Field-Testing $BEEF in Purebred Angus Cattle

Conducted by

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Introduction

Almost fifteen years have passed since the American Angus Association introduced its $Beef index ($B) to the U.S. beef industry. This index was designed primarily for use by commercial cattlemen to characterize genetic differences from weaning to harvest in registered Angus cattle. $B is both biologically and economically relevant, as well as being simple to use. Higher $B values indicate faster growth and more favorable carcass traits in the growing, finishing, and harvest phase of production. High $B cattle grow faster and more efficiently than their low $B counterparts. They also produce more valuable carcasses. Access to such an easy-to-use tool, which increases multi-trait genetic merit, has proven of great worth to commercial cattle producers and Angus breeders alike. Broad use of $B has resulted in the creation of more valuable Angus breeding stock, bearing fruit across the country in the form of better feeding and better carcass cattle that generate more net dollars to be shared across industry segments.

Objective

The authors have long believed that $B is highly effective in characterizing Angus genetics from weaning through harvest. High $B Angus outstrip low $B genetics with great consistency. We have witnessed such differences time and again. However, we also recognize the importance of real-world comparisons that make such differences easily observable for other cattle producers. To that end, the current field study was conducted as "proof of concept" research. Our objective was simply to compare High $B Angus genetics to Low $B Angus in a typical production setting. We sought to minimize environmental influences by raising the two genetic groups as much the same as possible.

How rapidly the cattle would gain weight and how their carcasses would compare was of particular interest. Physical traits and financial outcomes are tightly connected and both are of great importance. We captured numerous data points throughout the study, including a wide range of phenotypic metrics as well as DNA scores. Allowing both High $B and Low $B genetics to fully express their potential, then comparing the results, was the singular goal we sought to achieve. We expected the results would speak for themselves, and they do indeed.

Methods

All of the 43 animals raised and harvested for this study were the result of embryo transfer. Each animal had a registered Angus sire and a registered Angus dam, enabling more complete control over the genetic merit of the test animals. Both the top and bottom sides of the pedigree were known and genetically quantified via American Angus Association EPDs and $Indexes. Low $B embryos were purchased in 2013 and 2014 from Angus breeders that had "dated" embryos in their frozen inventory which met our criteria as being low in growth and carcass merit. High $B embryos were accessed from Gardiner Angus

Ranch (GAR), Ashland, Kansas, and were identical to the sire/dam matings GAR was making for its own breeding program at the time embryos were implanted into randomly-allocated recipient dams during the summer of 2014. We targeted a $100 difference in pedigree-average $B between the two genetic groups, and came close to meeting this objective as detailed in the next section.

Calves were born in a 44-day window from April 8th through May 22nd in 2015. Recipient dams with research calves at side remained on native pasture through weaning in the late fall. Post-weaning calves were treated with typical respiratory and clostridial vaccines and implanted with Ralgro. Winter and spring nutrition included wheat pasture and a growing ration, comprised of wheat silage, dried distillers grains, and alfalfa hay. Rates of gain on all cattle were favorable from birth through 13-14 months of age when the cattle were shipped from GAR to the feedlot.

All cattle were placed on feed June 6, 2016 at Triangle H East Feedlot, located south of Garden City, Kansas. The two $B groups were fed together (mixed pen of steers and heifers), treated with a standard implant protocol, and harvested in three drafts, targeting 0.50 inches in average backfat. Harvest dates ranged from late September through early November 2016.

The research group included 18 High $B steers (67%) and heifers (33%) and 25 Low $B cattle of both sexes (60% steers, 40% heifers). Cattle were harvested at National Beef in Liberal, Kansas, at which time detailed carcass data was collected. Carcasses were valued on the U.S. Premium Beef grid. Base market price adjustments were made in the financial evaluation portion of the study to standardize prices across harvest groups.

Results

High $B cattle outperformed their Low $B counterparts in every performance metric evaluated by the study. There was a pedigree average $B difference of $93.69 between the two groups ($141.12 versus $47.40), which represents the expected difference in progeny of the research cattle. Since the study evaluated the animals themselves (not their progeny), the expected value difference between the High $B and Low $B groups is twice their pedigree average $B difference or $187.38 per head ($93.69 x 2 = $187.38, which is the $B difference expressed in ***breeding value*** terms). This dollar amount turned out to be a reasonable prediction for how the cattle would perform. The study documented a conservative-leaning difference of $215.47 per head, favoring the High $B group. Following are detailed results by category.

i50K and GeneMax® Feeder Advantage Scores. Zoetis DNA evaluation accurately characterized the genetic differences in $B component traits between the two groups. High $B cattle ranked in top 12.3% of the entire Angus breed population when evaluated by i50K for Yearling Weight, Carcass Weight, Marbling, and Ribeye Area (4-trait average). Low $B animals ranked in the bottom 12.5% of the breed for the same four traits. The i50K results depict a large spread of 75.2-percentile-rank points between the two genetic groups, placing them at opposite ends of the bell curve for post-weaning growth and carcass value traits.

