

Sire Evaluation Report

FALL 2023

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Angus Sire Evaluation Information

From a total of 311,260 sires with progeny records in the American Angus Association database May 26, 2023, the *Fall 2023 Sire Evaluation Report* lists 2,377 sires with the following qualifications.

- 1. The sire must have at least 35 yearling progeny weights in proper contemporary groups on Angus Herd Improvement Records (AHIR®).
- 2. The sire must have a yearling accuracy value of at least 0.40.

3. The sire must have had at least five calves recorded in the American Angus Association Herd Book since June 1, 2021.

The Young Sire Supplement lists 2,833 bulls born after Jan. 1, 2019, that have at least 10 progeny weaning weights on AHIR and have a weaning accuracy of at least 0.30.

The American Angus Association takes reasonable research and editing measures to ensure the quality of the

genetic prediction analysis and other information made available in this report. However, the American Angus Association does not guarantee or assume responsibility for the accuracy, timeliness, correctness, or completeness of information available in this report. The information presented here should not be considered or represented to be a measure of the actual value of the animal or its progeny or a guarantee of performance. Any conclusions that users draw from the information presented here are

How to read the report

Each bull listed in this report is comparable to every other bull in the database. The analysis takes into account only the differences expressed in each herd in which the bulls

were used. For example, Bull A has a weaning EPD of +60 lb. and Bull B has a weaning EPD of +50 lb. If you randomly mate these bulls in your herd, you could expect Bull A's

calves to weigh, on average, 10 lb. more at weaning than Bull B's progeny (60 – 50 = 10).

EXPECTED PROGENY DIFFERENCES AND \$VALUES																													
SIRE STATISTICS	PRODUCTION								MANAGEMENT					MATERNAL						CARCASS					\$VALUES				
	CED ACC	BW ACC	WW ACC	YW ACC	RADG ACC	DMI ACC	YH ACC	SC ACC	Doc ACC	Claw ACC	Angle ACC	PAP ACC	HS ACC	HP ACC	CEM ACC	Milk ACC	MkH MkD	MW ACC	MH ACC	\$EN	CW ACC	Marb ACC	RE ACC	Fat ACC	CGrp CProg	UGrp UProg	\$M \$W	\$F \$G	\$B \$C
ANIMAL NAME 98765435251 07-08-80	+10.99	+2.4.99	+59.99	+98.99	+16.99	+27.99	-.3.99	+1.06.99	+6.90	+.50.85	+.51.85	+1.14.42	+.56.48	+13.1.80	+10.95	+23.99	268111634	+19.98	+3.99	+3	+37.89	+.55.90	+.22.89	+.017.88	1751	510	+46.29	+71.48	+95.168

Accuracy (ACC) is the reliability that can be placed on the EPD. An accuracy of close to 1.0 indicates higher reliability. Accuracy is impacted by the number of progeny and ancestral records included in the analysis.

Expected progeny difference (EPD) is the prediction of how future progeny of each animal are expected to perform relative to the progeny of other animals listed in the database. EPDs are expressed in units of measure for the trait, plus or minus. Interim EPDs may appear for young animals when their performance is yet to be incorporated into the American Angus Association National Cattle Evaluation (NCE) procedures. This EPD will be preceded by an “I,” and may or may not include the animal's own performance record for a particular trait, depending on its availability, appropriate contemporary grouping, or data edits needed for NCE.

PRODUCTION TRAITS

Calving ease direct (CED) is expressed as a difference in percentage of unassisted births, with a higher value indicating greater calving ease in first-calf heifers. It predicts the average difference in ease with which a sire's calves will be born when he is bred to first-calf heifers.

Birth weight (BW), expressed in pounds, is a predictor of a sire's ability to transmit birth weight to his progeny compared to that of other sires.

Weaning weight (WW), expressed in pounds, is a predictor of a sire's ability to transmit weaning growth to his progeny compared to that of other sires.

Yearling weight (YW), expressed in pounds, is a predictor of a sire's ability to transmit yearling growth to his progeny compared to that of other sires.

Residual average daily gain (RADG), expressed in pounds per day, is a predictor of a sire's genetic ability for post-weaning gain in future progeny compared to that of other sires, given a constant amount of feed consumed.

Dry-matter intake (DMI), expressed in pounds per day, is a predictor of a sire's ability to transmit feed intake during the postweaning phase to his progeny compared to that of other sires.

Yearling height (YH), expressed in inches, is a predictor of a sire's ability to transmit yearling height compared to that of other sires.

Scrotal circumference (SC), expressed in centimeters, is a predictor of a sire's ability to transmit scrotal size compared to that of other sires.

MANAGEMENT TRAITS

Docility (Doc) is expressed as a difference in yearling cattle temperament, with a higher value indicating more favorable docility. It predicts the average difference of progeny from a sire in comparison with another sire's calves. In herds where temperament problems are not an issue, this expected difference would not be realized.

Claw set (Claw) is expressed in units of claw-set score, with a lower EPD being more favorable, indicating a sire will produce progeny with more ideal claw set. The ideal claw set is toes that are symmetrical, even and appropriately spaced.

Foot angle (Angle) is expressed in units of foot-angle score, with a lower EPD being more favorable, indicating a sire will produce progeny with more ideal foot angle. The ideal is a 45-degree angle at the pastern joint with appropriate toe length and heel depth.

Pulmonary arterial pressure (PAP) is expressed in millimeters of Mercury (mmHg), with a lower EPD being more favorable, indicating a sire should produce progeny with a lower PAP score. PAP score is an indicator of susceptibility to high-altitude disease commonly experienced at elevations greater than 5,500 feet. Selection for this trait aims to improve the genetic potential for a sire's progeny to have lower PAP scores and thus a lower chance of contracting high-altitude disease, increasing the environmental adaptability of cattle living in mountain areas.

Hair shed (HS) is expressed in units of hair shed score, with a lower EPD being more favorable, indicating a sire should produce progeny who shed their winter coat earlier in the spring. Selection for this trait should improve the genetic potential for a sire's progeny to shed off earlier, increasing the environmental adaptability of cattle living in heat-stressed areas and grazing endophyte-infested (hot) fescue.

MATERNAL TRAITS

Heifer pregnancy (HP) is a selection tool to increase the probability or chance of a sire's daughters becoming pregnant as heifers during a normal breeding season. A higher EPD value is more favorable, and the EPD is reported in percentage units.

Calving ease maternal (CEM) is expressed as a difference in percentage of unassisted births with a higher value indicating greater calving ease in first-calf daughters. It predicts the average ease with which a sire's daughters will calve as first-calf heifers when compared to daughters of other sires.

Maternal milk (Milk), expressed in pounds of calf weaned, is a predictor of a sire's genetic merit for milk and mothering ability as expressed in his daughters compared to daughters of other sires. In other words, it is that part of a calf's weaning weight attributed to milk and mothering ability.

MkH indicates the number of herds from which daughters are reported as having progeny weaning weight records included in the analysis.

MkD indicates the number of daughters that have progeny weaning weight records included in the analysis.

Mature weight (MW), expressed in pounds, is a predictor of the difference in mature weight of daughters of a sire compared to the daughters of other sires.

Mature height (MH), expressed in inches, is a predictor of the difference in mature height of a sire's daughters compared to daughters of other sires.

Cow energy value (\$EN), expressed in dollar savings per cow per year, assesses differences in cow energy requirements as an expected dollar savings difference in daughters of sires. A larger value is more favorable when comparing two animals (more dollars saved on feed energy expenses). Components for computing the cow \$EN savings difference include lactation energy requirements and energy costs associated with differences in mature cow size.

CARCASS TRAITS

Carcass weight (CW), expressed in pounds, is a predictor of the difference in hot carcass weight of a sire's progeny compared to progeny of other sires.

Marbling (Marb), expressed as a fraction of USDA marbling score, is a predictor of the difference in marbling of a sire's progeny compared to progeny of other sires.

Ribeye area (RE), expressed in square inches, is a predictor of the difference in ribeye area of a sire's progeny compared to progeny of other sires.

their own and are not to be attributed to the American Angus Association.

The American Angus Association has available upon request additional booklets explaining expected progeny differences (EPDs) and national cattle evaluation (NCE) procedures.

To view the latest *Sire Evaluation Report* online, visit www.angus.org/nce.

Fat thickness (Fat), expressed in inches, is a predictor of the difference in external fat thickness at the 12th rib (as measured between the 12th and 13th ribs) of a sire's progeny compared to progeny of other sires.

Group/progeny (CGrp/CProg and UGrp/UProg) reflects the number of contemporary groups and the number of carcass and ultrasound progeny included in the analysis.

\$VALUE INDEXES

An economic selection index, or \$Value index, allows change in several different traits at once pertaining to a specific breeding objective. The \$Value is an estimate of how future progeny of each sire are expected to perform, on average, compared to progeny of other sires if the sires were randomly mated to cows and if calves were exposed to the same environment.

\$Maternal Weaned Calf Value (\$M), an index, expressed in dollars per head, predicts profitability differences from conception to weaning with the underlying breeding objective assuming that individuals retain their own replacement females within herd and sell the rest of the cull female and all male progeny as feeder calves.

\$Weaned Calf Value (\$W), an index, expressed in dollars per head, predicts profitability differences in progeny due to genetics from birth to weaning.

\$Feedlot Value (\$F), an index, expressed in dollars per head, predicts profitability differences in progeny due to genetics for postweaning feedlot merit compared to the progeny of other sires.

\$Grid Value (\$G), an index, expressed in dollars per carcass, predicts profitability differences in progeny due to genetics for carcass grid merit compared to progeny of other sires.

\$Beef Value (\$B), a terminal index, expressed in dollars per carcass, predicts profitability differences in progeny due to genetics for postweaning and carcass traits.

\$Combined Value (\$C), an index, expressed in dollars per head, which includes all traits that make up both Maternal Weaned Calf Value (\$M) and Beef Value (\$B) with the objective that commercial producers will replace 25% of their breeding females in the first generation and 20% per year thereafter with replacement heifers retained within their own herd. The remaining cull heifer and steer progeny are then assumed to be sent to the feedlot where the producers retain ownership of those cattle and sell them on a quality-based carcass-merit grid. EPDs directly influencing a combined index: calving ease direct (CED) and maternal (CEM), weaning weight (WW), yearling weight (YW), maternal milk (Milk), heifer pregnancy (HP), docility (DOC), mature cow weight (MW), foot angle (Angle), claw set (Claw), dry-matter intake (DMI), marbling (Marb), carcass weight (CW), ribeye area (RE) and fat thickness (Fat).

Trait Descriptions

Calving Ease

Calving ease. Heifer calving ease expected progeny differences (EPDs) were calculated using a multi-trait animal model including birth weight and calving score data. The result is a heifer calving ease direct and a heifer calving ease maternal EPD, as defined below.

Calving ease direct (CED): Calving ease direct EPD is expressed as a difference in percentage of unassisted births, with a higher value indicating greater calving ease in first-calf heifers. It predicts the average difference in ease with which a sire's calves will be born when the sire is bred to first-calf heifers.

Calving ease maternal (CEM): Calving ease maternal EPD is expressed as a difference in percentage unassisted births with a higher value indicating greater calving ease in first-calf daughters. It predicts the average ease with which a sire's daughters will calve as first-calf heifers when compared to daughters of other sires.

Growth

Birth weight/weaning weight/yearling weight/maternal milk. Growth traits were evaluated together in a multi-trait model. As it is recommended for the evaluation of maternally influenced traits, a direct genetic effect, a maternal genetic effect and a maternal permanent environmental effect were fitted for birth and weaning weights. Postweaning gain was not considered to be maternally influenced; therefore, the direct genetic effect was the only random effect fitted. Yearling weight EPDs were calculated from the EPDs for weaning weight direct and postweaning gain. The evaluation includes individual weights on embryo transfer calves out of registered Angus recipient females, provided any other national cattle evaluation (NCE) requirements for edited data are met.

Residual average daily gain and dry-matter intake. The steps to generate the components needed to calculate the residual average daily gain (RADG) EPD include a comprehensive genetic evaluation of multiple phenotypic traits, including the phenotypic feed intake data collected on individual animals through research and tests. Also, the dry-matter intake (DMI) genomic predictions are used as an indicator trait in the intake evaluation process. The resulting feed intake genetic component from the multi-trait animal model analysis is used to calculate RADG. The genetic RADG EPD reflects composition-constant genetic potential for growth given a constant amount of feed. It characterizes postweaning gain among animals given the same amount of feed consumed. RADG is presented in pounds per day, with a higher value being more favorable. DMI, expressed in pounds per day, is a predictor of difference in transmitting ability for feed intake during the postweaning phase, compared to that of other sires.

