Percentage of Choice**
★★★☆☆	★★★★☆	★★☆☆☆

The mathematical model relies upon the premise that differences in genetic merit for various traits, quantified as differences in EPD values, can be expressed in economic terms through the use of economic weighting factors. This premise is not disputed by the scientific community and, in fact, is central to the use of selection indices used with enormous success in poultry, swine and dairy cattle for decades. Their use with beef cattle is more recent, but the same robust scientific endorsement exists.

In consideration of the base hypothesis, the following questions arise:

1. How is the Genetic Merit Scorecard® score different from the popular $Index scores computed by breed associations, such as $B for Angus and $TI for Simmental?
2. What assumptions are made about the selection of replacement females within a herd (since half of the genes come from the cows)?
3. The data used to compute EPDs comes mostly from seedstock producers rather than feedlots and packing plants. Are EPDs legitimate predictors of performance in the real world of commercial beef production?
4. Why do some herds have a “star rating” for feed conversion and some don’t?
5. Why doesn’t the Genetic Merit Scorecard® score have an accuracy figure associated with it? Wouldn’t it be more accurate if a breeder was using proven sires via A.I. vs. using natural service sires with low accuracy EPDs?
6. How large is the practical spread between one set of calves and another?
7. How do feed costs or fed cattle prices influence the Genetic Merit Scorecard®?
8. Steers and heifers have a different value, yet their Genetic Merit Scorecard® score is the same, why?

Discussion of questions

1. How is Genetic Merit Scorecard® different from $B or $TI?

   The $B index for Angus will be used as an example to illustrate the difference between $B and Genetic Merit Scorecard®. The same argument holds for all breed association dollar denominated indexes.

   $B is computed by the American Angus Association (AAA) for an individual animal. It is the product of an equation that includes selected EPDs multiplied by their respective relative economic values. The $B Index can be used to compare individual animals to one another. The Genetic Merit Scorecard® score, by contrast, is the product of a more comprehensive model that considers the net result of genetic inputs introduced into a dynamic population of animals (a herd) over the course of time. The two indexes use some of the same basic facts but they are computed with a different objective.

   Typically, breed association selection indexes are developed to aid seedstock and commercial producers make better mating decisions. Given this objective, most indexes include factors such as calving ease. While this factor is important for breeding decisions, it does not have any actual impact on the value of calves at weaning. As such, the Genetic Merit Scorecard® only factors in traits that drive the value of the calf that is intended to be fed to finish and harvested. It is not designed to predict the value of an animal as a parent of the next generation of animals.

   Each breed association index has its own set of assumptions regarding the value of the underlying traits. One might be concerned that these weighting factors will dramatically impact the ranking of animals on indexes. In fact, most terminal indexes are highly correlated. The top animals on any given breed's terminal index are most likely to also be the highest bulls on the Genetic Merit Scorecard®. As such, breed terminal indexes can be successfully used to improve one's Genetic Merit Scorecard®.

2. What assumptions are made about replacement heifer selection? Wouldn't this affect the herd's average genetic score?

   The model assumes that the herd raises their own replacement heifers and that all retained heifers are average. The model assumes that heifers are kept in the same proportions out of all sires used. The model further assumes no selection differential for heifers. If replacement females are purchased, then the cow herd is assumed to be national average unless the source herd of the replacement females has been scored.

   It is also assumed that the sires placed in a herd over the preceding four years are the sires of the calf crop being offered. So, for example, if the average marbling EPD of sires used in the most recent four years was +.50, it is assumed that every heifer calf being retained from the current calf crop was sired by a bull with a marbling EPD of +.50. The dams of

the heifers would have been sired by bulls used from 2 to 10 years prior. Assume that the average marbling EPD of those earlier sires was +.30. Thus, in simplistic terms, the retained heifers in this scenario would be sired by bulls with +.50 marbling, out of cows sired by bulls with +.30 marbling. The “original” cowherd is assumed to be national average. For simplicity, assume that is +.30. Hence, when all the math is done, the heifer calves retained from the current calf crop would have average marbling EPD of
+.40.

All good things have room for improvement. Over time, as producers build a herd profile in the Genetic Merit Scorecard® database, the selection differential for replacement heifers could be included in the analysis. In the future, females could be transferred between herds while maintaining their genetic merit predictions. Additionally, regional averages for purchased females will be developed.