The average GeneMax Feeder Advantage score among the High $B cattle was 94, compared to an average score of 27 for the Low $B group. The scale for GeneMax Feeder Advantage ranges from 1 to 100. Higher scores indicate more favorable genetic potential for gain, feed intake, carcass weight, marbling, and ribeye area.

Numerical and Statistical Results Shown in the Table Below.

	High $Beef Advantage Versus Low $Beef	Statistical Difference	
Sire/Dam Average $Beef	$93.69	Yes	P<0.001
$Beef Difference in Breeding Value Terms (this amount predicts the per head financial difference between the two groups)	$187.38	Yes	P<0.001
i50k Average Percentile Rank Difference* *Average of YW, CW, MARB & REA	75.2%	Yes	P<0.001
GeneMax Feeder AdvantageScore (points)	67	Yes	P<0.001
Weight Per Day of Age (lbs.)	0.158	Yes	P<0.001
Age at Harvest (days)	-15.9	Yes	P<0.001
Carcass Weight (lbs.) *non-age-constant basis*	27	Yes	P<0.05
Carcass Weight (lbs.) *age-constant basis*	56	Yes	P<0.001
Marbling Score (MS units)	227	Yes	P<0.001
Ribeye Area (square inches)	1.41	Yes	P<0.001
Backfat (inches)	-0.05	No Difference	
Calculated Yield Grade (YG units)	-0.46	Yes	P<0.01
Carcass Value Per Head	$166.82	Yes	P<0.001
Feed & Yardage Saving Per Head	$48.65	Yes	P<0.001
Total Financial Difference Per Head	$215.47	Yes	P<0.001

This GeneMax Feeder Advantage difference of 67 points on a 100-point scale provides further indication of just how genetically separated these two groups of cattle were from each other. High $B cattle ranked very high DNA-wise for growth and carcass traits. The Low $B group ranked low in the same traits. See Appendix 1 for a further discussion and illustrations of DNA results.

Growth rate. High $B steers and heifers exhibited a lifetime advantage of 0.158 pounds in weight-per-day-of-age (WDA) compared to their Low $B counterparts. Faster growth leads to more pay weight, greater efficiency, and younger ages at harvest. All of these advantages were apparent in the study and contributed to the superior financial performance of the High $B Group.

Age at Harvest. High $B cattle averaged 15.9 days younger at harvest. This difference is beneficial in at least two ways. First, it saves feed and yardage. Nearly 16 days of covering animal maintenance expenses were avoided. Second, it reduces interest costs on borrowed funds often utilized during the finishing phase of production. A reasonable estimate of this cost savings is $3.06 per day (average per head cost of both groups while in the feedlot), which translates to $48.65 per head ($3.06 x 15.9 days), favoring the High $B genetic group.

Carcass Weight. Pounds always pay. Carcass weight was evaluated in two ways. In both cases, the High $B group demonstrated a significant advantage. On a non-age-constant basis, High $B cattle produced 27 more pounds of carcass weight despite being over two weeks younger when harvested. More total pounds with less time and less cost is an easily understood benefit the High $B genetics provided. Had these cattle been harvested on an age-constant basis, the carcass weight advantage would have increased to 56 pounds for the High $B group.

Marbling Score. Both groups of cattle in the study graded very well in absolute terms. Credit that outcome to favorable birth-to-harvest management both nutritionally and health-wise. Even so, the High $B group outdid their Low $B contemporaries by 227 points of marbling score. This difference resulted in larger grid premiums for quality grade, and directly contributed to superior carcass value among the High $B animals. The table below presents actual Quality Grade results for the two groups.

	Prime	CAB	Low Choice	Select
High $B	72%	28%	0%	0%
Low $B	0%	52%	44%	4%

Ribeye Area. Producing genetically superior cattle that excel in both marbling and muscling is possible. The High \$B group did exactly that compared to the Low \$B cattle. Marbling scores were higher as discussed above. Ribeye areas were also larger by 1.41 square inches. This muscling advantage improves red meat yield, and helps avoid Yield Grade 4 discounts on the grid. Actual ribeye sizes are shown below for the two groups in square inches.