Yearling height and scrotal evaluations. Yearling height and scrotal circumference traits are analyzed separately using a multi-trait animal model in the genetic evaluation. Both the height and scrotal evaluations include genetically correlated measures for yearling weight and any available genomic results. Yearling height EPDs are reported in inches and are reported on bulls and heifers at or near a year of age. Scrotal circumference EPDs, generated from scrotal data collected on yearling Angus bulls, are presented in centimeters.

Foot score evaluations

Two scores for claw set and foot angle are recorded on a 1-to-9 scale with 5 being ideal. Both foot score traits are moderately heritable. Even though the performance database is assembled using all scores (1-9) submitted, only scores falling into the 5 through 9 categories are used in the genetic evaluation for claw set and foot angle. Therefore, a lower or more negative EPD indicates a sire that is better able to produce progeny with more ideal feet. Claw set and foot angle EPDs are represented

in units of foot score. Producers can submit foot scores into the database on cattle as early as yearling age and are encouraged to submit scores on mature females as more variation in the traits are prevalent at older ages.

Pulmonary arterial pressure

Pulmonary arterial pressure (PAP) is an indicator for animals with lower risk of developing high-altitude disease (HAD), which in most cases results in congestive right heart failure. Researchers and veterinarians at Colorado State University (CSU) have been studying HAD, more commonly known as brisket disease, and its onset for decades and have developed PAP tests in order to select animals to avoid pulmonary hypertension.

This disease, most commonly found in cattle living at elevations of 5,500 ft. or greater, is a result of cattle living in hypoxic environments challenging heart and lung function. Symptoms of the disease include lethargy, diarrhea, weakness, brisket edema, right heart failure and eventual death. High-altitude pulmonary arterial pressure (PAP) predicts the genetic differences in PAP score with lower EPDs being more favorable.

A lower PAP EPD predicts a sire should produce progeny with lower pulmonary arterial pressures, decreasing the risk of contracting HAD, which is desirable. It is also important to remember that a PAP EPD is not a replacement for taking PAP scores on cattle living at elevation. An animal may have good genetics to pass on to the next generation, but due to a life event, BRD for instance, its respiratory system may be damaged, causing it to lack the viability to survive at high altitudes.

Think of PAP in terms of scrotal size. Bulls may have the genetic potential to pass along larger scrotal size genetics, but scrotal (SC) EPDs are not a replacement for breeding soundness exams (BSE). Producers will not send a bull out without conducting a BSE, no matter how good his SC EPD is. The EPD can be valuable to select parents for the next generation with less risk. However, if a sire is to be taken to higher elevations to live, they should be tested themselves before doing so.

For more information see *Selection Tools for Pulmonary Arterial Pressure* at <https://www.angus.org/Nce/documents/PapResearchReport05262020.pdf>

Hair shed

Early season hair shedding is an indicator for better heat tolerance and tolerance to fescue toxicosis. Hair shed scores are recorded on a 1-to-5 scale and can be recorded for an animal annually starting during the yearling age window. Hair shed is a moderately heritable trait. The EPD is represented in units of hair shed score. A lower EPD indicates a sire that should produce progeny who shed their winter coat earlier in the spring.

Docility

Yearling temperament scores were used to calculate an EPD for docility. Four categories were used for scores 1, 2, 3 and the combined category of scores 4, 5 and 6. The docility EPD is presented as a percentage, where a higher value is considered more favorable in terms of docile temperament. Since this is a threshold trait, herds that exhibit no problems in temperament will realize no improvement when selecting for favorable docility EPDs.

Heifer pregnancy

The heifer pregnancy (HP) EPD is designed to characterize differences among sires in the Angus breed for daughters' heifer pregnancy. When comparing two sires based on their heifer pregnancy EPDs (reported in units of percentage), a higher-EPD sire would be expected to have daughters with a greater probability or chance of becoming pregnant than a sire with the lower EPD.

Trait Descriptions continued on following page

A performance database is assembled using available breeding information on first-calf heifers. A heifer’s breeding record is coded as a success or failure of being pregnant based on any pregnancy-check data or calving information recorded and submitted by the breeder. The heifer contemporary group is defined as breeding herd, breeding year, season and synchronization code. Edited data on heifers are analyzed in a threshold analysis.

Mature cow size

Mature weight (MW) and height (MH) are highly heritable traits, indicating selection for these traits can be effective. The mature size genetic evaluation is a multi-trait animal model using repeated measures on cows from yearling age throughout their lifetime.

A body condition score must be included with the cow weight in order for data to be utilized to calculate mature size EPDs in the NCE. Any cow weights submitted without a body condition score are not used. For more information on body condition score, go to www.cowbcs.info.

As a reminder for weaning time, cow weights with a body condition score need to be taken ±45 days of the calf’s weaning measure date. Cow hip heights may be captured at this time, also. It is important to collect this information after the cow has weaned her first calf, and then again in subsequent years.

EPDs are generated for mature weight and mature height based on these varying amounts of performance information and pedigree relationships. The resulting EPDs are representative of the genetics for Angus cow size at a projected 6 years of age.

Carcass

Carcass EPDs are calculated from an integrated analysis of the Beef Improvement Records carcass, ultrasound, growth (weaning weight) and genomic profile databases. The weekly genetic evaluations result in a single EPD, respectively, for carcass weight, marbling score, ribeye area and fat thickness. The units of measure for EPDs are in carcass trait format — marbling score, carcass weight in pounds, carcass ribeye in square inches, and carcass fat thickness in inches. Growth (weaning weight), carcass, genomic and pedigree databases are simultaneously combined into one set of genomic-enhanced carcass EPDs for Angus breeding programs.

The carcass and ultrasound data contributing to the evaluation are described in Table 1 and Table 2 with average adjusted measurements.

Ultrasound images incorporated into the carcass EPDs were collected by field technicians certified by the Ultrasound Guidelines Council (UGC). The images were interpreted through one of the American Angus Association’s authorized ultrasound processing labs by UGC-certified lab technicians.

Table 1: Angus phenotypic averages of steer and heifer carcasses

Heifers:	Age at harvest, days			
	330 < Age < 480		481 < Age < 799	
	Avg.	SD ¹	Avg.	SD
Avg. age at harvest, days	436	31	562	64
Adj. ² carcass wt., lb.	719	91	726	105
Adj. fat thickness, in.	0.61	0.19	0.56	0.20
Adj. ribeye area, sq. in.	12.22	1.44	12.29	1.60
Adj. marbling score	6.85	1.33	6.50	1.43
No. of heifers	6,594		8,764	
Steers:				
Avg. age at harvest, days	438	26	527	46
Adj. carcass wt., lb.	805	88	794	106
Adj. fat thickness, in.	0.58	0.18	0.56	0.19
Adj. ribeye area, sq. in.	12.73	1.39	12.86	1.54
Adj. marbling score	6.30	1.11	6.02	1.32
No. of steers	84,440		33,614	

¹SD = standard deviation.
²Carcasses adjusted to 480 days of age at harvest.

Table 2: Yearling Angus live-animal and ultrasound measures

Trait	Bulls		Heifers		Steers	
	Avg.	SD ¹	Avg.	SD	Avg.	SD
Age, days	371	26	389	30	402	38
Gain, lb./day	2.91	0.70	1.51	0.52	2.81	0.73
Adj. scan wt., lb.	1,120	141	868	114	1,101	168
Adj. %IMF, %	3.84	1.14	4.86	1.43	4.97	1.45
Adj. ribeye area, sq. in.	12.64	1.90	9.79	1.74	12.33	2.28
Adj. 12th-rib fat thickness, in.	0.28	0.10	0.26	0.11	0.40	0.15
Adj. rump fat thickness, in.	0.30	0.11	0.30	0.12	0.41	0.15
Total animals	1,357,368		878,594		14,271	

¹SD = standard deviation.

As a review, the scoring system for marbling and its relationship to the USDA Quality Grading System is defined in Table 3. For a carcass to meet *Certified Angus Beef*® (CAB®) standards, it must have a Modest (average Choice) or higher marbling degree, be of “A” maturity (the most youthful classification for beef), have a 10- to 16-square-inch ribeye, 1 inch or less fat thickness, 1,100-pound hot carcass weight or less and a fine to medium marbling texture. For more details, go to www.cabcattle.com.

Table 3: USDA quality grading system and marbling score

Quality Grade	Amount of Marbling	Numerical Score
Prime+	Abundant	10.0-10.9
Prime	Moderately abundant	9.0-9.9
Prime-	Slightly abundant	8.0-8.9
Choice+	Moderate	7.0-7.9
Choice	Modest	6.0-6.9
Choice-	Small	5.0-5.9
Select	Slight	4.0-4.9
Standard	Traces	3.0-3.9
Standard	Practically devoid	2.0-2.9
Utility	Devoid	1.0-1.9

Dollar value indexes, or \$Values, are tools used to select for several traits at once based on a specific breeding objective. An economic index approach takes into account genetic and economic values, as well as the relationships between traits to select for profit. An index is challenging to develop, but the end result is easy to use, adding the simplicity and convenience of a multi-trait approach.

\$Values provide the opportunity for commercial producers to select for profitability given a specific breeding objective. Maternal weaned calf value (\$M) and weaned calf value (\$W) are expressed in dollars per head predicting preweaning profitability differences among different sire groups. Cow energy value (\$EN) provides an opportunity to fine-tune the cow herd for costs associated with maternal milk and cow size. In addition, feedlot value (\$F), grid value (\$G) and beef value (\$B) are economic index values to assist commercial beef producers in selecting individuals profitable for terminal traits, including feedlot gain and carcass merit. Combined value (\$C), expressed in dollars per head, includes all 15 traits involved in \$M and \$B.

\$Values encompass the revenue generated from genetically derived outputs and associated costs (expenses) from required inputs. \$Values only have meaning when used in comparing the relative merit or the ranking of two individuals. Each sire listed in this report is comparable to every other sire. The \$Values are sensitive to the assumptions for the industry-relevant components used in calculating the indexes. Angus Genetics Inc., the American Angus Association and Certified Angus Beef, alongside industry-leader CattleFax, work together to annually update these economic assumptions, which are derived from the previous seven-year market trend rolling average. As with expected progeny differences (EPDs), variation in \$Values between animals indicates expected differences in the relative value of progeny if random mating is assumed. Thus, a \$Value has meaning only when used in comparison to the \$Value of another animal.

\$Maternal Weaned Calf Value, \$Weaned Calf, and Cow \$Energy

Maternal weaned calf value (\$M)

Maternal weaned calf value (\$M) is the most maternally focused selection index currently available to Angus members and commercial users of Angus genetics. \$M, expressed in dollars per head, aims to predict profitability differences in progeny due to genetics from conception to weaning. \$M is built off of a self-replacing herd model where commercial cattlemen replace 25% of their breeding females in the first generation and 20% in subsequent generations. Remaining cull females and all male progeny are sold as feeder calves.

\$M places greater emphasis on the cost side of commercial cow-calf production than \$W. Increased selection pressure on \$M aims to decrease overall mature cow size while maintaining weaning weights consistent with today’s production. Under \$M selection, less emphasis is placed on maternal milk, while heifer pregnancy and docility have an increased emphasis, and foot traits start to improve. The index finds cattle that are most profitable when producers receive no economic benefit for traits affecting postweaning performance.

For example, if Bull A has a \$M of +75 and Bull B has a \$M of +55 and both are mated to a comparable set of females, one would expect, on average, for Bull A’s progeny to be \$20 more profitable per head for the cow-calf producer.

EPDs directly influencing the index include: calving ease direct, calving ease maternal, weaning weight, maternal milk, heifer pregnancy, docility and mature weight, as well as foot angle and claw set.

Weaned calf value (\$W)

Weaned calf value (\$W) provides the expected dollar-per-head difference in future progeny preweaning performance

from birth to weaning. \$W assumes that producers retain 20% of their female progeny for replacements and sell the rest of their cull female and male progeny as feeder calves. Over time, increased selection pressure on \$W will increase weaning and yearling weight traits while also continuing to increase mature cow size. As with any \$Value, \$W only has meaning when used in comparing the relative merit or ranking of two individuals.

EPDs directly influencing \$W include: birth weight, weaning weight, maternal milk and mature cow size.

The base components used to calculate these \$Values for any registered animal are:

Weaned steer calf	\$167 per cwt.
Weaned heifer calf	\$152 per cwt.
Hay price (alfalfa)	\$181 per ton
Hay price (other)	\$136 per ton
Cow/heifer herd mix	80/20

Cow energy value (\$EN)

A cow energy value (\$EN) is available to assess differences in cow energy requirements, expressed in dollars per cow per year, as an expected dollar savings difference in future daughters of sires. A larger value is more favorable when comparing two animals (more dollars saved on feed energy expenses). Components for computing the \$EN savings difference include lactation energy requirements and energy costs associated with differences in mature cow size.