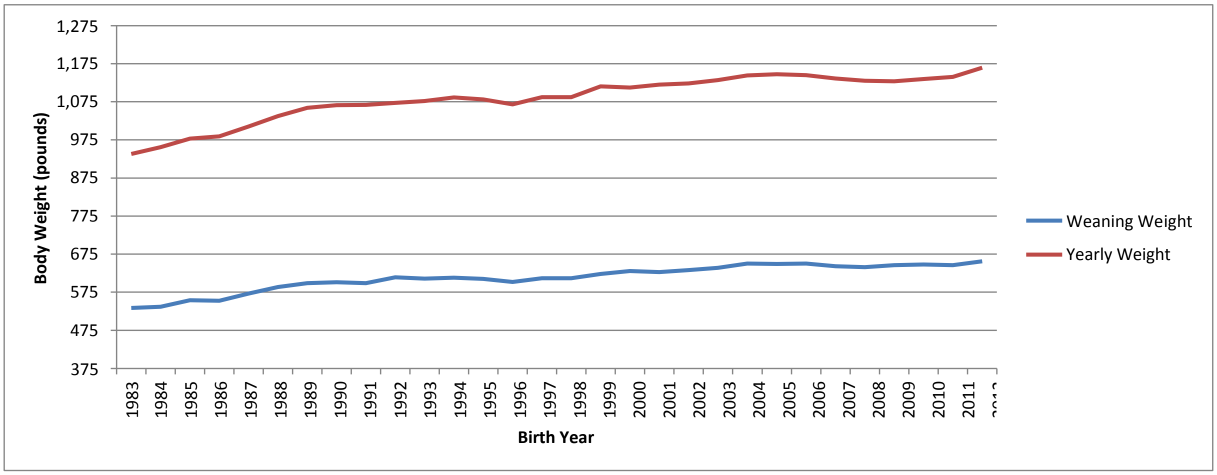
3. Are EPDs legitimate predictors of performance in commercial beef production?

The short answer is yes. EPDs were introduced to the beef industry about 30 years ago and have been validated and re-validated by numerous legitimate breed associations and genetic researchers. They represented a breakthrough in genetic selection because they allowed genetic comparison of animals between different herds. Two key developments enabled geneticists to compute EPDs: 1) Widespread use of artificial insemination (A.I.) resulted in bulls siring calves in multiple herds, thus allowing sires to be compared to one another in multiple environments based upon progeny performance and 2) dramatic expansion of computing power made it possible to perform the complex mathematical equations that underlie EPD computation on a very large scale.

For those in the cattle feeding industry, EPDs may seem academic, theoretical and far removed from the business of cattle feeding. Over time, the expanding number of EPDs available on each registered animal has grown to the point where even those in the seedstock industry are challenged to keep up with them. Currently, there are as many as 17 EPDs computed for each registered Angus. Some are correlated with one another and some are not. Some are enhanced with DNA information and some aren’t. Little has been done to boil all of this information down into a number that could be used by feeder calf buyers to make an informed judgment about which set of calves is worth more than average or less than average. As explained earlier, the Genetic Merit Scorecard® score attempts to do exactly that.

Consider 30 years of performance history and genetic trend data from the American Angus Association (AAA), the largest of the breed associations in the U.S. Figure 2 illustrates the trend in actual growth performance of Angus bulls produced by members of the AAA, who submit data in standardized format to the Association.

Figure 2. Weaning and Yearling Weight Trends of Angus Bulls



During the same time period, Weaning Weight and Yearling Weight EPDs also changed, as illustrated in Figure 3.

