Spring 2021 Sire Evaluation Report Forward

by American Angus Association staff

From a total of **289,145** sires with progeny records in the American Angus Association database Dec. 4, 2020, the *Spring 2021 Sire Evaluation Report* lists **2,251** 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 Jan. 1, 2019.

The Young Sire Supplement lists **2,182** bulls born after **Jan. 1, 2017**, 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 users draw from the information presented here are 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.

Editor's note: To view the latest Sire Evaluation Report online, visit www.angus.org/nce.

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 pounds (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	HP ACC	CEM ACC	Milk ACC	MkH MkD	MW ACC	MH ACC	SEN	CW ACC	Marb ACC	RE ACC	Fat ACC	CGrp CProg	UGrp UPreg	$M $W	$F $G	$B $C
A & B COMPLEMENT 4123 17984394 02-12-14	+12 .60	-.9 .77	+38 .71	+81 .60	+.21 .40	+.78 .40	-.1 .59	+.17 .51	+11 .35	+.49 .31	+.63 .33	+1.98 .26	+8.3 .36	+11 .39	+44 .40	1 8	+17 .42	-.1 .44	-8	+24 .56	+.58 .53	+.52 .49	+.044 .48	3 13	2 3	+45 +59	+64 +45	+109 +186

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 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 postweaning 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.

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 the 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.

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) is 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).

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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 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 is 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 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 a PAP EPD is not a replacement for taking scores on cattle living at elevation. An animal may have good genetics to pass onto the next generation, but due to a life event, bovine respiratory disease (BRD) for instance, their respiratory system may be damaged, causing them 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 (sometimes referred to as a 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*

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.

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 BCSmust 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.

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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*

Age at harvest, days	330< Age < 480		481 < Age < 799	
Heifers:	Avg.	SD[1]	Avg.	SD
Avg. age at harvest, days	436	30	557	60
Adj. [2] carcass wt., lb.	714	86	720	101
Adj. fat thickness, in.	0.61	0.19	0.56	0.19
Adj. ribeye area, sq. in.	12.13	1.38	12.24	1.58
Adj. marbling score	6.84	1.33	6.46	1.41
No. of heifers	6,272		7,969	
Steers:				
Avg. age at harvest, days	437	26	525	44
Adj. carcass wt., lb.	802	86	787	103
Adj. fat thickness, in.	0.58	0.18	0.55	0.19
Adj. ribeye area, sq. in.	12.69	1.37	12.76	1.50
Adj. marbling score	6.27	1.11	5.97	1.30
No. of steers	81,659		31,020	

[1]SD = standard deviation.
[2]Carcasses 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	0.69	1.51	0.52	2.83	0.73
Adj. scan wt., lb.	1,119	140	866	113	1,104	167
Adj. %IMF, %	3.84	1.10	4.83	1.39	4.97	1.44
Adj. ribeye area, sq. in.	12.61	1.90	9.77	1.74	12.35	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	1,244,346		823,418		13,807	

[1]SD = standard deviation

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

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, less than 1,050-pound hot carcass weight and a fine to medium marbling texture. For more details, go to *www.cabcattle.com*.

Angus $Values

Dollar value indexes, or $Values, are a tool 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 industry-relevant components used in calculating the indexes. Angus Genetics Inc., the American Angus Association and Certified Angus Beef LLC, 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 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.

$Values ($Maternal Weaned Calf Value, $Weaned Calf, and Cow $Energy)

Maternal weaned calf value ($M)

$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)

$W provides the expected dollar-per-head difference in future progeny preweaning performance from birth to weaning. $W assumes 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.

Weaned steer calf	$185 per cwt.
Weaned heifer calf	$169 per cwt.
Hay price (alfalfa)	$174 per ton
Hay price (other)	$130 per ton
Cow/heifer herd mix	80/20

Cow energy value

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 cow $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

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 value ($F), grid value ($G) and beef value ($B)

$F, $G and $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 $Values for any registered animal are:

Feedlot assumptions:	
Calf-fed/Yearling-fed	75/25
Time on feed (steer), calf-fed/yearling-fed	
	236/165 days
Yearling steer	$157 per cwt.
Yearling heifer	$150 per cwt.
Fed steer, dressed delivered carcass	$203 per cwt.
Ration cost	$194 per ton

Grid assumptions:

Quality components:

Prime premium (above Choice)	$20.31 per cwt.
CAB premium (above Choice)	$5.14 per cwt.
Choice-Select spread	$-12.86 per cwt.
Standard discount	$-36.88 per cwt.