Cow Energy (\$EN) Savings, \$/cow/year	+16	Cow Energy (\$EN) Savings, \$/cow/year	+5
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In the above example, the expected difference in cow energy savings per cow per year for future daughters of the two animals is +11 [+16 - (+5) = +11].

\$Feedlot, \$Grid and \$Beef

Feedlot value (\$F), grid value (\$G) and beef value (\$B) are postweaning bioeconomic \$Values, expressed in dollars per head, to assist commercial beef producers by adding simplicity to genetic selection decisions. The \$Values were developed primarily to serve as selection tools for commercial bull buyers.

\$Values are reported in dollars per head with a higher value indicating greater profitability:

	\$F	\$G	\$B
Example	+82	+44	+126

Although feedlot and carcass merit are important components of the beef production chain, it should be stressed to producers that \$F, \$G and \$B are not to be used as a single selection criterion, since the indexes only encompass postweaning and carcass performance.

\$F, \$G and \$B values incorporate available gain, feed intake and carcass EPDs, converted into economic terms, incorporating industry-relevant components for feedlot performance and carcass merit. The base components used to calculate these \$Values for any registered animal are:

Feedlot assumptions:			
Calf-fed/yearling-fed		75/25	
Time on feed (steer), calf-fed/yearling-fed	246/171 days		
Yearling steer	\$143 per cwt.		
Yearling heifer	\$135 per cwt.		
Fed steer, dressed delivered	\$192 per cwt. carcass		
Ration cost	\$199 per ton		

Grid assumptions:			
<i>Quality components:</i>			
Prime premium (above Choice)	\$23.52 per cwt.		
CAB premium (above Choice)	\$5.80 per cwt.		
Choice-Select spread	\$-16.43 per cwt.		
Standard discount	\$-39.59 per cwt.		
<i>Yield components:</i>			
YG 1 premium	\$5.86 per cwt.		
YG 2-2.5 premium	\$3.23 per cwt.		
YG 2.5-3 premium	\$3.04 per cwt.		
YG 4 discount	\$-13.24 per cwt.		
YG 5 discount	\$-20.19 per cwt.		
Industry avg. steer carcass weight	893 lb.		
Heavyweight discount (900-1,000 lb.)	\$-8.17 per cwt.		
Heavyweight discount (1,000-1,050 lb.)	\$-14.24 per cwt.		
Heavyweight discount (1,050+ lb.)	\$-28.76 per cwt.		

Beef value (\$B)

Beef value (\$B) facilitates simultaneous multi-trait genetic selection for feedlot and carcass merit. \$B is a terminal index representing the expected average dollar-per-carcass difference in the progeny postweaning performance and carcass value compared to progeny of other sires. This index assumes commercial producers wean all male and female progeny, retain ownership of these animals through the feedlot phase and market these animals on a quality-based carcass grid. EPDs directly influencing \$B include: weaning and yearling weight, dry-matter intake, carcass weight, marbling, ribeye area and fat.

\$B only has meaning when two animals are compared against one another. For instance, if Bull A has a \$B of +90 and Bull B has a \$B of +120, one would expect, on average, the progeny of Bull B to be \$30 (\$120 - \$90 = \$30) more profitable per carcass due to feedlot gain and carcass merit, assuming both bulls were randomly mated to comparable females.

The resulting \$B value is not designed to be driven by one factor, such as quality, red meat yield or weight. Instead, it is a dynamic result of the application of commercial market values to Angus genetics for both feedlot and carcass merit.

Feedlot value (\$F)

Feedlot value (\$F), an index value expressed in dollars per head, is the expected average difference in future progeny performance for postweaning merit compared to progeny of other sires. \$F incorporates postweaning gain and carcass weight along with feed efficiency traits, genomic information and trait interrelationships. The underlying objective assumes commercial producers will retain ownership of cattle through the feedlot phase and sell fed cattle on a carcass weight basis with no consideration of premiums or discounts for quality and yield grade.

Grid value (\$G)

Grid value (\$G), an index value expressed in dollars per carcass, is the expected average difference in future progeny performance for carcass grid merit compared to progeny of other sires. The \$G combines quality grade and yield grade attributes, and is calculated for animals with carcass EPDs. A seven-year rolling average is used to establish typical industry economic values for quality grade and yield grade schedules. Quality grade premiums are specified for Prime, CAB and

Choice carcasses, as well as Select and Standard discounts. Yield grade premiums are incorporated for Yield Grade (YG) 1 and YG 2 (high-yielding carcasses), with discounts for YG 4 and YG 5 (low red meat yields).

The summation of \$F and \$G equates to \$B.

Combined value (\$C)

Combined value (\$C), expressed in dollars per head, includes all 15 traits involved in \$M and \$B. The breeding objective, which drives the \$C model, is built around a 500-head commercial cow herd that replaces 25% of its breeding females in the first generation and 20% per year thereafter with replacement heifers retained within its own herd. In addition, this same herd retains ownership on cull heifers and steer mates through the feedlot and markets those cattle on a quality-based carcass merit grid. EPDs directly influencing the combined index include calving ease direct (CED) and maternal (CEM), weaning weight (WW), yearling weight (YW), maternal milk (Milk), heifer pregnancy (HP), docility (DOC), mature cow weight (MW), foot angle (Angle), claw set (Claw), dry-matter intake (DMI), marbling (Marb), carcass weight (CW), ribeye area (RE) and fat thickness (Fat).

\$C is a linear combination of \$M and \$B. The simple formula to calculate \$C on any animal is $\$C = \$M + (1.297 \times \$B)$. In the example below, Bull A and Bull B are compared head-to-head. As a result, Bull A and Bull B should produce progeny with similar profitability if heifers are being retained as replacements and remaining calves are fed and marketed on a carcass merit grid.

	\$M	\$B	\$M + (1.297 × \$B)	\$C
Bull A	+70	+127	70 + (1.297 × 127)	+235
Bull B	+51	+140	51 + (1.297 × 140)	+233
			Difference	+2

The idea of combining maternal and terminal traits into one economic selection index allows a producer to make genetic progress in several different traits at once while accounting for the relationships among these traits, which may pull costs and revenues in different directions. For example, continuing to increase WW, YW and CW results in more saleable product, increasing revenue; however, it also drives up input costs across other segments of the operation. Mature cow size, for instance, is positively correlated to these three growth traits. As increased selection pressure on weaning, yearling and carcass weight continues, mature cow size will increase, resulting in higher maintenance energy requirements increasing costs. \$C recognizes these types of relationships and targets an optimal level of genetic change in each of these traits that results in maximum profitability.

Availability of \$Values

\$Value Search

\$Values on individual animals may be viewed at www.angus.org. Members and affiliates can also access \$Values through AAA Login.

Accuracy and Associated Possible Change

The following table lists the possible change values associated with each EPD trait at the various accuracy levels. Possible change is expressed as “+” or “-” units of EPD and can be described as a measure of expected change or potential deviation between the EPD and the “true” progeny difference. This confidence range depends on the standard error of prediction for an EPD. For a given accuracy, about two-thirds

of the time an animal should have a “true” progeny difference within the range of the EPD plus or minus the possible change value. For example, a sire with an accuracy of 0.60 for a marbling EPD of +0.50 is expected to have his “true” progeny value falling within ±0.12 marbling score EPD (ranging between +0.38 and +0.62) about two-thirds of the time.

With the conservative approach taken with respect to heritabilities in the Angus evaluation, actual EPD changes of animals within the population are much less than statistics would indicate.

ACCURACY AND ASSOCIATED POSSIBLE CHANGE

Accuracy	Production								Management					Maternal					Carcass			
	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HS	HP	CEM	Milk	MW	MH	CW	Marb	RE	Fat
.05	9.7	2.55	14.9	24.3	.065	.763	.47	.76	16.7	.14	.12	2.15	.26	7.7	10.4	9.5	38	.52	20	.29	.30	.041
.10	9.2	2.42	14.1	23.0	.061	.723	.44	.72	15.8	.13	.12	2.04	.25	7.3	9.9	9.0	36	.49	19	.28	.28	.039
.15	8.7	2.28	13.3	21.7	.058	.682	.42	.68	14.9	.12	.11	1.93	.23	6.9	9.3	8.5	34	.46	18	.26	.27	.037
.20	8.2	2.15	12.6	20.5	.054	.642	.39	.64	14.0	.11	.11	1.81	.22	6.5	8.8	8.0	32	.43	17	.25	.25	.034
.25	7.7	2.02	11.8	19.2	.051	.602	.37	.60	13.2	.11	.10	1.70	.21	6.1	8.2	7.5	30	.41	16	.23	.23	.032
.30	7.2	1.88	11.0	17.9	.048	.562	.34	.56	12.3	.10	.09	1.59	.19	5.7	7.7	7.0	28	.38	15	.22	.22	.030
.35	6.7	1.75	10.2	16.6	.044	.522	.32	.52	11.4	.09	.09	1.47	.18	5.3	7.1	6.5	26	.35	14	.20	.20	.028
.40	6.2	1.61	9.4	15.4	.041	.482	.29	.48	10.5	.09	.08	1.36	.16	4.9	6.6	6.0	24	.33	13	.18	.19	.026
.45	5.6	1.48	8.6	14.1	.037	.442	.27	.44	9.7	.08	.07	1.25	.15	4.5	6.0	5.5	22	.30	12	.17	.17	.024
.50	5.1	1.34	7.9	12.8	.034	.401	.25	.40	8.8	.07	.07	1.13	.14	4.1	5.5	5.0	20	.27	11	.15	.16	.022
.55	4.6	1.21	7.1	11.5	.031	.361	.22	.36	7.9	.06	.06	1.02	.12	3.7	4.9	4.5	18	.24	10	.14	.14	.019
.60	4.1	1.08	6.3	10.2	.027	.321	.20	.32	7.0	.06	.05	0.91	.11	3.3	4.4	4.0	16	.22	9	.12	.12	.017
.65	3.6	.94	5.5	9.0	.024	.281	.17	.28	6.1	.05	.05	0.79	.10	2.9	3.8	3.5	14	.19	7	.11	.11	.015
.70	3.1	.81	4.7	7.7	.020	.241	.15	.24	5.3	.04	.04	0.68	.08	2.4	3.3	3.0	12	.16	6	.09	.09	.013
.75	2.6	.67	3.9	6.4	.017	.201	.12	.20	4.4	.04	.03	0.57	.07	2.0	2.7	2.5	10	.14	5	.08	.08	.011
.80	2.1	.54	3.1	5.1	.014	.161	.10	.16	3.5	.03	.03	0.45	.05	1.6	2.2	2.0	8	.11	4	.06	.06	.009
.85	1.5	.40	2.4	3.8	.010	.120	.07	.12	2.6	.02	.02	0.34	.04	1.2	1.6	1.5	6	.08	3	.05	.05	.006
.90	1.0	.27	1.6	2.6	.007	.080	.05	.08	1.8	.01	.01	0.23	.03	.8	1.1	1.0	4	.05	2	.03	.03	.004
.95	.5	.13	.8	1.3	.003	.040	.02	.04	.9	.01	.01	0.11	.01	.4	.5	.5	2	.03	1	.02	.02	.002

Across-breed EPD Adjustment Factors

Researchers at the Roman L. Hruska U.S. Meat Animal Research Center (MARC) in Clay Center, Neb., develop breed adjustment factors annually so that expected progeny difference (EPD) values can be compared across breeds. This process allows the estimation of across-breed EPDs, sometimes referred to as AB-EPDs. The across-breed EPD concept was introduced in the late 1980s and continues to spark interest with commercial bull buyers using more than one breed of bull. This is mostly due to the fact that without adjustments, the within-breed EPDs cannot be used to directly compare animals of different breeds, since the values are typically computed separately for each breed. Table 1 presents the most recent MARC adjustment factors that can be added to the EPDs of animals of different breeds,

adjusting their EPD values to an Angus equivalent. The adjustment factors, given relative to an Angus equivalent of zero for each trait, take into account breed differences measured in the Germplasm Evaluation Project at MARC, as well as differences in breed average EPDs and base year. Animals of various breeds can be compared on the same EPD scale, after adding the specific adjustment factor to EPDs produced in the most recent genetic evaluations of the representative breeds. Use of these factors does not change differences in EPDs among bulls within a breed. However, it does affect differences among bulls of different breeds. The example in Table 2 illustrates EPDs for Angus and Simmental bulls after across-breed adjustment factors have been applied to estimate AB-EPDs. The AB-EPDs for Simmental Bull #002 are on an Angus-equivalent scale and

can be directly compared with values for Angus Bull #001. It is important to remember that EPDs are not perfect when comparing bulls, even within a breed; therefore, AB-EPDs are somewhat less accurate when comparing animals of different breeds. AB-EPDs are most effective for selecting bulls of two or more breeds for use in systematic crossbreeding. When evaluating the potential application of AB-EPDs as a tool for a particular breeding program, commercial cow-calf producers must first examine the needs of their individual operations. Producers must diligently review their breed choices and crossbreeding systems in order to provide the best sire selection match to cow genetic type, environment, feed resources, and market targets.