Figure 3. Genetic Trend for Weaning Weight and Yearling Weight of Angus Bulls

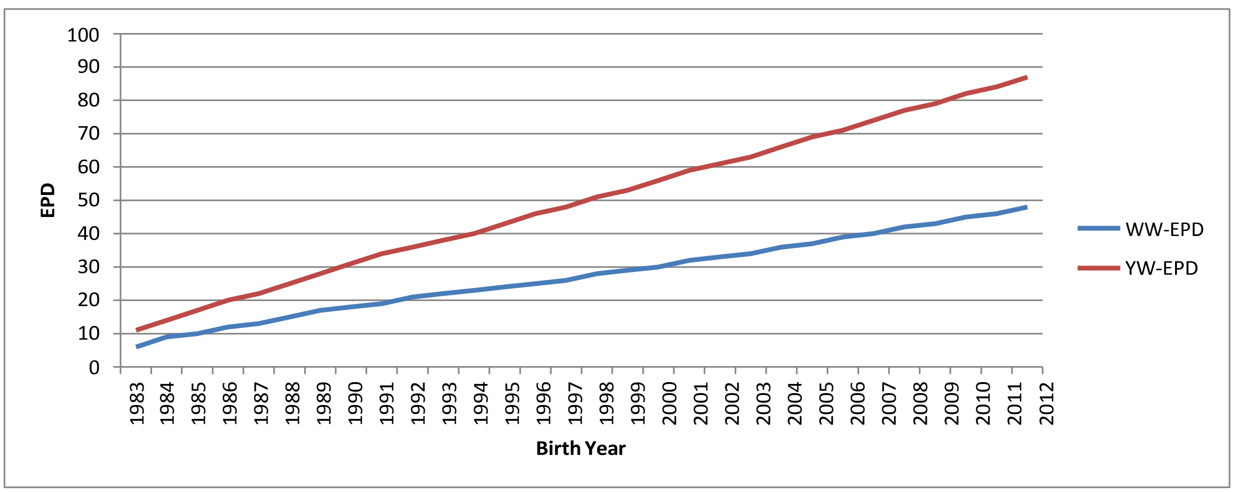


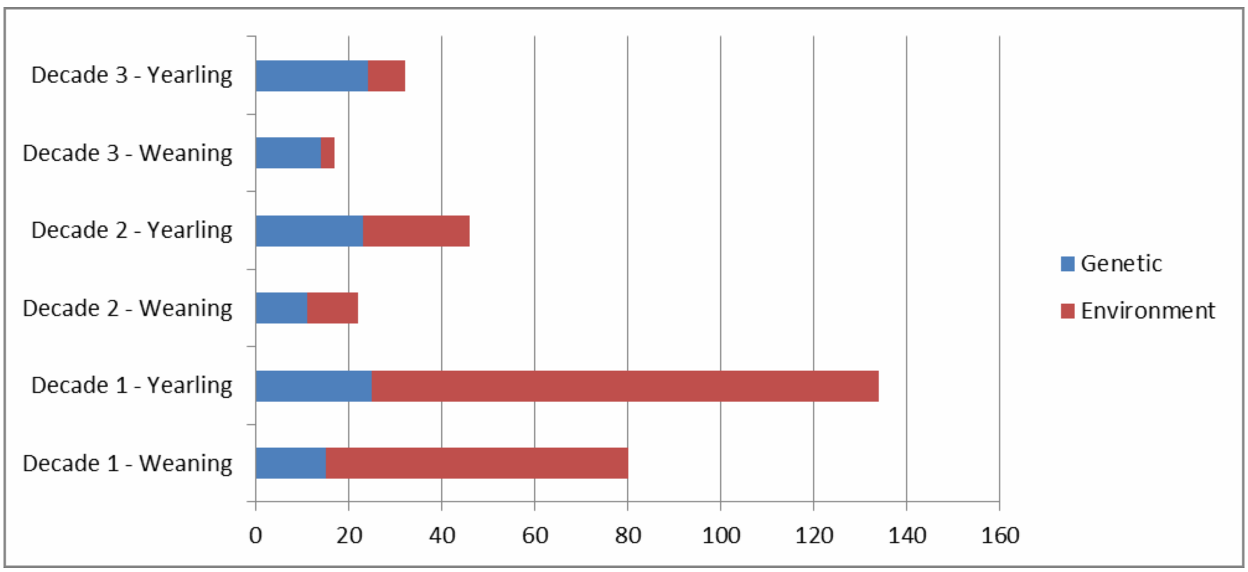
Table 1.Summary of Figures 2 and 3

Change in Actual Weight – Last 30 years		
Increase in Weaning Weight	122-lbs	4-lbs/yr
Increase in Yearling Weight	226-lbs	7.5-lbs/yr
Change in EPDs – Last 30 years		
Increase in Weaning Weight EPD	42-lbs	1.4-lbs/yr
Increase in Yearling Weight EPD	76-lbs	2.5-lbs/yr

On average, the changes in EPDs over the 30-year period explain about 1/3rd of the change in actual weights. The balance of the improvement in actual weights is explained by non-genetic factors, presumably led by improvements in nutrition, health and general management (i.e. "environmental improvement"). Though perhaps a bit complex at first blush, it is generally straightforward to separate genetic effects from non-genetic effects in a population over time. Consider that an A.I. sire may be used in hundreds of herds over a 5 to 8 year period. During that time, his DNA obviously does not change, but there may well be an upward trend in the performance of his progeny (after adjusting for any uptrend in genetic merit of mates during that time). Such a trend is obviously due to environmental improvements. With literally thousands of bulls used over multiple years in multiple herds, the volume of data available to sort genetic trend from environmental trend allow for accurate separation.

Considering that genetic change accounted for only 1/3rd of the improvement in growth rates, one might conclude that with regard to improving animal performance, genetics takes a back seat to nutrition, health and management. Further analysis of the same data suggests otherwise. Figure 4 shows the relative impact of genetic improvement versus environmental improvement in each of three decades represented by these data.

Figure 4. Relative Contributions of Genetics and Environment on Overall Gains in Growth Performance - By Decade



An interesting story is conveyed in Figure 4. When the 30-year period from 1983 through 2012 is broken into 3 decades, it is clear that the relative improvements in genetics and environment (nutrition, health, management) show a dramatic change from decade to decade. In Decade 1 (1983-1992), remarkable improvements in weaning weight and yearling weight were achieved by Angus breeders. The vast majority of the improvement was due to improvements in environment. Genetic improvement was evident, but paled by comparison to the improvements due to non-genetic factors.