Yield components:

YG 1 premium	$5.80 per cwt.
YG 2-2.5 premium	$3.07 per cwt.
YG 2.5-3 premium	$2.75 per cwt.
YG 4 discount	$-13.17 per cwt.
YG 5 discount	$-18.90 per cwt.
Industry avg. steer carcass weight	879 lb. per cwt.
Heavyweight discount (900-1,000 lb.)	$-9.15 per cwt.
Heavyweight discount (1,000-1,050 lb.)	$-15.44 per cwt.
Heavyweight discount (1,050+ lb.)	$-35.57 per cwt.

Beef value ($B)

$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)

$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)

$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)

$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 = $M + (1.297*$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	$C
Bull A	+70	+127	+235
Bull B	+51	+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	Production								Management				Maternal					Carcass			
	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	1.2	1.6	1.5	6	.08	3	.05	.05	.006
.90	1.0	.27	1.6	2.6	.07	.080	.05	.08	1.8	.01	.01	0.23	.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	.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 (USMARC) in Clay Center, Neb., develop breed adjustment factors annually so 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 USMARC, 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

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	0.0	0.0	0.0	0.0
Hereford	1.0	-16.1	-44.0	-10.4	-0.32	0.06	-0.075	-67.3
Red Angus	2.5	-19.5	-29.8	2.7	-0.13	0.24	-0.049	-14.4
Shorthorn	4.2	-32.5	-44.0	2.9	-0.05	0.55	-0.025	7.2
South Devon	2.3	-27.0	-68.1	4.4	-0.38	0.40	-0.181	-72.5
Beefmaster	4.0	21.3	-3.8	9.5				
Brahman	9.7	49.8	10.8	18.8		0.01	-0.164	-36.6
Brangus	2.7	14.2	0.5	15.8				
Santa Gertrudis	4.9	37.5	34.9	20.8	-0.46	0.14	-0.091	-10.8
Braunvieh	1.9	-19.4	-42.4	4.8	-0.65	1.05	-0.107	-51.7
Charolais	6.2	29.6	24.7	8.7	-0.31	0.82	-0.200	8.8
Chiangus	2.5	-21.0	-36.0	4.2	-0.47	0.57	-0.140	-17.8
Gelbvieh	3.3	-11.6	-19.6	12.4	-0.52	0.92	-0.102	-5.3
Limousin	2.2	-17.2	-48.6	-2.1	0.01	0.65	-0.021	-3.1
Maine-Anjou	1.6	-30.0	-63.1	-4.3	-0.46	1.02	-0.184	-32.9
Salers	0.6	-9.9	-41.8	7.1	0.09	1.16	-0.179	-43.0
Simmental	2.5	-13.0	-18.7	1.7	-0.08	0.48	-0.049	-5.4
Tarentaise	2.5	19.1	-15.8	22.4				

[a]Marbling score units: 4.00 = Sl[00]; 5.00 = Sm[00]

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
Bull #001	EPD[2]:	2.8	56	83	20
	AB-EPD[3]:	2.8	56	83	20
Simmental	AB adj. factors[1]:	2.5	-13.0	-18.7	1.7
Bull #002	EPD[2]:	1.8	68	101	22
	AB-EPD[3]:	4.3	55	82	24

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

#002 are on an Angus-equivalent scale and can be directly compared with values for Angus Bull #001.