Table 1: Adjustment factors to estimate across-breed EPDs

Breed	BW	WW	YW	Milk	Marb ^a	RE	Fat	CW
Angus	0.0	0.0	0.0	0.0	0.00	0.00	0.000	0.0
Hereford	0.8	-14.4	-39.3	-10.6	-0.31	0.01	-0.068	-68.3
Red Angus	2.2	-17.9	-24.8	1.4	-0.09	0.24	-0.035	-10.0
Shorthorn	3.8	-24.2	-38.6	0.5	-0.13	0.27	-0.040	-10.9
South Devon	3.5	-37.5	-63.4	10.6	-0.07	0.28	-0.068	-17.9
Beefmaster	3.4	26.8	7.4	6.1				
Brahman	9.0	57.6	15.5	14.9	-0.68	0.09	-0.154	-38.7
Brangus	2.7	20.9	11.6	17.8				
Santa Gertrudis	4.8	40.4	37.2	20.4	-0.45	0.18	-0.071	-0.5
Braunvieh	3.4	-23.1	-48.0	25.6	-0.15	0.90	-0.038	-23.3
Charolais	6.4	6.4	-22.7	-1.4	-0.33	0.76	-0.188	6.9
Chiangus	2.3	-22.5	-41.3	6.4	-0.42	0.52	-0.108	-23.7
Gelbvieh	3.3	-10.0	-20.0	7.1	-0.57	0.73	-0.116	-20.0
Limousin	1.8	-9.3	-32.1	-2.7	-0.29	0.63	-0.067	-11.0
Maine-Anjou	1.9	-27.3	-55.5	-7.0	-0.51	0.92	-0.166	-38.0
Salers	2.0	-17.6	-30.0	10.8	-0.19	0.47	-0.078	-20.6
Simmental	1.8	-13.3	-24.3	-0.6	-0.16	0.45	-0.056	-4.5
Tarentaise	2.4	28.0	-5.6	13.3				

^aMarbling score units: 4.00 = SI⁰⁰; 5.00 = Sm⁰⁰
Across-breed adjustments current as of 1/2023. Visit beefimprovement.org for updates.
Source: U.S. Meat Animal Research Center.

Table 2: Example of using across-breed adjustment factors to convert noncomparable within-breed EPDs to comparable across-breed EPDs

		BW	WW	YW	Milk
Angus	AB adj. factors ¹ :	0.0	0.0	0.0	0.0
	EPD ² :	2.1	58	103	20
	AB-EPD ³ :	2.1	58	103	20
Simmental	AB adj. factors ¹ :	1.8	-13.3	-24.3	-0.6
	EPD ² :	1.2	65	115	22
	AB-EPD ³ :	3.0	51.7	90.7	21.4

¹AB adj. factors are the across-breed adjustment factors from Table 1.
²EPDs are the within-breed EPD values from the breed’s genetic evaluation for the bull of interest.
³Across-breed EPDs after adjustment factors are applied to within-breed EPDs.

AHIR® AVERAGE ADJUSTED WEIGHTS AND MEASUREMENTS, BY YEAR

YEAR	BIRTH WT		WEANING WT		YEARLING WT		YEARLING HT		SCROTAL Bulls
	Bulls	Heifers	Bulls	Heifers	Bulls	Heifers	Bulls	Heifers	
1972	69	65	477	425	847	621	44.0		
1973	68	65	476	425	857	638	44.0		
1974	69	65	478	427	855	630	44.1		
1975	69	65	475	427	866	642	44.7		
1976	70	65	493	440	884	661	44.1		
1977	72	67	500	446	881	657	45.8	42.5	
1978	73	68	499	445	882	663	46.1	43.5	
1979	73	68	508	453	901	674	47.1	44.7	
1980	74	69	518	463	922	693	47.7	45.1	
1981	75	70	530	474	926	692	48.0	45.7	36.4
1982	77	72	530	475	940	696	48.5	46.1	36.4
1983	78	73	534	480	938	703	48.6	46.5	35.8
1984	79	74	537	484	956	711	48.8	46.6	36.1
1985	80	75	554	498	978	730	49.3	47.2	36.4
1986	81	76	553	498	984	737	49.4	47.4	35.9
1987	81	76	572	516	1,010	762	50.0	48.1	36.1
1988	82	77	589	531	1,037	784	50.5	48.4	36.1
1989	83	78	599	542	1,059	797	50.3	48.6	36.0
1990	83	78	601	542	1,066	798	50.6	48.7	35.8
1991	83	78	599	539	1,067	796	50.6	48.5	35.7
1992	82	78	614	553	1,072	802	50.6	48.6	35.7
1993	82	78	611	551	1,077	802	50.4	48.6	35.6
1994	82	77	613	553	1,086	813	50.6	48.6	35.8
1995	82	77	610	551	1,081	798	50.4	48.4	35.7
1996	82	77	602	544	1,068	794	50.3	48.4	35.5
1997	82	77	612	554	1,087	809	50.3	48.3	35.7
1998	82	77	612	553	1,087	813	50.4	48.4	35.7
1999	82	77	623	564	1,115	832	50.5	48.6	35.9
2000	81	77	631	569	1,112	829	50.5	48.6	36.2
2001	82	77	628	567	1,120	840	50.6	48.8	36.1
2002	81	76	633	571	1,123	838	50.5	48.7	36.1
2003	81	76	639	578	1,132	848	50.5	48.8	36.2
2004	80	76	650	589	1,144	855	50.5	48.7	36.3
2005	80	75	649	587	1,147	860	50.5	48.7	36.3
2006	80	75	650	589	1,145	848	50.4	48.6	36.3
2007	80	75	643	584	1,136	844	50.3	48.3	36.4
2008	80	75	641	581	1,130	838	50.1	48.3	36.2
2009	79	75	646	584	1,129	839	50.0	48.2	36.2
2010	79	74	648	586	1,135	840	50.0	48.2	36.4
2011	79	74	646	583	1,139	844	49.9	48.2	36.3
2012	78	73	655	590	1,145	847	49.9	48.1	36.3
2013	78	74	652	588	1,147	845	50.0	48.1	36.4
2014	78	74	662	595	1,152	854	49.9	48.2	36.4
2015	78	73	661	594	1,153	854	50.0	48.3	36.4
2016	77	73	662	596	1,152	856	50.0	48.1	36.3
2017	78	73	665	598	1,159	859	49.9	48.2	36.3
2018	78	73	655	591	1,138	840	49.8	48.1	36.2
2019	78	73	650	586	1,134	839	49.8	48.1	36.2
2020	78	73	656	592	1,144	852	49.8	48.1	36.2
2021	78	73	656	592	1,142	857	49.7	48.0	36.2
2022	78	74	658	594	1,166	858	49.4	47.7	36.3
Averages	79	75	626	562	1,107	819	50.1	48.3	36.2

EXPECTED PROGENY DIFFERENCE (EPD) AND \$VALUE AVERAGES, STANDARD DEVIATIONS (SD) AND MINIMUM/MAXIMUM

Trait	No. records	No. EPD	Avg.	SD	Min.	Max.
<i>Production:</i>						
Calving ease direct, %	1,906,764	11,814,885	3	6	-39	24
Birth weight, lb.	9,964,803	12,774,272	1.0	2.3	-12.7	16.1
Weaning weight direct, lb.	10,318,309	12,774,272	30	25	-85	128
Yearling weight, lb.	5,050,029	12,774,272	53	44	-144	224
Residual average daily gain, lb./day	35,351	2,190,251	.22	.06	-.13	.48
Dry-matter intake, lb.	35,351	2,190,251	.62	.71	-3.62	3.47
Yearling height, in.	1,110,800	3,326,333	.4	.4	-2.3	2.5
Scrotal circumference, cm	1,144,950	3,556,853	.62	.56	-3.74	3.91
<i>Management:</i>						
Docility, %	393,694	2,459,298	15	8	-47	44
Foot claw set, score	193,700	2,565,760	.49	.09	.01	.99
Foot angle, score	191,046	2,565,760	.49	.07	.04	1.06
PAP, mmHg	27,715	1,971,961	1.17	1.49	-6.15	10.20
Hair Shed, score	29,518	1,958,353	.53	.18	-.42	1.51
<i>Maternal:</i>						
Heifer pregnancy, %	151,386	2,146,278	11.2	3.1	-7.2	27.6
Calving ease maternal, %	1,906,764	11,814,885	6	5	-40	22
Maternal milk, lb.	10,318,309	12,774,272	20	8	-29	55
Mature weight, lb.	260,195	2,348,209	38	44	-197	210
Mature height, in.	131,460	2,348,209	.2	.5	-3.3	2.9
<i>Carcass:</i>						
Carcass weight, lb.	133,412	4,522,133	27	19	-77	125
Marbling score	133,412	4,509,056	.45	.3	-.85	2.58
Ribeye area, sq. in.	133,412	4,522,133	.38	.27	-.76	1.90
12th-rib fat thickness, in.	133,404	4,522,133	.008	.024	-.123	.173
Ultrasound intramuscular fat, %	2,303,298					
Ultrasound ribeye area, sq. in.	2,309,224					
Ultrasound fat thickness, in.	2,312,992					
Current sires ¹		No. Indexes				
Maternal Wean Calf Value (\$M), \$ per head		29,022	59	15	-34	133
Wean Value (\$W), \$ per head		29,228	58	15	-38	107
Feedlot Value (\$F), \$ per head		29,028	86	20	-8	170
Grid Value (\$G), \$ per head		27,166	47	20	-15	153
Beef Value (\$B), \$ per head		27,129	134	34	-5	278
Combined Index (\$C), \$ per head		27,116	233	47	-9	422
Cow Energy (\$EN), savings, \$/cow/year		29,065	-14	17	-86	46

¹Current sires have at least one calf registered in the American Angus Association Herd Book within the past two years.

FALL 2023 BREED AVERAGE EPD AND \$VALUES

Production									Management					Maternal						Carcass				\$Values					
	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HS	HP	CEM	Milk	MW	MH	\$EN	CW	Marb	RE	Fat	\$M	\$W	\$F	\$G	\$B	\$C
Current Sires ¹	+6	+1.2	+61	+108	+25	+.98	+.5	+.83	+17	+49	+48	+1.27	+.54	+11.6	+8	+26	+59	+3	-14	+44	+.56	+.58	+.012	+.59	+.58	+86	+47	+134	+233
Main Sires ²	+7	+1.0	+62	+110	+25	+.97	+.4	+.85	+18	+49	+48	+1.23	+.54	+11.3	+8	+26	+56	+3	-13	+43	+.56	+.57	+.013	+.59	+.59	+88	+47	+135	+234
Supplemental Sires ³	+7	+1.1	+68	+119	+26	+1.18	+.6	+.93	+19	+48	+47	+1.34	+.54	+12.4	+8	+28	+69	+4	-19	+52	+.61	+.63	+.016	+.64	+.64	+90	+50	+141	+247
Current Dams ¹	+6	+1.3	+57	+100	+.23	+.81	+.5	+.77	+16	+50	+49	+1.17	+.54	+11.6	+8	+27	+51	+3	-10	+40	+.54	+.52	+.012	+.59	+.54	+82	+45	+128	+225
Non-Parent Bulls ⁴	+7	+1.2	+63	+111	+.26	+1.11	+.6	+.87	+18	+49	+48	+1.29	+.52	+12.1	+8	+27	+65	+4	-14	+49	+.66	+.64	+.012	+.63	+.59	+85	+52	+140	+243
Non-Parent Cows ⁴	+6	+1.2	+62	+110	+.26	+1.10	+.6	+.86	+18	+50	+48	+1.32	+.53	+11.9	+8	+27	+66	+4	-14	+49	+.68	+.65	+.011	+.63	+.58	+85	+52	+140	+243

¹Current Sires and Dams — At least one calf registered in herd book within the past two years.²Main Sires — Sires that met the requirements of the most recent *American Angus Association Sire Evaluation Report*.³Supplemental Sires — Young sires meeting the requirements for the *American Angus Association Sire Evaluation Report*.⁴Non-Parents — Registered animals born in the last three years with no current progeny in the Angus National Cattle Evaluation.