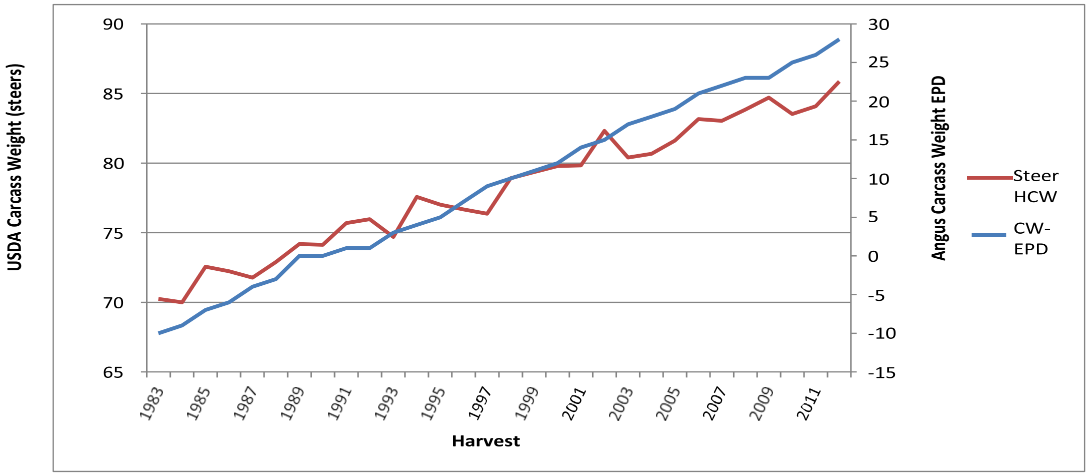
In addition to technical improvements in nutrition and health programs and products, the dramatic change in yearling weight during Decade 1 may have been driven significantly by what could be called "Breeders' Objective." This decade represented a significant shift from marketing 2-yr-old bulls to yearling bulls. As yearling bulls became the norm, breeders managed for far more aggressive early-life gains, including pre- and post- weaning periods.

The impact of environmental improvements on weight gain in Decades 2 and 3 (1993-2012) declined substantially. In Decade 3, for instance, 83% of the improvement in weaning weight is explained by genetic improvement. Similarly, 75% of the improvement in yearling weight is explained by genetic improvement. Hence, only 17% and 25% of the gains in weaning weight and yearling weight, respectively, can be explained by improvements in environment during the most recent decade.

If the argument stands that the "low hanging fruit" of improved nutrition and management, as they affect weight gains, has already been largely picked, then the complement to that conclusion is that the vast majority of improvements to be made henceforth will (must) come from genetic improvement. It is worth noting that the absolute rate of genetic improvement in weaning and yearling weight shows no sign of leveling off over the 30-year period. For Decades 1, 2 and 3, respectively, the annual genetic gain in weaning weight was 1.5, 1.1 and 1.4. Likewise for genetic change in yearling weight for Decades 1, 2 and 3, respectively, the gain was 2.5, 2.3 and 2.4. Why was Decade 2 less "productive" in raising weaning and yearling weight? The data clearly shows that Angus breeders spent that decade reversing an undesirable trend in birth weight and obviously (and temporarily) gave up some progress in weaning and yearling growth to accomplish it (which they did).

Again using Angus data, how well does the genetic trend in carcass weight, as measured by changes in CW EPDs, correlate with the trend in average steer carcass weights reported by USDA using actual packing plant data? This may be seen as a more legitimate test of whether EPDs reflect what really happens in commercial beef production.

Figure 5. 30-year Trend in Carcass Weight EPD vs. Actual Trend in USDA Steer Carcass Weight Average



Actual carcass weight increased by 157 pounds over the 30-year period, while the CW EPD in the Angus population increased by 38 pounds. Thus, genetic change in one breed alone explains about 25% of the increase in overall average carcass weight over this period of time. The balance of the increase is due to genetic trends for other breeds plus environmental/management factors, including use of aggressive implant strategies, beta agonists and other technologies that increase carcass weight.

Back to the original question: Do EPDs predict differences in real world performance of cattle? The obvious answer is yes. They do not explain all of it, nor should anyone expect that to be the case. Genetics are just part of the puzzle. Continuous advancements in nutrition, health and management also affect cattle performance.