	Steers	Heifers
High \$B	15.05	14.70
Low \$B	13.59	13.39
Difference	1.46	1.31

Backfat. A goal of the project was to feed both genetic groups to the same fat endpoint. This objective was accomplished. There was no statistically significant difference in measured backfat between the 12th and 13th rib. Both \$B groups were very near industry averages. Steers averaged 0.5 inches of backfat, with heifers slightly over 0.6 inches.

Yield Grade. Because of their superior muscle and equal external fat (and despite heavier carcass weights), the High \$B genetic group netted a statistically significant advantage for Yield Grade. Lower numeric Yield Grades are favorable, and the difference between the two groups was -0.46 YG units, or almost half a Yield Grade score. Virtually all industry grids pay premiums for YG 1s and YG 2s, while discounting YG 4s and YG 5s. The table below presents actual Yield Grade results for the two genetically-different groups.

	YG1	YG2	YG3	YG4
High \$B	0%	67%	28%	6%
Low \$B	0%	20%	52%	28%

Carcass Value. Pounds, marbling, and red meat yield are the largest contributors to carcass value. The High \$B group excelled their Low \$B Angus cousins in all of these categories, resulting a very large difference of \$166.82 per head. This tremendous result speaks for itself. Genetics do make all the difference, and the EPDs and \$Indexes published by the American Angus Association are extremely useful tools in helping both seedstock and commercial producers create more valuable cattle.

Financial Results. Carcass value superiority (\$166.82 per head in greater revenue) combined with measured feed/yardage savings (\$48.65 per head in lower production costs) gave the High \$B group a total financial advantage of \$215.47 per head versus the Low \$B group. As mentioned above, this amount is reasonably close to the projected pedigree-average \$B difference between the two genetic groups when expressed in breeding value terms ($187.38 per head). $B did its job well, and even leaned conservative compared to actual field test results.

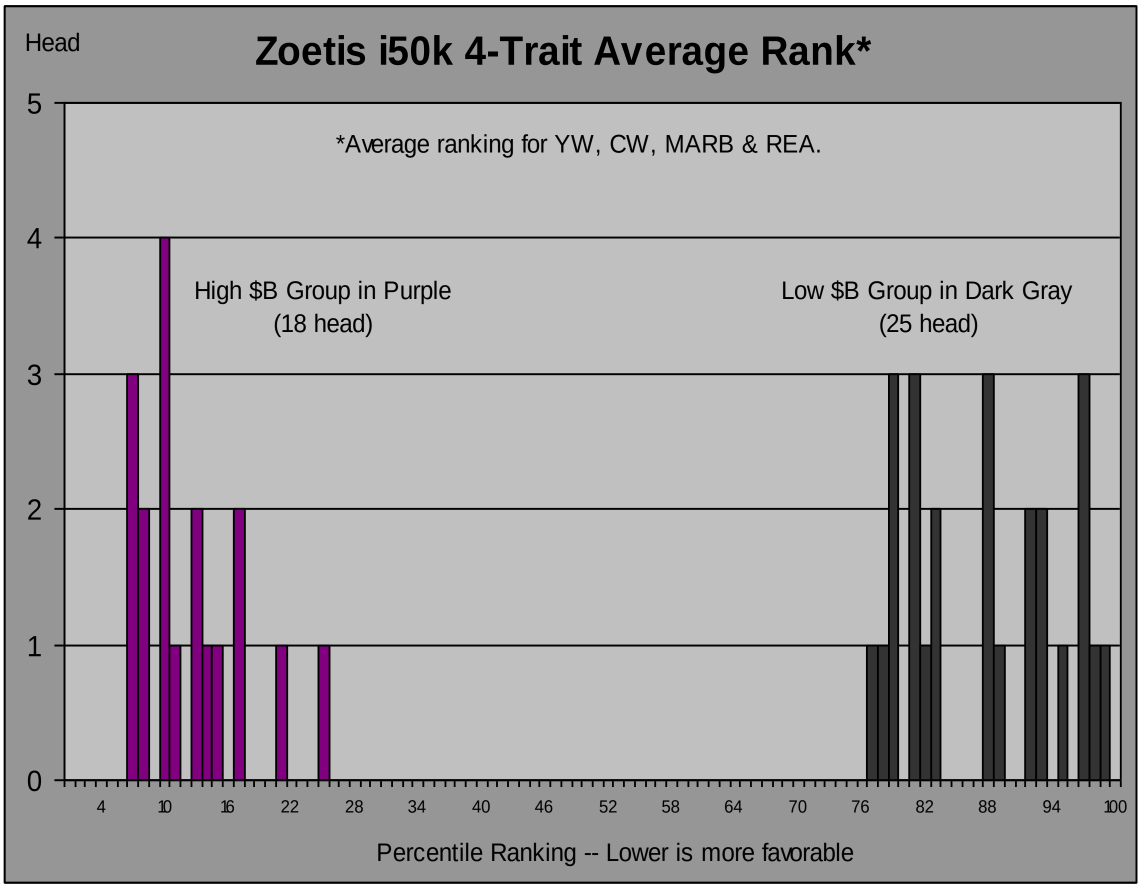
Additional dollars related to lifetime feed efficiency could also be attributed to the High $B group, but such an advantage was not quantified in this study. Since the High $B cattle grew faster, they undoubtedly grew more efficiently from birth to harvest. Faster growing cattle are well known for that. It is noteworthy that the WDA advantage with the High $B cattle versus Low $B group was nearly identical to the WDA difference between the steers and heifers in this study (0.158 and 0.153 pounds, respectively). Steers are generally 7% to10% more feed efficient than heifers. Thus, it is quite likely that the High $B genetic cattle grew more efficiently by a similar magnitude.