ANGUS TRAIT HERITABILITIES (on diagonal) AND GENETIC CORRELATIONS (on upper off diagonal)

Trait	CED	BW	WW	PG	DMI	YH	SC	Doc	Claw	Angle	PAP	HS	HP	CEM	Milk	MW	MH	YW	UFAT	UIMF	UREA	FAT	MARB	REA	CW	
Calving ease direct (CED)	0.19 ¹	-0.65 ²												-0.06												
Birth weight direct (BW)		0.46	0.29	0.29																						
Weaning direct (WW)			0.28	0.48	0.50											0.44	0.48	0.87	0.12		0.34	0.09		0.27	0.65	
Postweaning gain (PG)				0.27	0.61	0.65	0.28																			
Dry-matter intake (DMI)					0.33																					
Yearling height (YH)						0.49											0.41	0.68								
Scrotal circumference (SC)							0.48																			
Docility (Doc)								0.44																		
Foot claw set (Claw)									0.25																	
Foot angle (Angle)										0.25																
Pulmonary arterial pressure (PAP)											0.39															
Hair shed (HS)												.36														
Heifer pregnancy (HP)													0.15													
Calving ease maternal (CEM)														0.20												
Maternal milk (Milk)															0.12											
Mature weight (MW)																0.35	0.69									
Mature height (MH)																	0.59									
Yearling weight (YW)																		0.42	0.07		0.33	-0.07		0.35	0.75	
Ultrasound fat (UFAT)																			0.46		0.00	0.65		-0.35	-0.10	
Ultrasound % intramuscular fat (UIMF)																				0.41			0.71			
Ultrasound ribeye area (UREA)																					0.39	-0.10		0.65	0.28	
Fat thickness (FAT)																						0.33		-0.34	0.10	
Marbling (MARB)																							0.48			
Ribeye area (REA)																								0.32	0.46	
Carcass weight (CW)																									0.44	
¹ Heritability estimates are on the diagonal. ² Upper off-diagonals are genetic correlations among traits.																										

Note: Symbols are used with a registration number to denote important information about an animal. An “F” following the symbol for a genetic condition means the animal has tested free of the condition. A “C” following represents a carrier of the condition, an “A” represents

an animal that is affected, and a “P” represents an animal that is a potential carrier by pedigree. The status for a bull listed in this *Fall 2023 Sire Evaluation Report* represents the status of that animal as of **May. 26, 2023**.

Symbol	Meaning	Symbol	Meaning	Symbol	Meaning
#	Pathfinder cow or Pathfinder sire	DM	Double muscling	RTF	Produced 35 or more calves from daughters without a simple recessive genetic defect or genetic factor
+	Embryo transfer calf	DW	Dwarfism		
^	Cell clone	HG	Horn gene	SN	Syndactyly
%	Split-ET	HI	Heterochromia irides	WT	Wild type color gene
@	Clone-ET	M1	nt821 mutation for double muscling	XA	Affected of more than one genetic condition
*	Parentage qualified to both parents and the mating	NG	Not genomic tested		
AM	Arthrogryposis multiplex	NH	Neuropathic hydrocephalus	XC	Carrier of more than 1 genetic condition
CA	Contractural arachnodactyly	OH	Oculocutaneous hypopigmentation	XF	Free of more than 1 genetic condition
D2	PRKG2 gene mutation for dwarfism	OS	Osteopetrosis		
DD	Developmental duplication	RD	Red gene		



ANGUS GENETIC TREND, EPD BY BIRTH YEAR

Production									Management					Maternal						Carcass				\$Values					
YEAR	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HS	HP	CEM	Milk	MW	MH	\$EN	CW	Marb	RE	Fat	\$M	\$W	\$F	\$G	\$B	\$C
1972	+5	-3.3	-18	-34	+0.4	-1.46	-.7	+2.2	+12	+48	+48	+1.04	+52	+10.7	+0	+10	-90	-1.3	+36	+0	+22	+18	+0.003	+16	-32	+33	+25	+58	+91
1973	+5	-3.1	-17	-32	+0.5	-1.38	-.6	+2.1	+12	+48	+48	+1.12	+51	+10.7	+0	+9	-87	-1.2	+36	+0	+21	+18	+0.002	+16	-33	+33	+25	+58	+91
1974	+4	-2.9	-15	-30	+0.5	-1.37	-.6	+2.1	+12	+48	+48	+1.13	+52	+10.9	+0	+9	-84	-1.2	+36	+0	+21	+18	+0.002	+17	-30	+34	+25	+59	+94
1975	+4	-2.8	-14	-27	+0.5	-1.35	-.6	+2.1	+12	+48	+48	+1.17	+50	+10.7	+0	+9	-81	-1.2	+35	-1	+21	+18	+0.002	+17	-30	+35	+25	+60	+95
1976	+4	-2.6	-13	-25	+0.5	-1.32	-.5	+2.0	+12	+48	+48	+1.10	+51	+10.8	+0	+9	-79	-1.1	+35	-1	+21	+18	+0.002	+18	-29	+36	+25	+61	+97
1977	+3	-2.3	-11	-22	+0.6	-1.28	-.5	+2.0	+12	+48	+48	+1.13	+50	+10.6	+0	+9	-76	-1.1	+35	-1	+20	+17	+0.001	+19	-27	+37	+24	+62	+99
1978	+2	-2.1	-10	-20	+0.6	-1.26	-.5	+2.1	+12	+48	+48	+1.12	+51	+10.9	+0	+9	-73	-1.0	+34	-1	+20	+16	+0.002	+20	-27	+39	+24	+63	+102
1979	+2	-1.9	-9	-18	+0.7	-1.25	-.4	+2.1	+12	+48	+48	+1.04	+50	+10.8	+0	+9	-70	-1.0	+34	-2	+20	+16	+0.002	+20	-26	+39	+24	+64	+103
1980	+1	-1.6	-7	-15	+0.8	-1.23	-.3	+2.1	+12	+48	+48	+1.08	+51	+10.8	+0	+8	-66	-.9	+34	-2	+20	+15	+0.002	+20	-26	+41	+24	+65	+104
1981	+0	-1.3	-5	-11	+0.8	-1.18	-.3	+2.2	+12	+48	+48	+1.06	+50	+10.8	+0	+8	-61	-.8	+33	-1	+20	+14	+0.002	+21	-25	+43	+24	+67	+108
1982	+0	-.8	-3	-8	+0.9	-1.14	-.2	+2.3	+12	+48	+48	+1.09	+50	+10.9	+0	+8	-57	-.7	+33	-1	+20	+15	+0.001	+22	-23	+44	+24	+68	+110
1983	+0	-.4	+0	-4	+0.9	-1.10	-.1	+2.2	+12	+48	+48	+1.02	+50	+10.9	+0	+9	-50	-.6	+31	-1	+20	+14	+0.001	+25	-20	+45	+24	+69	+114
1984	-1	+0	+1	+0	+1.0	-1.08	+0	+2.3	+12	+48	+49	+1.09	+50	+10.9	+0	+9	-46	-.5	+31	-1	+20	+14	-.002	+24	-20	+48	+24	+72	+117
1985	-2	+4	+3	+3	+1.0	-1.04	+1	+2.2	+12	+48	+49	+1.04	+50	+10.9	+0	+9	-41	-.4	+30	+0	+20	+14	-.003	+25	-19	+50	+24	+74	+121
1986	-2	+7	+5	+6	+1.0	-.99	+2	+2.3	+12	+48	+49	+1.07	+50	+10.9	+1	+10	-37	-.3	+29	+0	+20	+15	-.004	+28	-17	+50	+25	+75	+125
1987	-3	+1.1	+7	+9	+1.1	-.94	+3	+2.2	+12	+48	+49	+1.11	+50	+11.0	+1	+10	-32	-.3	+28	+0	+20	+15	-.005	+29	-15	+51	+25	+75	+126
1988	-3	+1.4	+9	+12	+1.1	-.87	+3	+2.4	+11	+48	+49	+1.08	+50	+11.0	+1	+11	-28	-.2	+27	+0	+20	+15	-.005	+30	-13	+51	+25	+76	+129
1989	-3	+1.6	+11	+16	+1.2	-.81	+4	+2.5	+11	+48	+49	+1.07	+50	+11.1	+2	+12	-22	-.1	+26	+1	+22	+15	-.005	+33	-11	+53	+26	+78	+134
1990	-3	+1.8	+12	+19	+1.3	-.74	+4	+2.7	+11	+48	+49	+1.06	+50	+11.1	+2	+13	-18	-.1	+25	+2	+22	+14	-.004	+34	-10	+54	+25	+80	+138
1991	-3	+1.9	+14	+23	+1.3	-.68	+4	+2.8	+10	+48	+49	+1.05	+50	+11.0	+2	+13	-14	+0	+24	+3	+23	+14	-.004	+35	-9	+56	+26	+82	+141
1992	-3	+2.0	+16	+25	+1.3	-.63	+5	+3.0	+10	+48	+49	+1.06	+50	+11.1	+3	+14	-12	+0	+24	+4	+23	+14	-.004	+38	-6	+56	+26	+82	+144
1993	-2	+1.9	+17	+28	+1.4	-.56	+5	+3.0	+10	+49	+49	+1.05	+50	+11.0	+3	+15	-9	+0	+23	+5	+24	+14	-.002	+40	-4	+57	+26	+84	+149
1994	-1	+1.9	+18	+30	+1.4	-.49	+5	+3.1	+10	+49	+49	+1.05	+50	+11.0	+4	+16	-7	+0	+22	+6	+24	+13	-.001	+42	-2	+58	+26	+84	+151
1995	-1	+1.8	+19	+33	+1.4	-.42	+4	+3.1	+10	+49	+49	+1.08	+50	+11.0	+4	+17	-4	+0	+21	+7	+24	+13	+0.001	+43	+0	+60	+26	+86	+155
1996	+0	+1.8	+21	+36	+1.5	-.35	+5	+3.1	+9	+49	+49	+1.07	+50	+11.0	+4	+17	+0	+0	+20	+8	+24	+14	+0.002	+45	+2	+60	+26	+86	+157
1997	+0	+1.8	+22	+39	+1.5	-.29	+5	+3.4	+9	+49	+49	+1.04	+50	+11.0	+5	+18	+1	+0	+19	+10	+24	+15	+0.003	+46	+3	+62	+26	+88	+160
1998	+0	+1.8	+24	+42	+1.6	-.24	+5	+3.8	+9	+49	+49	+1.06	+50	+10.9	+5	+18	+5	+1	+17	+10	+25	+15	+0.003	+45	+5	+62	+27	+89	+160
1999	+0	+1.9	+26	+45	+1.6	-.19	+5	+4.3	+9	+49	+50	+1.04	+50	+10.8	+5	+19	+7	+1	+16	+12	+27	+16	+0.005	+46	+8	+63	+28	+91	+164
2000	+0	+1.9	+27	+48	+1.7	-.14	+5	+4.5	+9	+49	+50	+1.05	+50	+10.8	+6	+20	+10	+1	+14	+13	+28	+18	+0.004	+47	+9	+65	+28	+93	+168
2001	+1	+1.9	+29	+51	+1.7	-.10	+5	+4.6	+9	+49	+50	+1.04	+50	+10.7	+6	+20	+13	+1	+12	+15	+30	+20	+0.004	+47	+11	+66	+30	+96	+172
2002	+1	+1.9	+30	+54	+1.8	-.06	+5	+4.8	+10	+49	+50	+1.02	+51	+10.8	+6	+21	+16	+1	+10	+16	+33	+21	+0.004	+47	+13	+68	+31	+99	+175
2003	+1	+1.9	+31	+56	+1.8	-.02	+5	+4.9	+10	+49	+50	+97	+51	+10.8	+6	+21	+18	+2	+9	+17	+35	+24	+0.005	+47	+13	+69	+33	+102	+179
2004	+2	+1.8	+33	+59	+1.9	+0.3	+5	+5.2	+10	+49	+50	+94	+51	+10.9	+7	+22	+20	+2	+8	+19	+37	+26	+0.005	+49	+17	+70	+34	+104	+184
2005	+2	+1.8	+34	+62	+1.9	+0.9	+5	+5.4	+10	+49	+50	+94	+51	+10.9	+7	+22	+23	+2	+6	+20	+40	+28	+0.006	+48	+17	+71	+36	+107	+187
2006	+2	+1.7	+36	+64	+1.9	+1.5	+5	+5.7	+10	+49	+49	+97	+52	+10.7	+7	+23	+25	+2	+4	+22	+41	+29	+0.007	+49	+21	+72	+36	+108	+189
2007	+3	+1.7	+38	+67	+1.9	+2.2	+5	+6.0	+10	+49	+49	+1.01	+51	+10.6	+7	+23	+27	+2	+3	+23	+43	+31	+0.007	+50	+22	+72	+38	+109	+191
2008	+3	+1.7	+39	+70	+2.0	+2.8	+5	+6.0	+11	+50	+49	+1.09	+52	+10.5	+7	+24	+30	+2	+1	+25	+46	+32	+0.009	+49	+24	+74	+39	+113	+196
2009	+4	+1.6	+41	+73	+2.0	+3.3	+5	+6.1	+11	+50	+50	+1.13	+52	+10.5	+7	+24	+31	+2	+1	+26	+47	+34	+0.011	+51	+26	+75	+40	+114	+199
2010	+4	+1.5	+42	+75	+2.0	+3.9	+5	+6.5	+12	+50	+50	+1.16	+53	+10.5	+7	+24	+33	+2	+0	+27	+46	+36	+0.011	+51	+27	+75	+39	+115	+200
2011	+4	+1.5	+43	+77	+2.1	+4.3	+5	+6.6	+13	+50	+50	+1.10	+53	+10.6	+7	+24	+35	+2	-1	+28	+46	+39	+0.011	+51	+28	+76	+40	+116	+201
2012	+4	+1.5	+45	+80	+2.1	+5.0	+5	+6.9	+13	+50	+49	+1.06	+53	+10.5	+7	+25	+36	+2	-2	+30	+47	+41	+0.011	+53	+31	+77	+41	+117	+205
2013	+5	+1.4	+47	+83	+2.2	+5.5	+5	+7.0	+14	+51	+49	+1.03	+53	+10.4	+8	+25	+38	+2	-3	+31	+49	+42	+0.012	+54	+33	+77	+42	+118	+207
2014	+5	+1.4	+48	+86	+2.2	+6.3	+5	+7.1	+14	+51	+49	+1.04	+54	+10.5	+8	+25	+41	+2	-5	+33	+52	+45	+0.012	+53	+33	+78	+44	+122	+211
2015	+5	+1.4	+50	+89	+2.2	+6.7	+5	+7.2	+15	+51	+49	+1.08	+55	+10.7	+8	+25	+44	+3	-6	+35	+52	+48	+0.011	+54	+35	+79	+44	+123	+214
2016	+5	+1.3	+52	+92	+2.3	+7.2	+5	+7.3	+16	+51	+49	+1.09	+54	+10.9	+8	+25	+47	+3	-8	+37	+53	+51	+0.010	+55	+37	+80	+45	+125	+217
2017	+5	+1.3	+54	+95	+2.3	+7.9	+5	+7.5	+16	+51	+49	+1.16	+55	+11.3	+8	+25	+51	+3	-10	+39	+54	+54	+0.010	+56	+38	+81	+46	+127	+221
2018	+5	+1.3	+57	+100	+2.4	+9.2	+5	+7.8	+16	+51	+49	+1.24	+55	+11.6	+8	+26	+56	+3	-13	+42	+57	+56	+0.011	+56	+42	+82	+48	+129	+223
2019	+6	+1.3	+59	+104	+2.5	+1.01	+6	+8.3	+17	+50	+49	+1.33	+54	+11.8	+8	+26	+62	+4	-16	+45	+60	+60	+0.011	+56	+43	+84	+50	+134	+230
2020	+6	+1.2	+61	+108	+2.5	+1.07	+6	+8.6	+18	+50	+48	+1.38	+53	+11.9	+8	+26	+64	+4	-17	+47	+64	+63	+0.012	+58	+45	+86	+52	+138	+237
2021	+6	+1.2	+63	+112	+2.6	+1.14	+6	+8.7	+18	+49	+48	+1.26	+52	+12.1	+8	+26	+66	+4	-18	+50	+70	+67	+0.011	+59	+46	+88	+56	+144	+246
2022	+6	+1.2	+65	+116	+2.7	+1.23	+6	+8.8	+19	+49	+47	+1.29	+52	+12.4	+8	+27	+69	+4	-20	+53	+77	+70	+0.013	+61	+48	+90	+60	+150	+256