4. Why do some herds have a "star rating" for feed conversion (i.e. Feed:Gain) and some do not?

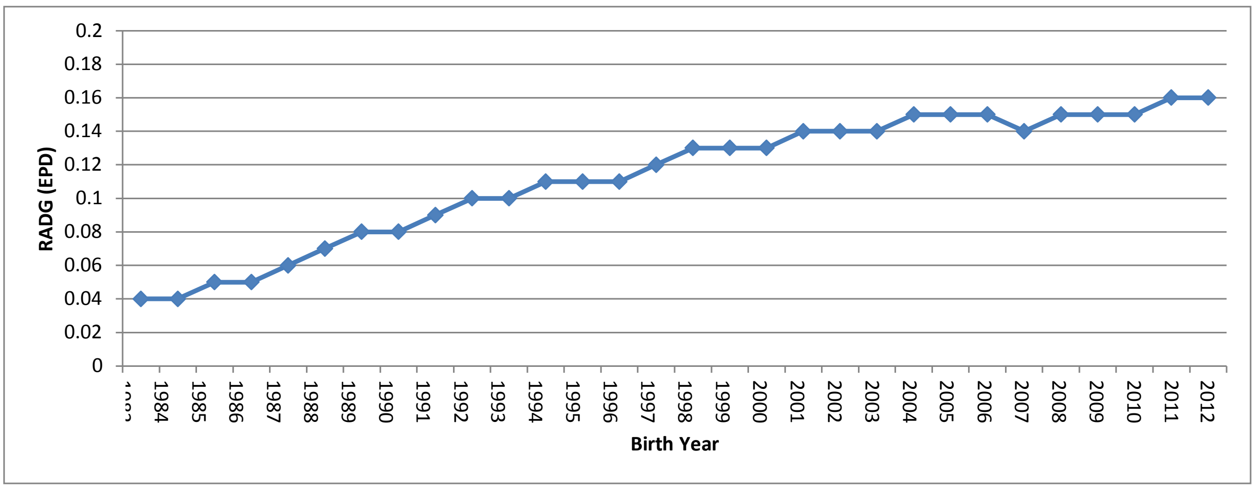
In contrast to collection of growth and carcass data, which forms the basis of growth and carcass EPDs, feed conversion data are much more difficult and expensive to collect.

Hence, there is far less actual data tied to specific animals (sires or dams). Collection of feed efficiency data has increased significantly in the past decade. As a result, an increasing number of seedstock animals either have individual feed efficiency data or have ancestors with such data. Additionally, DNA panels that estimate relative differences in feed efficiency are increasingly available. Breed associations have taken the logical and sensible approach of incorporating DNA-based information directly into the EPD computation for feed efficiency (along with any pedigree information and actual feed efficiency measurements). All available data are boiled down to one number – the feed efficiency EPD.

Some seedstock producers have consciously introduced feed efficiency into their breeding objective– by using feed efficiency proven sires, for instance. As such, an increasing percentage of the bulls sold by these firms have an EPD for feed efficiency. Commercial herds that are using bulls from these firms will be given a Feed:Gain "star" rating on their feeder calves.

An example of a feed efficiency EPD is the Residual Average Daily Gain (RADG) EPD published by the AAA. As the name implies, the RADG EPD estimates the incremental gain expected by the progeny of a sire, given a fixed amount of feed consumption. This EPD has been computed only in the past few years, but it is possible to "reverse engineer" the calculations and estimate the RADG EPD on animals that were born prior to the computation of this measure. Figure 6 shows the genetic trend in RADG over the preceding 30-year period (source: American Angus Association).

Figure 6.Trend in Residual Average Daily Gain EPD for Angus



Significant progress has been made in feed efficiency the past 30 years. Comparing 1983 to 2012, the difference in RADG is 0.12 pounds per day. This is, presumably, the "free" daily gain given a fixed amount of feed consumed.

Because the computation of feed efficiency EPDs is still in the early stages, and because the economic impact of feed efficiency is so significant, the developers of the Genetic Merit Scorecard® are taking a very conservative approach to scoring herds on Feed:Gain. For instance, until the RADG EPD of Angus is validated internally by the Genetic Merit Scorecard® developers, a Feed:Gain score will not be included in the Genetic Merit Scorecard® based solely on RADG-EPDs of Angus bulls used in the herd.

This viewpoint on RADG can be disputed, and probably will be. However, a simple analysis of the genetic trends for YW EPD and RADG EPD yields a correlation of .98. The conclusion from this simple analysis is straightforward: with a correlation of .98, YW EPD and RADG EPD are essentially the same trait. And because this is a correlation between EPDs, it is a de-facto genetic correlation. This simply means that many of the genes that are driving up YW are also driving up RADG.

The author asserts that the improvement in RADG EPD over the last 30 years is due almost entirely to the dilution of maintenance feed requirement associated with more rapid post-weaning gain and is not due to a genetic trend in basic metabolic efficiency.

There is an inherent statistical dynamic at play that must be understood. Namely, the correlation is so strong between YW and RADG (in the statistical models used by AAA), and the volume of YW data is so overwhelming, that the sprinkling of actual feed efficiency data in the AAA database simply does not have the mathematical power to move an animal very far from where that animal is positioned by virtue of its YW EPD.