Conclusion

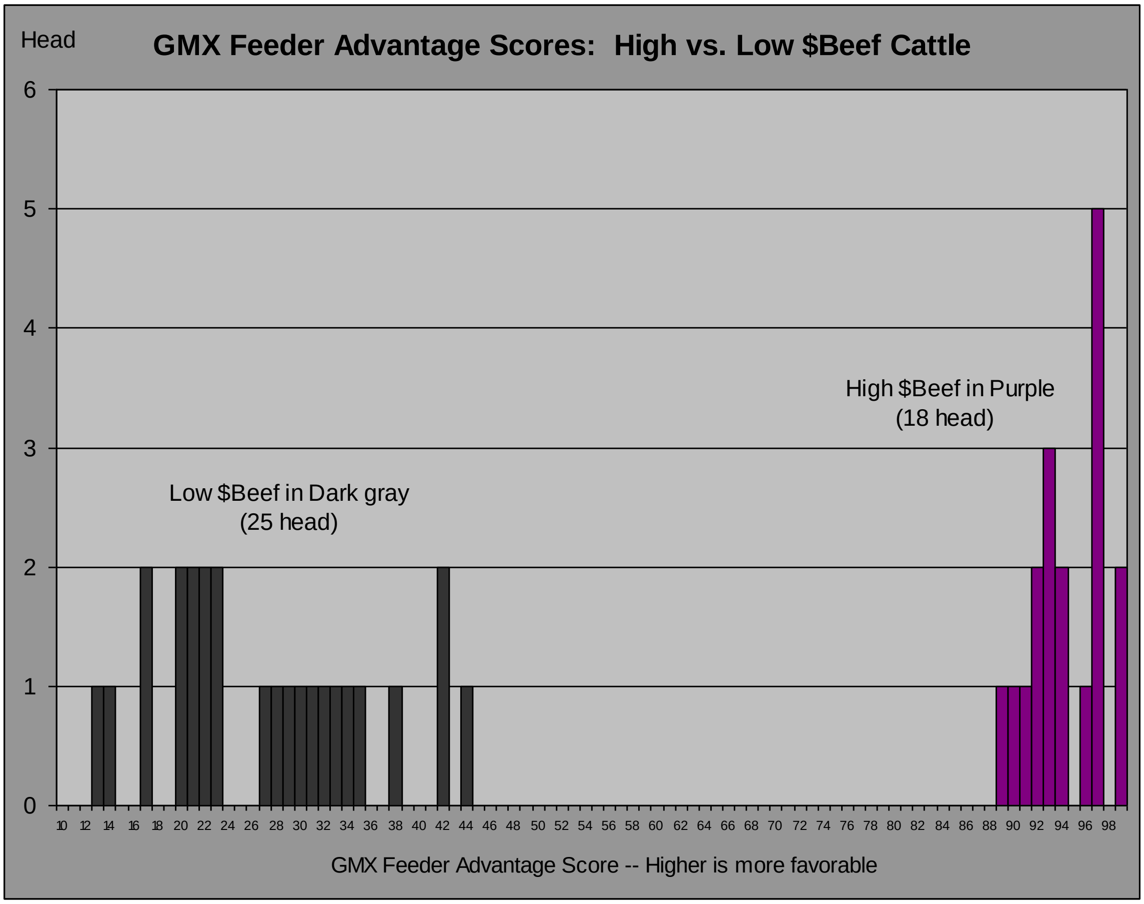
Real-world genetic comparisons are expensive and time consuming to conduct, but provide valuable information to those who desire to use EPDs and $Indexes to their best advantage. This field test was designed to compare High $B and Low $B Angus genetics in a commercial production setting. The quantified financial difference between the High $B and Low $B groups aligned well with that predicted by the pedigree average $B differences expressed in breeding value form ($215.47 versus $187.38 per head). This outcome provides meaningful evidence that EPDs and $Indexes correctly represent differences from animal to animal or group to group. Angus EPDs and $Indexes are more than "numbers on a page." They can be relied on to produce real-world results.