Fall 2023 EPD and \$Value Percentile Breakdowns

CURRENT SIRES

Production									Mangement					Maternal						Carcass				\$Values					
TOP PCT	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HS	HP	CEM	Milk	MW	MH	\$EN	CW	Marb	RE	Fat	\$M	\$W	\$F	\$G	\$B	\$C
1%	+17	-3.1	+94	+165	+36	-.71	+1.3	+2.23	+34	+29	+31	-2.29	+09	+19.6	+17	+41	+138	+1.3	+25	+84	+1.53	+1.22	-.053	+95	+87	+132	+100	+213	+339
2%	+16	-2.5	+90	+159	+35	-.38	+1.3	+2.06	+33	+31	+33	-1.93	+15	+18.5	+16	+39	+128	+1.2	+23	+80	+1.38	+1.14	-.046	+91	+84	+126	+93	+203	+326
3%	+15	-2.2	+88	+155	+34	-.24	+1.2	+1.94	+32	+33	+35	-1.64	+18	+18.0	+15	+38	+122	+1.1	+21	+77	+1.31	+1.09	-.041	+88	+82	+123	+89	+197	+318
4%	+14	-1.9	+86	+152	+33	-.13	+1.1	+1.86	+31	+34	+36	-1.43	+20	+17.5	+15	+37	+118	+1.1	+19	+74	+1.26	+1.06	-.037	+86	+81	+120	+85	+192	+313
5%	+14	-1.7	+85	+150	+33	-.05	+1.1	+1.80	+30	+35	+36	-1.28	+22	+17.2	+14	+36	+114	+1.0	+17	+73	+1.21	+1.03	-.034	+85	+80	+118	+83	+189	+308
10%	+12	-1.0	+80	+141	+31	+21	+1.0	+1.57	+28	+38	+39	-.72	+29	+15.9	+13	+34	+103	+9	+10	+67	+1.05	+93	-.024	+79	+76	+111	+74	+177	+293
15%	+11	-.6	+77	+135	+30	+37	+9	+1.42	+26	+40	+41	-.34	+34	+15.1	+12	+33	+94	+8	+4	+63	+94	+87	-.017	+75	+72	+106	+68	+168	+281
20%	+11	-.2	+74	+131	+29	+49	+8	+1.31	+25	+42	+42	-.04	+38	+14.4	+12	+31	+88	+7	+0	+59	+86	+81	-.012	+73	+70	+102	+64	+162	+273
25%	+10	+1	+72	+127	+28	+60	+8	+1.21	+24	+43	+43	+21	+41	+13.9	+11	+30	+82	+6	-3	+57	+80	+77	-.007	+70	+68	+99	+60	+156	+265
30%	+9	+3	+70	+123	+27	+69	+7	+1.12	+22	+45	+44	+43	+44	+13.3	+11	+30	+78	+6	-5	+54	+74	+73	-.003	+68	+66	+96	+57	+151	+258
35%	+9	+6	+68	+120	+27	+77	+7	+1.04	+21	+46	+45	+64	+47	+12.9	+10	+29	+73	+5	-8	+52	+69	+69	+0.001	+66	+64	+94	+54	+147	+252
40%	+8	+8	+66	+117	+26	+85	+6	+97	+20	+47	+46	+84	+49	+12.5	+10	+28	+69	+5	-10	+50	+63	+65	+0.005	+64	+62	+91	+51	+143	+246
45%	+7	+1.0	+64	+114	+25	+93	+6	+90	+19	+48	+47	+1.02	+52	+12.0	+9	+27	+65	+4	-12	+48	+58	+62	+0.009	+62	+61	+89	+48	+139	+241
50%	+7	+1.2	+62	+111	+25	+1.00	+5	+83	+18	+49	+48	+1.22	+54	+11.6	+9	+26	+60	+4	-14	+45	+54	+58	+0.012	+60	+59	+86	+45	+135	+235
55%	+6	+1.4	+61	+107	+24	+1.07	+5	+76	+17	+50	+49	+1.40	+57	+11.2	+8	+26	+56	+3	-16	+43	+49	+55	+0.016	+58	+57	+84	+43	+131	+230
60%	+5	+1.6	+59	+104	+24	+1.15	+4	+68	+16	+52	+50	+1.59	+59	+10.8	+8	+25	+52	+2	-19	+41	+45	+52	+0.019	+57	+55	+82	+40	+127	+224
65%	+5	+1.9	+57	+101	+23	+1.22	+4	+60	+15	+53	+51	+1.81	+62	+10.3	+7	+24	+47	+2	-21	+39	+40	+48	+0.023	+54	+54	+79	+38	+122	+218
70%	+4	+2.1	+55	+97	+22	+1.30	+3	+52	+14	+54	+52	+2.02	+64	+9.8	+7	+23	+43	+1	-23	+36	+35	+44	+0.027	+52	+52	+77	+35	+118	+211
75%	+3	+2.3	+52	+93	+21	+1.39	+3	+44	+12	+55	+53	+2.25	+67	+9.3	+6	+22	+37	+1	-25	+34	+30	+40	+0.031	+50	+49	+74	+32	+113	+204
80%	+2	+2.6	+50	+88	+21	+1.49	+2	+34	+11	+57	+54	+2.52	+71	+8.7	+5	+21	+32	+0	-28	+30	+25	+35	+0.036	+48	+47	+71	+30	+108	+197
85%	+1	+3.0	+47	+82	+20	+1.60	+1	+22	+9	+59	+56	+2.86	+75	+8.1	+4	+20	+24	+1	-31	+27	+19	+30	+0.041	+44	+43	+67	+27	+101	+187
90%	+0	+3.4	+42	+74	+18	+1.74	+0	+07	+6	+61	+57	+3.30	+80	+7.2	+3	+19	+14	+2	-36	+22	+12	+23	+0.048	+40	+40	+61	+23	+92	+174
95%	-2	+4.1	+34	+59	+16	+1.94	+2	+15	+2	+64	+60	+3.99	+88	+5.9	+1	+16	+2	+5	-42	+13	+01	+13	+0.059	+34	+33	+52	+18	+77	+154
Total																													
Animals	29,184	29,228	29,228	29,228	23,854	23,854	24,490	25,207	24,430	23,971	23,971	23,741	23,715	23,810	29,184	29,228	23,857	23,857	29,065	25,570	25,570	25,570	25,570	29,022	29,028	29,028	27,166	27,129	27,116
Avg. EPD	+6	+1.2	+61	+108	+25	+98	+5	+83	+17	+49	+48	+1.27	+54	+11.6	+8	+26	+59	+3	-14	+44	+56	+58	+0.012	+59	+58	+86	+47	+134	+233