Consider this analogy: The YW EPD and the RADG EPD are tied together with a super- duty bungee cord. There is a little stretch in the cord, but not much. Hence, the YW EPD " pulls" the RADG EPD wherever it goes. The YW data has the power because of the sheer volume of it. If some actual feed efficiency data were available, and is thrown into the analysis, it is the equivalent of a light-duty rubber band tugging on the RADG EPD attempting to create some separation between it and the YW EPD. A light-duty rubber band tugging against the strength of a super-duty bungee cord is not going to move it very far.

Until and unless a compelling argument is made to consider the RADG EPD a good proxy for metabolic feed efficiency, the author agrees with the Genetic Merit Scorecard® developers that a herd should not be scored on the trait of Feed:Gain based solely on the RADG EPDs of Angus bulls used in the herd.

5. Why doesn't the Genetic Merit Scorecard® score have an accuracy figure associated with it? Wouldn't it be more accurate if a breeder was using proven sires via A.I. vs. using natural service sires with low accuracy EPDs?

Bulls used in herds can have dramatically different accuracy levels. As an illustration, consider two extreme examples. In Case #1, a breeder is using a proven A.I. sire on 100% of his cows. Assume his EPD for marbling is +.50 and the accuracy of the marbling EPD is 0.85. In Case #2, a breeder with 300 cows has 12 natural service sires with an average marbling EPD of +.50, but each bull has a marbling accuracy of only 0.30-0.35 (typical for a natural service bull with no progeny records). The arithmetic fact is that the average EPD of the 12 natural service sires is equal to or higher than the accuracy of the EPD on the proven sire.

In practice, most bulls used naturally in commercial herds are relatively low in accuracy. Typically, they are around 30% accuracy for most EPD traits. Fortunately, the accuracy of the Genetic Merit Scorecard® does not depend on the accuracy of individual bulls. Rather, the accuracy of the Genetic Merit Scorecard® depends on the accuracy of the predicted herd average for each EPD. When EPD from 20 or more bulls are averaged, the accuracy of the average is over 95%. An analogy can be made by comparing the accuracy of an individual processing weight on a steer compared to the accuracy of the average of all of the individual weights on all steers in the pen. The individual weights are not very accurate but the average of all the individual weights very accurately predicts the average of the pen.

Another related question is whether the model predicts variation in a pen. In theory, using similar bulls will lead to more uniform calf crops. There may be less variation in marbling within the calf crop sired 100% by a single A.I. sire compared to the calf crop sired by 12 natural service sires. However, pen profitability for the feedlot depends primarily on the average performance, and much less on the variability of individuals within the group.

An accuracy figure (or a +/- possible change bracket) and perhaps a variability score may be added over time to the Genetic Merit Scorecard®. In the meantime, the "law of averages" applies. The Genetic Merit Scorecard® score predicts the herd average accurately.

6. How large is the practical spread between one set of calves and another?

   Based on the small number of herds scored to date (as of July 2014) the spread from the top group to the bottom group exceeds $40/cwt, which amounts to over $220/hd on 550- lbs calves. Calf weight (payweight) affects the Genetic Merit Scorecard® value. All else being equal, lighter calves will have a larger $/cwt spread than heavier calves.

   Actual data on feedlot closeouts suggests that the Genetic Merit Scorecard® could be underestimating the value differences. Review of 2,800 closeouts from a cooperating feedlot, which feeds mostly retained-ownership cattle for ranchers, revealed a value difference among 650-lb calves of $168/hd when comparing the top 15% of the closeouts to the bottom 15%. Note this is the top 15% vs the bottom 15% – not the top lot vs the bottom lot, where the difference in value approaches $600 per head – on 650-lb calves! Not all of this is genetics, of course, but genetics are a significant part of it.

   When the same 2,800 closeouts were analyzed to determine which performance characteristics explained the variation in profitability (with all input costs and market factors standardized), the results were:

   - 34.6% of profit difference due to growth efficiency
   - 29.9% of profit difference due to grid value
   - 18.1% of profit difference due to carcass weight
   - 17.5% of profit difference due to health

   These results are not dissimilar to those reported at the 2013 Beef Improvement Federation meeting where the nation's largest cattle feeding company showed data comparing the top 15% of their closeouts to the average. The performance difference amounted to $154 per head, and the grid value added another $65/hd difference. The top 15% of closeouts had $219/hd higher value than the average. Again, some of these differences are due to things other than genetics, but genetic differences explain a significant portion of it.

Consider the list of factors above that explain the observed profit variation amongst the 2,800 lots of cattle analyzed. The first three listed factors of Growth Efficiency, Grid Value and Carcass Weight combined explained 82.5% of the profit variation. All three are moderate to highly heritable. Simply stated, it is virtually impossible to obtain high levels of performance for these three profit-driver factors without having high genetic merit for these traits.

7. How do feed costs or fed cattle prices influence the Genetic Merit Scorecard®?

   Feed costs and market prices are always variables in the cattle business. For purposes of calculating the Genetic Merit Scorecard®, estimates are used, reflecting current averages and the price outlook based on futures quotes. As such, they will never be exactly the same as the prices actually realized when a feedlot sells fed cattle or purchases feed.