The physical performance and financial results of this study make a large and definitive statement, reflecting the extreme genetic differences found between High $B and Low $B cattle. Most importantly, these results should help cattle producers realize that the tools they have at their fingertips (EPDs, $Indexes, and DNA test results) are powerful tools indeed toward the creation of more valuable cattle. The authors believe the U.S. beef industry will continue to aggressively use these tools in the years ahead, resulting in sizable benefits for producers, feeders, packers, and beef consumers.

Appendix 1. The two charts below illustrate the large difference in i50k percentile rankings and GeneMax Feeder Advantage scores observed between High $B and Low $B groups. For the i50k results (first chart), lower numeric percentile rankings mean a higher and more favorable ranking within the overall Angus population---as is noted with the High $B Group. Conversely, a higher numeric percentile ranking, as seen in the Low $B Group, depicts a position near the bottom of the Angus breed. These cattle literally “bookended” the Angus bell curve for growth and carcass traits.



Note in the chart below that the Low $B cattle fell near the bottom end of the range with their GeneMax Feeder Advantage scores, while High $B cattle were tightly grouped at the high end of the range. Higher scores are more favorable here, and again we see a very large genetic difference between the two groups.



Appendix 2. The question will be asked about cow size and related maintenance costs when it comes to High $B genetics. Yes, High $B Angus genetics produce more valuable steer and heifer progeny. However, do High $B genetics also result in larger mature cow sizes and therefore higher cow maintenance costs that (for example) offset some or all of the advantages documented in this study? Important perspective on this subject can be gained from the following article, published in the October 2015 issue of the Angus Journal --- http://www.angusjournal.com/articlepdf/btn-10_15.pdf.

This field study is unique in that we can directly address the issue of cow size and cow cost. Every animal harvested in both the High $B and Low $B groups were out of registered Angus dams. These dams have EPDs for Milk, Mature Weight, Mature Height, and the $EN index. We can use this information to accurately evaluate cow maintenance costs associated with the mothers of our two genetic groups. The table below presents both

High $B and Low $B dam EPDs and the $EN index on a weighted-average basis (head weighted to match animals harvested in this study).

	Milk	MW	MH	$EN
High $B Dams	29	66	0.6	-17.45
Low $B Dams	18	33	0.6	15.31

Milk = Milk EPD
MW = Mature Weight EPD
MH = Mature Height EPD
$EN = $Energy index

Dams of the High $B group would be heavier by approximately 2x the difference in the Mature Weight EPD or 66 pounds (2x the 33-pound difference between the average MW EPD = 66 pounds). There would not be any appreciable difference in height or frame size, since the Mature Height EPD averages 0.6 for both groups. The High $B dams would be heavier at maturity, being longer and stouter-made than their Low $B counterparts, but not taller. See pictures on the following page. It takes only a little imagination to envision what these two heifers would have looked like as cows.

The High $B dams also have higher average Milk EPDs, which would support pre-weaning calf growth, but also add to their feed requirements. None of the calves in this field test were raised by their own dams, making these Milk EPDs irrelevant to our $B field study results. However, we can still get a good idea about the cow cost associated with the High $B and Low $B genetic groups by looking at the $EN difference. $EN is expressed as an EPD, so it must be multiplied by two (converting it to breeding value terms, as discussed with $B above). There is a $32.76 difference in $EN between our two dam groups, which equates to a $65.52 difference as a breeding value. The approximate difference in annual cow feed costs between the High $B and Low $B dams would thus be $65.52 per cow per year, with the Low $B dams costing less annually to feed.

A conservatively-calculated lifetime financial advantage of $215.47 per head for High $B genetics was observed in this study, which nets down to $149.95 per head after subtracting the higher cow feed cost of $65.52 ($215.47 - $62.52 = $149.95).

When bred to High $B bulls, the High $B dams in this study produced an overall $150 per head advantage in their progeny versus the Low $B dams bred to Low $B Angus sires. As a whole, High $B genetics required somewhat larger inputs, but much greater output value. Conversely, the Low $B genetics cost less to produce, when cow costs are considered, but this savings was totally negated by the lower value of the lower value of their output.

High $B Heifer---graded Prime YG2 with an 887-lb. carcass.

Low $B Heifer---graded Low Choice YG2 with an 870-lb. carcass.