It is important to remember 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 3: *AHIR® Average Adjusted Weights and Measurements, By Year*

YEAR	BIRTH WT Bulls	Heifers	WEANING WT Bulls	Heifers	YEARLING WT Bulls	Heifers	YEARLING HT Bulls	Heifers	SCROTAL Bulls
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	861	49.9	48.2	36.3
2018	78	73	655	591	1,138	839	49.8	48.1	36.2
2019	78	73	650	586	1,138	838	49.7	48.1	36.1
Averages	80	75	624	560	1,104	817	50.1	48.3	36.2

Table 4: *EPD And $Value Averages, Standard Deviations (Sd) And Minimum/Maximum*

Trait	No. records	No. EPD	Avg.	SD	Min.	Max.
Production:						
Calving ease direct, %	1,737,251	10,749,572	3	6	-39	24
Birth weight, lb.	9,139,110	11,768,812	1.0	2.3	-12.7	16.1
Weaning direct, lb.	9,645,294	11,768,812	27	24	-80	117
Yearling weight, lb.	4,698,249	11,768,812	47	43	-137	203
Residual average						
daily gain, lb./day	30,233	1,609,281	.21	.06	-.13	.46
Dry-matter intake, lb.	30,233	1,609,281	.47	.71	-3.69	3.18
Yearling height, in.	1,016,553	2,736,798	.4	.4	-2.3	2.6
Scrotal circumference, cm	1,028,404	2,966,474	.56	.54	-3.76	3.94
Management:						
Docility, %	333,835	1,895,538	14	8	-47	44
Foot claw set, score	105,527	1,744,376	.49	.08	.03	1.03
Foot angle, score	93,088	1,744,376	.50	.07	.11	1.12
PAP, mmHg	16,689	1,404,465	1.09	1.26	-4.75	8.28
Maternal:						
Heifer pregnancy, %	118,569	1,564,086	10.5	2.8	-7.3	25.6
Calving ease maternal, %	1,737,251	10,749,572	6	5	-40	22
Maternal milk, lb.	9,645,294	11,768,812	19	8	-30	55
Mature weight, lb.	231,852	1,775,824	28	45	-202	196
Mature height, in.	119,041	1,775,824	.2	.5	-3.3	2.9
Carcass:						
Carcass weight, lb.	126,920	3,925,828	24	18	-76	111
Marbling score	126,920	3,916,072	.42	.27	-.78	2.23
Ribeye area, sq. in.	126,920	3,925,828	.34	.25	-.75	1.81
12th-rib fat thickness, in.	126,916	3,925,828	.008	.023	-.119	.185
Ultrasound intramuscular fat, %	2,127,640					
Ultrasound ribeye area, sq. in.	2,133,499					
Ultrasound fat thickness, in.	2,137,251					
Current sires[1]		**No. Indexes**				
Maternal Wean Calf Value ($M), $/head		28,024	54	15	-23	111
Wean Value ($W), $/head		28,264	56	18	-63	113
Feedlot Value ($F), $/head		28,045	82	19	-22	161
Grid Value ($G), $/head		25,765	44	16	-7	123
Beef Value ($B), $/head		25,715	127	29	-18	232
Combined Index ($C), $/head		25,688	219	42	-9	365
Cow Energy ($EN), savings, $/cow/year		28,094	-13	15	-80	41

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

Table 5: *Spring 2021 Breed Average EPD And $Values*

	Production								Management					Maternal					Carcass				$Values					
	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HP	CEM	Milk	MW	MH	$EN	CW	Marb	RE	Fat	$M	$W	$F	$G	$B	$B
Current Sires[1]	+6	+1.2	+56	+99	+.24	+.81	+.5	+.78	+16	+.50	+.49	+1.11	+10.7	+8	+25	+51	+.3	-13	+40	+.51	+.53	+.012	+54	+56	+82	+44	+127	+219
Main Sires[2]	+7	+1.0	+57	+101	+.24	+.79	+.4	+.79	+17	+.49	+.49	+1.08	+10.5	+8	+24	+48	+.2	-13	+38	+.51	+.51	+.015	+54	+57	+83	+44	+127	+218
Supplemental Sires[3]	+7	+1.2	+63	+112	+.25	+1.05	+.6	+.90	+18	+.50	+.49	+1.13	+11.5	+9	+26	+66	+.4	-20	+47	+.52	+.58	+.012	+58	+64	+88	+45	+134	+232
Current Dams[1]	+6	+1.4	+51	+91	+.22	+.64	+.5	+.72	+15	+.50	+.50	+1.07	+10.9	+8	+25	+42	+.3	-9	+35	+.50	+.46	+.012	+55	+52	+78	+43	+122	+213
Non-Parent Bulls[4]	+6	+1.2	+57	+100	+.24	+.94	+.5	+.78	+17	+.50	+.49	+1.16	+11.2	+9	+25	+57	+.4	-13	+42	+.56	+.57	+.011	+58	+56	+81	+46	+130	+225
Non-Parent Cows[4]	+6	+1.3	+56	+99	+.25	+.94	+.6	+.75	+17	+.51	+.49	+1.23	+11.0	+9	+25	+58	+.4	-13	+43	+.61	+.59	+.009	+58	+55	+81	+47	+131	+226