   Logically, if corn moves back to $7.50 per bushel, or the futures price moves significantly higher, the relative impact of genetic differences for feed efficiency will be higher compared to a market where corn is $4.50. This will be reflected in the Genetic Merit Scorecard® scores as base assumptions are adjusted to reflect current market conditions at least every six months.

   Likewise, the Genetic Merit Scorecard® score uses a constant Choice/Select spread that reflects long term averages. If a buyer of feeder calves expects to market them as fed cattle with a higher than average Choice/Select spread, or is selling on a grid that places higher than average value on marbling, then that buyer would favor calves that have more “stars” for Percentage Choice.

8. Steers and heifers have a different value, yet their Genetic Merit Scorecard® score is the same, why?

   Heifers would have the same Genetic Merit Scorecard® score as their steer mates because they are sired by the same bulls and are out of the same cowherd. Their average genetic merit is equal (again, assuming that selection of replacement heifers did not distort the average merit of the feeder heifers being offered). The Genetic Merit Scorecard® score can be used to compare one offering of heifer calves to another, not to compare a set of heifers with a set of steers.

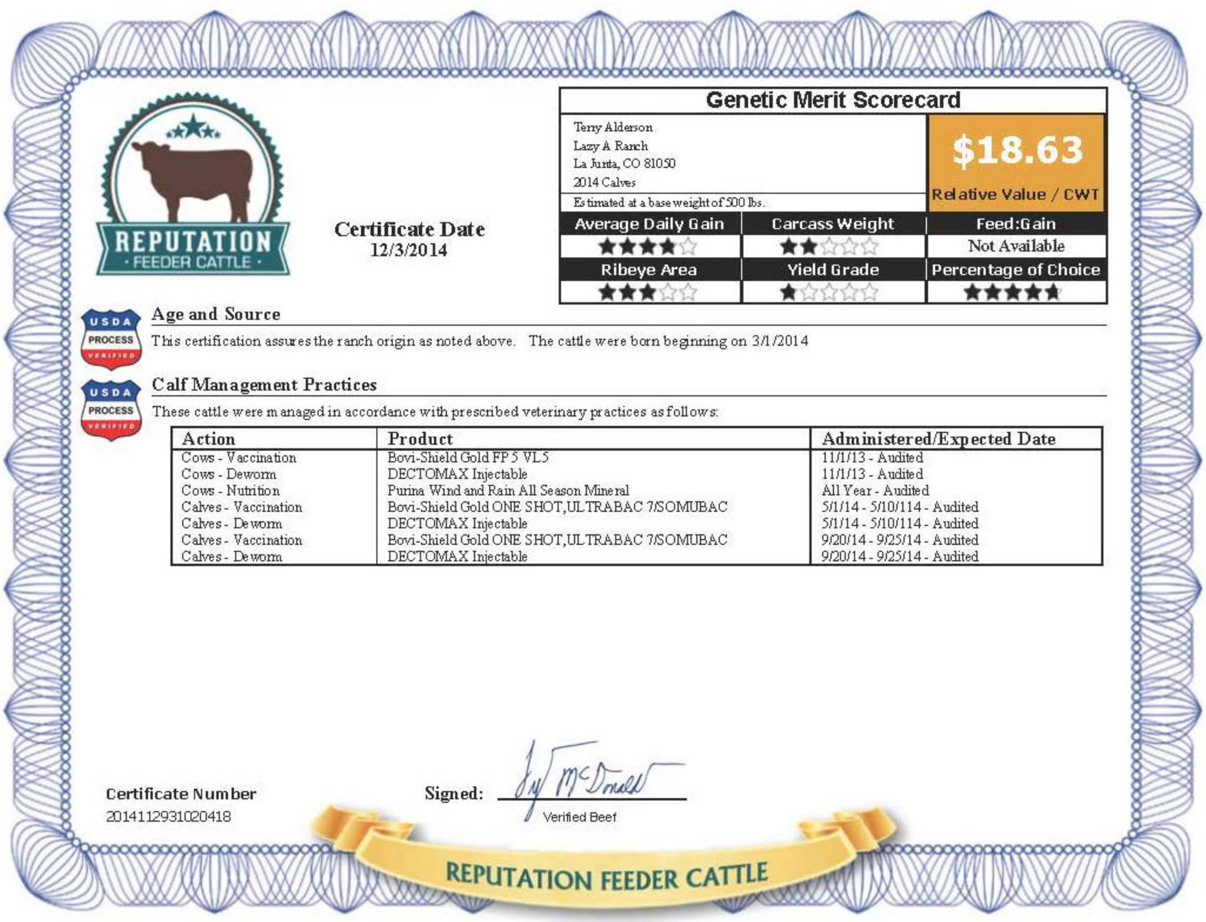
   Feeder heifers have lower value than genetically comparable steers for reasons that all cattle feeders understand – less efficient growth and less final payweight.