CURRENT DAMS

Production									Mangement					Maternal						Carcass				\$Values						
TOP PCT	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HS	HP	CEM	Milk	MW	MH	\$EN	CW	Marb	RE	Fat	\$M	\$W	\$F	\$G	\$B	\$C	
1%	+16	-2.7	+88	+154	+34	-.45	+1.3	+2.08	+33	+31	+33	-2.18	+11	+18.9	+16	+40	+126	+1.2	+23	+77	+1.40	+1.14	-.050	+92	+82	+123	+92	+198	+318	
2%	+15	-2.2	+84	+148	+33	-.29	+1.2	+1.92	+31	+34	+35	-1.77	+16	+18.0	+15	+39	+116	+1.1	+20	+72	+1.28	+1.06	-.042	+88	+79	+118	+85	+189	+307	
3%	+14	-1.9	+82	+143	+32	-.19	+1.2	+1.81	+30	+35	+36	-1.52	+20	+17.5	+15	+38	+110	+1.0	+18	+69	+1.21	+1.01	-.037	+85	+77	+115	+82	+183	+299	
4%	+13	-1.6	+80	+140	+32	-.12	+1.1	+1.74	+29	+36	+37	-1.33	+22	+17.1	+14	+37	+106	+1.0	+17	+67	+1.15	+98	-.034	+83	+76	+112	+79	+179	+294	
5%	+13	-1.4	+78	+138	+31	-.06	+1.1	+1.67	+29	+37	+38	-1.17	+24	+16.7	+14	+36	+103	+9	+16	+65	+1.11	+95	-.031	+82	+75	+110	+76	+176	+289	
10%	+12	-.8	+73	+129	+29	+13	+9	+1.46	+26	+40	+40	-.65	+31	+15.6	+13	+34	+91	+8	+10	+59	+96	+85	-.021	+77	+70	+103	+68	+164	+274	
15%	+11	-.4	+70	+123	+28	+26	+9	+1.33	+24	+42	+42	-.31	+36	+14.8	+12	+33	+83	+7	+6	+55	+87	+78	-.015	+74	+67	+99	+63	+157	+264	
20%	+10	+0	+67	+119	+27	+36	+8	+1.22	+23	+43	+43	-.04	+39	+14.2	+11	+31	+77	+6	+3	+52	+79	+73	-.010	+71	+65	+96	+59	+151	+257	
25%	+9	+3	+65	+115	+26	+45	+7	+1.13	+22	+45	+44	+20	+42	+13.7	+11	+30	+71	+6	+0	+50	+73	+68	-.005	+69	+63	+93	+55	+146	+250	
30%	+8	+5	+63	+111	+26	+53	+7	+1.05	+21	+46	+45	+41	+45	+13.2	+10	+30	+67	+5	-2	+47	+68	+65	-.001	+67	+61	+90	+52	+142	+245	
35%	+8	+7	+62	+108	+25	+60	+7	+98	+20	+47	+46	+60	+47	+12.8	+10	+29	+63	+5	-4	+45	+63	+61	+0.002	+65	+59	+88	+50	+138	+239	
40%	+7	+9	+60	+105	+24	+67	+6	+91	+19	+48	+47	+78	+50	+12.4	+9	+28	+59	+4	-6	+43	+59	+58	+0.005	+63	+58	+86	+47	+134	+235	
45%	+7	+1.1	+58	+103	+24	+74	+6	+84	+18	+49	+48	+96	+52	+12.0	+9	+27	+55	+4	-8	+41	+55	+55	+0.009	+62	+56	+84	+45	+131	+230	
50%	+6	+1.4	+57	+100	+23	+80	+5	+77	+17	+50	+49	+1.12	+54	+11.6	+9	+27	+51	+3	-10	+40	+51	+52	+0.012	+60	+55	+82	+43	+128	+225	
55%	+5	+1.6	+55	+97	+23	+87	+5	+71	+16	+51	+50	+1.30	+56	+11.2	+8	+26	+47	+3	-12	+38	+47	+49	+0.015	+58	+53	+80	+41	+124	+221	
60%	+5	+1.8	+54	+94	+22	+94	+4	+64	+15	+52	+50	+1.48	+58	+10.8	+8	+25	+43	+2	-13	+36	+43	+45	+0.018	+57	+51	+78	+39	+121	+216	
65%	+4	+2.0	+52	+91	+22	+1.01	+4	+57	+14	+53	+51	+1.66	+61	+10.4	+7	+25	+40	+2	-15	+34	+39	+42	+0.022	+55	+50	+76	+37	+118	+212	
70%	+4	+2.2	+50	+88	+21	+1.08	+4	+50	+12	+54	+52	+1.86	+63	+10.0	+6	+24	+35	+1	-17	+32	+35	+39	+0.025	+53	+48	+74	+34	+114	+207	
75%	+3	+2.4	+48	+85	+20	+1.17	+3	+42	+11	+55	+53	+2.09	+66	+9.5	+6	+23	+31	+1	-20	+30	+31	+35	+0.029	+51	+46	+71	+32	+110	+201	
80%	+2	+2.7	+46	+81	+20	+1.26	+3	+32	+10	+57	+54	+2.34	+69	+9.0	+5	+22	+26	+0	-22	+27	+27	+32	+0.033	+49	+44	+69	+30	+106	+195	
85%	+1	+3.0	+43	+76	+19	+1.37	+2	+22	+8	+59	+56	+2.64	+72	+8.4	+4	+21	+20	+1	-25	+25	+22	+27	+0.038	+46	+41	+66	+27	+101	+189	
90%	+0	+3.4	+40	+70	+18	+1.51	+1	+09	+6	+61	+57	+3.04	+77	+7.6	+3	+19	+12	+2	-29	+21	+15	+21	+0.044	+43	+38	+62	+24	+95	+180	
95%	-2	+4.0	+35	+61	+16	+1.71	+0	-.12	+2	+64	+60	+3.68	+84	+6.4	+1	+17	+0	+4	-35	+15	+06	+13	+0.054	+37	+33	+55	+20	+85	+165	
Total																														
Animals	340,317	340,926	340,926	340,926	243,064	243,064	254,561	256,906	252,839	246,793	246,793	242,626	242,294	246,175	340,317	340,926	249,646	249,646	338,357	268,432	268,432	268,432	268,432	338,022	340,932	338,159	301,117	300,916	300,851	
Avg. EPD	+6	+1.3	+57	+100	+23	+8.1	+5	+77	+16	+50	+49	+1.17	+54	+11.6	+8	+27	+51	+3	-10	+40	+54	+52	+0.012	+59	+54	+82	+45	+128	+225	

NON-PARENT BULLS

Production									Mangement					Maternal						Carcass				\$Values					
TOP PCT	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HS	HP	CEM	Milk	MW	MH	\$EN	CW	Marb	RE	Fat	\$M	\$W	\$F	\$G	\$B	\$C
1%	+16	-3.0	+94	+165	+37	-20	+1.4	+2.24	+34	+28	+30	-2.53	+0.05	+19.7	+16	+40	+138	+1.4	+22	+85	+1.62	+1.24	-.053	+95	+86	+129	+104	+217	+342
2%	+15	-2.5	+90	+158	+35	-.03	+1.3	+2.08	+33	+31	+33	-2.10	+1.10	+18.8	+15	+39	+129	+1.2	+19	+81	+1.49	+1.17	-.045	+92	+84	+124	+97	+207	+330
3%	+15	-2.1	+88	+154	+34	+0.08	+1.2	+1.97	+32	+32	+34	-1.82	+1.14	+18.3	+15	+38	+124	+1.2	+17	+78	+1.41	+1.13	-.040	+89	+82	+120	+93	+201	+322
4%	+14	-1.9	+86	+151	+34	+1.15	+1.2	+1.89	+31	+34	+35	-1.61	+1.17	+17.8	+15	+37	+120	+1.1	+14	+76	+1.35	+1.09	-.037	+87	+81	+118	+89	+196	+316
5%	+14	-1.7	+85	+149	+33	+2.21	+1.1	+1.83	+30	+34	+36	-1.44	+1.19	+17.5	+14	+36	+117	+1.1	+12	+74	+1.30	+1.06	-.034	+86	+79	+115	+86	+192	+312
10%	+12	-1.0	+80	+141	+32	+4.42	+1.0	+1.62	+28	+38	+38	-.86	+2.26	+16.3	+13	+34	+105	+9	+6	+69	+1.14	+9.97	-.024	+81	+75	+108	+77	+179	+295
15%	+11	-.6	+76	+135	+31	+5.56	+9	+1.48	+27	+40	+40	-.46	+3.31	+15.5	+12	+32	+97	+8	+1	+65	+1.03	+90	-.017	+78	+72	+103	+71	+170	+284
20%	+10	-.2	+74	+130	+30	+6.67	+9	+1.36	+25	+42	+42	-.15	+3.35	+14.9	+12	+31	+91	+8	-2	+62	+9.95	+8.85	-.011	+75	+70	+100	+67	+164	+276
25%	+10	+1	+72	+126	+29	+7.76	+8	+1.26	+24	+43	+43	+1.13	+3.38	+14.4	+11	+30	+86	+7	-4	+59	+8.88	+8.81	-.007	+73	+68	+96	+63	+158	+269
30%	+9	+3	+70	+123	+28	+8.84	+7	+1.18	+23	+45	+44	+3.38	+4.41	+13.9	+11	+30	+82	+6	-6	+57	+8.83	+7.77	-.003	+71	+66	+94	+60	+154	+263
35%	+8	+6	+68	+120	+27	+9.91	+7	+1.10	+22	+46	+45	+6.60	+4.44	+13.4	+10	+29	+77	+6	-9	+55	+7.77	+7.74	+0.001	+69	+64	+91	+57	+150	+258
40%	+8	+8	+66	+117	+27	+9.98	+7	+1.02	+21	+47	+46	+8.81	+4.47	+13.0	+10	+28	+73	+5	-11	+53	+7.73	+7.70	+0.005	+67	+62	+89	+55	+146	+253
45%	+7	+1.0	+64	+114	+26	+1.05	+6	+9.95	+20	+48	+47	+1.02	+4.49	+12.5	+9	+27	+69	+5	-12	+51	+6.68	+6.67	+0.009	+66	+60	+87	+52	+142	+248
50%	+7	+1.2	+63	+111	+26	+1.12	+6	+8.87	+19	+49	+48	+1.23	+5.52	+12.1	+9	+27	+65	+4	-14	+49	+6.63	+6.64	+0.012	+64	+59	+84	+50	+138	+243
55%	+6	+1.4	+61	+109	+25	+1.18	+5	+8.80	+18	+50	+49	+1.44	+5.54	+11.7	+8	+26	+61	+4	-16	+47	+5.59	+6.61	+0.015	+62	+57	+82	+48	+135	+239
60%	+6	+1.6	+60	+106	+24	+1.25	+5	+7.72	+17	+52	+50	+1.65	+5.57	+11.3	+8	+25	+57	+3	-18	+45	+5.55	+5.58	+0.019	+60	+56	+80	+45	+131	+234
65%	+5	+1.8	+58	+103	+24	+1.32	+4	+6.65	+16	+53	+51	+1.87	+6.60	+10.8	+7	+25	+53	+3	-20	+43	+5.50	+5.54	+0.023	+59	+54	+78	+43	+128	+229
70%	+4	+2.1	+56	+100	+23	+1.39	+4	+5.57	+15	+54	+52	+2.11	+6.63	+10.3	+7	+24	+49	+2	-22	+41	+4.46	+5.51	+0.026	+57	+52	+76	+41	+124	+224
75%	+4	+2.3	+54	+96	+23	+1.47	+3	+4.48	+13	+55	+53	+2.36	+6.66	+9.8	+6	+23	+44	+1	-25	+38	+4.41	+4.47	+0.030	+55	+50	+74	+38	+120	+218
80%	+3	+2.6	+52	+92	+22	+1.55	+3	+3.38	+12	+57	+54	+2.65	+6.69	+9.3	+5	+22	+38	+1	-27	+36	+3.35	+4.43	+0.035	+52	+48	+72	+35	+115	+212
85%	+2	+2.9	+49	+88	+21	+1.65	+2	+2.27	+10	+59	+55	+3.01	+7.73	+8.6	+5	+21	+32	+0	-30	+33	+2.29	+3.38	+0.041	+49	+46	+69	+32	+110	+204
90%	+1	+3.4	+46	+82	+20	+1.78	+1	+1.13	+8	+61	+57	+3.47	+7.78	+7.8	+4	+20	+24	+1	-34	+29	+2.22	+3.32	+0.048	+46	+42	+65	+29	+103	+194
95%	-1	+4.0	+40	+70	+18	+1.96	+0	-.09	+4	+64	+60	+4.23	+8.86	+6.5	+2	+18	+12	+3	-40	+23	+1.10	+2.22	+0.058	+40	+37	+58	+23	+91	+179
Total																													
Animals	161,062	162,850	162,850	162,850	92,155	92,155	95,412	99,624	94,749	93,275	93,275	91,931	91,508	91,492	161,062	162,850	91,492	91,492	161,212	100,084	100,084	100,084	100,084	160,969	163,462	161,234	132,377	132,373	132,291
Avg. EPD	+7	+1.2	+63	+111	+26	+1.11	+6	+8.87	+18	+49	+48	+1.29	+5.52	+12.1	+8	+27	+65	+4	-14	+49	+66	+64	+0.012	+63	+59	+85	+52	+140	+243

NON-PARENT COWS

Production									Mangement					Maternal							Carcass				\$Values					
TOP PCT	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HS	HP	CEM	Milk	MW	MH	\$EN	CW	Marb	RE	Fat	\$M	\$W	\$F	\$G	\$B	\$C	
1%	+16	-3.0	+93	+164	+37	-21	+1.4	+2.24	+34	+28	+30	-2.52	+0.05	+19.5	+16	+40	+140	+1.4	+22	+87	+1.65	+1.26	-.055	+94	+86	+129	+105	+219	+344	
2%	+15	-2.4	+89	+157	+36	-.04	+1.3	+2.09	+33	+31	+33	-2.09	+1.11	+18.7	+15	+38	+131	+1.3	+19	+82	+1.53	+1.19	-.047	+90	+83	+123	+98	+209	+332	
3%	+15	-2.1	+87	+153	+35	+0.05	+1.2	+1.98	+32	+33	+34	-1.79	+1.14	+18.1	+15	+37	+125	+1.2	+16	+79	+1.45	+1.14	-.042	+88	+81	+120	+93	+202	+324	
4%	+14	-1.8	+85	+150	+34	+1.13	+1.2	+1.90	+31	+34	+35	-1.58	+1.17	+17.7	+14	+36	+121	+1.1	+14	+77	+1.39	+1.11	-.038	+87	+79	+117	+90	+197	+317	
5%	+14	-1.6	+83	+147	+34	+1.19	+1.1	+1.83	+31	+35	+36	-1.41	+1.19	+17.3	+14	+36	+118	+1.1	+12	+75	+1.34	+1.08	-.035	+85	+78	+115	+87	+193	+312	
10%	+12	-1.0	+79	+139	+32	+4.0	+1.0	+1.61	+28	+38	+38	-.82	+2.6	+16.2	+13	+33	+106	+9	+5	+69	+1.17	+98	-.025	+81	+74	+107	+77	+178	+295	
15%	+11	-.5	+75	+133	+31	+5.4	+9	+1.47	+27	+40	+40	-.42	+3.1	+15.4	+12	+32	+98	+8	+1	+65	+1.07	+92	-.018	+77	+71	+103	+71	+170	+284	
20%	+10	-.2	+73	+129	+30	+6.5	+9	+1.35	+25	+42	+42	-.11	+3.5	+14.7	+11	+31	+92	+8	-2	+62	+98	+87	-.012	+75	+68	+99	+67	+164	+275	
25%	+10	+1	+71	+125	+29	+7.4	+8	+1.26	+24	+44	+43	+1.5	+3.9	+14.2	+11	+30	+87	+7	-4	+59	+92	+83	-.008	+73	+66	+96	+63	+158	+269	
30%	+9	+4	+69	+121	+28	+8.3	+7	+1.17	+23	+45	+44	+4.0	+4.1	+13.7	+10	+29	+82	+6	-7	+57	+86	+79	-.004	+71	+64	+93	+60	+153	+263	
35%	+8	+6	+67	+118	+28	+9.0	+7	+1.08	+22	+46	+45	+6.3	+4.4	+13.2	+10	+29	+78	+6	-9	+55	+81	+7.5	+0.00	+69	+62	+91	+57	+149	+257	
40%	+8	+8	+65	+115	+27	+9.7	+7	+1.01	+21	+47	+46	+8.4	+4.7	+12.8	+9	+28	+74	+5	-10	+53	+7.5	+7.2	+0.04	+67	+61	+88	+54	+146	+252	
45%	+7	+1.0	+64	+113	+26	+1.04	+6	+9.3	+20	+48	+47	+1.05	+5.0	+12.4	+9	+27	+70	+5	-12	+51	+7.1	+6.8	+0.07	+65	+59	+86	+52	+142	+248	
50%	+7	+1.2	+62	+110	+26	+1.11	+6	+8.6	+19	+50	+48	+1.27	+5.2	+11.9	+9	+27	+66	+4	-14	+49	+6.6	+6.5	+0.11	+64	+58	+84	+50	+139	+243	
55%	+6	+1.4	+61	+108	+25	+1.17	+5	+7.8	+18	+51	+49	+1.47	+5.5	+11.5	+8	+26	+62	+4	-16	+47	+6.2	+6.2	+0.14	+62	+56	+82	+48	+135	+238	
60%	+5	+1.6	+59	+105	+25	+1.24	+5	+7.1	+17	+52	+50	+1.69	+5.7	+11.1	+8	+25	+58	+3	-18	+45	+5.7	+5.9	+0.18	+60	+55	+80	+45	+132	+234	
65%	+5	+1.9	+57	+102	+24	+1.31	+4	+6.3	+16	+53	+51	+1.90	+6.0	+10.6	+7	+25	+54	+3	-20	+43	+5.3	+5.5	+0.22	+58	+53	+78	+43	+128	+229	
70%	+4	+2.1	+56	+99	+23	+1.38	+4	+5.5	+15	+54	+52	+2.14	+6.3	+10.2	+7	+24	+49	+2	-22	+41	+4.8	+5.2	+0.25	+57	+51	+76	+41	+125	+224	
75%	+4	+2.3	+54	+96	+23	+1.46	+3	+4.5	+13	+56	+53	+2.40	+6.6	+9.7	+6	+23	+44	+2	-24	+39	+4.3	+4.8	+0.30	+54	+50	+74	+38	+121	+218	
80%	+3	+2.6	+52	+92	+22	+1.55	+3	+3.6	+12	+57	+54	+2.68	+7.0	+9.1	+6	+22	+39	+1	-26	+36	+3.7	+4.4	+0.34	+52	+48	+72	+35	+116	+212	
85%	+2	+2.9	+49	+88	+21	+1.65	+2	+2.4	+10	+59	+55	+3.03	+7.4	+8.4	+5	+21	+33	+0	-29	+33	+3.1	+3.9	+0.40	+49	+45	+69	+32	+111	+204	
90%	+1	+3.4	+46	+82	+20	+1.77	+1	+0.9	+8	+61	+57	+3.49	+7.9	+7.6	+4	+20	+25	+1	-33	+29	+2.2	+3.2	+0.47	+46	+42	+65	+29	+104	+194	
95%	-1	+4.0	+40	+71	+18	+1.96	+0	-.12	+4	+65	+60	+4.26	+8.7	+6.3	+2	+18	+13	+3	-40	+23	+1.1	+2.3	+0.57	+40	+37	+59	+24	+93	+178	
Total																														
Animals	135,974	137,962	137,962	137,962	64,268	64,268	67,689	64,087	67,034	65,414	65,414	64,181	64,160	65,379	135,974	137,962	64,090	64,090	134,983	69,975	69,975	69,975	69,975	134,687	134,338	135,016	106,458	106,456	106,382	
Avg. EPD	+6	+1.2	+62	+110	+26	+1.10	+6	+8.6	+18	+50	+48	+1.32	+5.3	+11.9	+8	+27	+66	+4	-.14	+49	+6.8	+6.5	+0.11	+63	+58	+85	+52	+140	+243	

Angus Model for National Cattle Evaluation

The Angus National Cattle Evaluation (NCE) combines information from multiple sources to create the best estimate of the animal's genetic value as a breeding candidate presented as expected progeny differences (EPDs). All sources of information used, including genomic information, are described in Fig. 1.

The genotypes used in the NCE include a common set of about 40,000 single-nucleotide polymorphisms (SNPs). The EPDs are calculated using a single-step genomic BLUP (Best Linear Unbiased Predictor) model (SSGBLUP, or single step). The single-step model and underlying software was developed by Drs. Misztal, Legarra, Lourenco and colleagues at the University of Georgia and is peer-reviewed¹.

Due to the large number of genotyped individuals in the Angus dataset, the APY (Algorithm for Proven and Young) is implemented in the single-step approach. The Angus NCE includes a number of trait complexes that are combined into individual multiple-trait genetic evaluations that are used to calculate the reported EPD. The single-step approach allows for genotyped and non-genotyped animals to be combined into the same genetic evaluation analysis.

The traditional genetic analysis (animal model) to calculate EPDs is reliant on a pedigree relationship between all animals. Examples of these relationships include the parent offspring (0.5⁺), full siblings (0.5) and half siblings (0.25). Such expected relationships are based on pedigree. The analysis considers the interrelationships between all animals in the pedigree.

The high-density genotypes used in the Angus single-step approach allow a more accurate relationship to be determined between individuals than is possible with pedigree alone. When genetic relationships are based on pedigree, the average relationship is modeled. A progeny always inherits half its genetics from each parent, but the sample that parent passes from each of its parents (progeny grandparents) is different. The relationships determined from the genotypes (genomic relationships) reflect the "true" relationship between individuals and represent the different sampling from grandparents passed to grandprogeny.

The single-step model uses these true genetic relationships based on genomics to calculate more accurate EPD values. With genomics included, different individual EPDs,

can be provided to full-sib flushmates, for example, instead of the expected average EPD possible with pedigree alone.

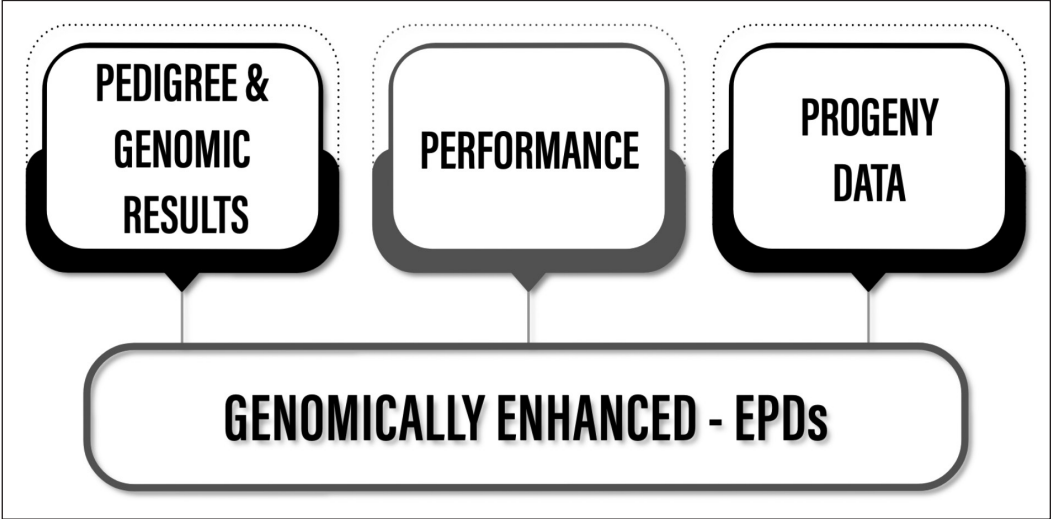
The genetic relationship matrix used includes both genotyped and non-genotyped animals in the same analysis, making all animals in the Angus genetic evaluation influenced by genomics. Even if they are not genotyped, with other animals in the analyses genotyped, and all animals related, all EPDs from the Angus genetic evaluation should be considered influenced by genomic information.

The degree that an individual's EPDs are influenced by genomic information will depend on the relationship of that animal's inherited DNA to similar segments of DNA tied to phenotypes elsewhere in the pedigree. The individuals more influenced by genomics will be those that are genotyped. Among genotyped individuals, those most closely connected to genotyped individuals tied to phenotypes will have the highest EPD accuracy.

The EPDs presented are dependent on the phenotypic recording by Angus breeders. The Angus genetic evaluation offers the opportunity to more accurately evaluate young animals with genotypes for all traits. The genomic-enhanced predictions

are only possible due to the phenotypic recording tied to genotypes in the database. Through recording (phenotyping) and genotyping, breeders provide the information contributing to the most accurate genomic predictions on their young animals.

Fig. 1: EPDs combine multiple sources of information simultaneously



Source: Angus Genetics Inc.

¹Legarra, A., I. Aguilar and I. Misztal. 2009. A relationship matrix including full pedigree and genomic information. *J. Dairy. Sci.* 92:4656-4663.

Misztal, I., A. Legarra and I. Aguilar. 2014. Using recursion to compute the inverse of the genomic relationship matrix. *J. Dairy. Sci.* 97:3943-3952.

Lourenco, D.A., S. Tsuruta, B.O. Fragomeni, Y. Masuda, I. Aguilar, A. Legarra, J.K. Bertrand, T.S. Amen, L. Wang, D.W. Moser and I. Misztal. 2015. Genetic evaluation using single-step genomic best linear unbiased predictor in American Angus. *J. Anim. Sci.* 93:2653-2662.

*These relationships will be slightly higher in the Angus pedigree due to common ancestors (inbreeding).

Genomic-enhanced expected progeny differences (GE-EPDs) contained in this report are calculated using the American Angus Association database along with results from the AngusGS[®], Zoetis HD 50K and i50K for Angus, and the GeneSeek GGP-HD and GGP-LD for Angus. Published EPDs include genomic results.

EPDs and associated \$Values in this report were as of **May 26, 2023**. For the most up-to-date information on an individual animal, go to www.angus.org and input the animal's registration number in the search function.

DISCLAIMER

The data contained in the *Angus Sire Evaluation Report* was compiled from AHIR[®] records submitted by Angus breeders. Every effort has been made to accurately present the information herein; however, THE AMERICAN ANGUS ASSOCIATION[®] MAKES NO REPRESENTATION OR WARRANTY WITH RESPECT TO THE ACCURACY OF THE DATA OR THE FITNESS FOR A PARTICULAR PURPOSE. The American Angus Association assumes no responsibility for the use or interpretation of information on the animals included in this program.

The Expected Progeny Differences (EPDs) and Dollar Values (\$Values) presented in this report have meaning only when compared to the EPDs and \$Values of other animals in the database. The EPDs and \$Values should not be considered or represented to have independent value apart from such comparisons. Thus, the \$Values should not be considered or represented to be a prediction of the actual value of the animal or its progeny in the marketplace. The EPDs and \$Values are prediction estimates only and should not be considered or represented to be a guarantee of progeny performance. A variety of factors will impact actual progeny performance, including the dam and environmental factors. The EPDs and \$Values are sensitive to the accuracy of the data provided by the members, and the \$Values are further dependent upon the assumptions for industry-relevant components used in the calculation of the \$Values.