   The Genetic Merit Scorecard® score is relative to the national average, which has been fixed at $10/cwt in the model. An offering of steers with a Genetic Merit Scorecard® score of +$15 are worth $5/cwt over the average steer price. Likewise, an offering of heifers with a Genetic Merit Scorecard® score of +$15 are worth $5/cwt over the average heifer price (weight-adjusted of course).

Bringing the Genetic Merit Scorecard® to the Point of Sale

Many good ideas have found their final resting place on an academic shelf because they were never carried forward to the real world where buyers and sellers make deals. The inventors of the Genetic Merit Scorecard® (which is patented intellectual property) realized that an estimate of genetic potential without other critical documentation on an offering of feeder calves left the story incomplete. The obvious void was filled when a license to use the intellectual property was issued to a firm with a long-standing record of documenting various on-farm management practices under the auspices of a USDA-approved Process Verification Program (PVP).
A license was issued to Verified Beef, LLC, a Montana-based service company. Subsequently, Verified Beef developed a program known as Reputation Feeder Cattle® which includes the Genetic Merit Scorecard® as well as Source and Age Verification and Calf Management documentation, the latter two items being operated as Process Verified Programs.

The combined documentation is presented in a Reputation Feeder Cattle® certificate as illustrated below.



REPUTATION · FEEDER CATTLE ·

Certificate Date
12/3/2014

Genetic Merit Scorecard

Terry Alderson
Lazy A Ranch
La Junta, CO 81050
2014 Calves
Estimated at a base weight of 500 lbs.

$18.63
Relative Value / CWT

Average Daily Gain	Carcass Weight	Feed:Gain
★★★★☆	★★☆☆☆	Not Available
Ribeye Area	**Yield Grade**	**Percentage of Choice**
★★★☆☆	★☆☆☆☆	★★★★★

USDA PROCESS VERIFIED

Age and Source

This certification assures the ranch origin as noted above. The cattle were born beginning on 3/1/2014

USDA PROCESS VERIFIED

Calf Management Practices

These cattle were managed in accordance with prescribed veterinary practices as follows:

Action	Product	Administered/Expected Date
Cows - Vaccination	Bovi-Shield Gold FP 5 VL5	11/1/13 - Audited
Cows - Deworm	DECTOMAX Injectable	11/1/13 - Audited
Cows - Nutrition	Purina Wind and Rain All Season Mineral	All Year - Audited
Calves - Vaccination	Bovi-Shield Gold ONE SHOT,ULTRABAC 7/SOMUBAC	5/1/14 - 5/10/114 - Audited
Calves - Deworm	DECTOMAX Injectable	5/1/14 - 5/10/114 - Audited
Calves - Vaccination	Bovi-Shield Gold ONE SHOT,ULTRABAC 7/SOMUBAC	9/20/14 - 9/25/14 - Audited
Calves - Deworm	DECTOMAX Injectable	9/20/14 - 9/25/14 - Audited

Certificate Number
20141129310020418

Signed:
Verified Beef

REPUTATION FEEDER CATTLE

For producers enrolled in the program, a certificate such as the one above is issued on each calf crop. In reality, several certificates can be issued for each calf crop if the offering of calves is sorted into different sale lots based on estimated base weight (payweight). All else being equal, a group of calves offered at 500-lbs, for example, will have a higher Relative Value score than the very same set of calves offered at 600-lbs. The Relative Value on a per-hd basis will be the same, but when that is divided into fewer pounds (as with the 500-lb vs. 600-lb example above), the $/cwt number is larger.

Summary

A rational market is one that objectively recognizes value differences and prices offerings accordingly. Rational pricing is fundamental to continuous improvement of any product because without it the incentives and disincentives are not aligned with reality. The feeder cattle trade is slowly rationalizing. Price differences based on objective criteria are becoming more apparent. The key factor that enables this trend is documentation. Buyers of feeder calves are rewarding trusted calf suppliers with higher prices for calves with documented health, nutrition and management histories.

The next logical step in this rational progression is documentation of genetic merit. Genetic merit is subjectively evaluated every day by cattle buyers attempting to sort the total offering to find calves that fit their orders. The Genetic Merit Scorecard® is an important step forward in documenting genetic merit based on objective data.

Ultimately, the long term competitiveness of beef production depends on the industry's rate of improvement compared to that of competing protein sources. The pork and poultry industries have the advantage of integrated production systems under single ownership. As such, pork and poultry are better able to make rapid change that improves profitability from birth to harvest. By improving the quality of value signals sent between feeders and cow/calf producers, the Genetic Merit Scorecard® could accelerate the rate of improvement in the beef industry.

For more information on Reputation Feeder Cattle® and the Genetic Merit Scorecard®, contact:

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