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

Table 6: *Angus Trait Heritabilities (on diagonal) and Genetic Correlations (on upper off diagonal)*

Trait	CED	BW	WW	PG	DMI	YH	SC	Doc	Claw	Angle	PAP	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 Claw Angle (Angle)										0.25														
Pulmonary arterial pressure (PAP)											0.39													
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 *Spring 2020 Sire Evaluation Report* represents the status of that animal as of Dec. 4, 2020.

Symbol	Meaning
#	Pathfinder cow or Pathfinder sire
+	Embryo transfer calf
^	Cell clone
%	Split-ET
@	Clone-ET
*	Parentage qualified to both parents and the mating
AM	Arthrogryposis multiplex
CA	Contractural arachnodactyly
D2	PRKG2 gene mutation for dwarfism
DD	Developmental duplication

Symbol	Meaning
DM	Double muscling
DW	Dwarfism
HG	Horn gene
HI	Heterochromia irides
M1	nt821 mutation for double muscling
NG	Not genomic tested
NH	Neuropathic hydrocephalus
OH	Oculocutaneous hypopigmentation
OS	Osteopetrosis
RD	Red gene

Symbol	Meaning
RTF	Produced 35 or more calves from daughters without a simple recessive genetic defect or genetic factor
SN	Syndactyly
WT	Wild type color gene
XA	Affected of more than one genetic condition
XC	Carrier of more than 1 genetic condition
XF	Free of more than 1 genetic condition

Angus Genetic Trend, EPD By Birth Year

YEAR	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HP	CEM	Milk	MW	MH	$EN	CW	Marb	RE	Fat	$M	$W	$F	$G	$B	$C
			Production							Management					Maternal					Carcass					$Values			
1972	+5	-3.4	-19	-36	+.05	-1.60	-.7	+.18	+13	+.48	+.49	+.89	+10.1	+0	+9	-96	-1.4	+30	-2	+.22	+.17	+.004	+1	-48	+28	+27	+55	+72
1973	+5	-3.2	-18	-34	+.05	-1.51	-.6	+.17	+13	+.48	+.49	+1.01	+10.1	+0	+8	-93	-1.3	+31	-2	+.21	+.17	+.003	+1	-48	+28	+27	+55	+72
1974	+5	-3.0	-17	-32	+.06	-1.50	-.6	+.18	+13	+.48	+.49	+1.02	+10.2	+0	+8	-90	-1.3	+30	-2	+.21	+.17	+.003	+1	-47	+30	+27	+56	+74
1975	+4	-2.8	-16	-29	+.06	-1.48	-.6	+.18	+13	+.49	+.49	+1.07	+10.1	+0	+8	-87	-1.2	+30	-2	+.21	+.17	+.003	+1	-46	+32	+27	+58	+76
1976	+4	-2.6	-14	-27	+.06	-1.46	-.5	+.17	+13	+.49	+.49	+1.00	+10.2	+0	+8	-84	-1.2	+29	-2	+.21	+.17	+.003	+3	-44	+32	+27	+58	+78
1977	+3	-2.3	-13	-24	+.07	-1.40	-.5	+.17	+13	+.48	+.49	+1.04	+10.0	+0	+8	-81	-1.1	+29	-2	+.20	+.16	+.002	+3	-43	+34	+26	+60	+81
1978	+2	-2.1	-11	-22	+.07	-1.38	-.4	+.17	+13	+.49	+.49	+1.05	+10.3	+0	+8	-79	-1.1	+29	-3	+.20	+.15	+.003	+5	-41	+34	+26	+60	+83
1979	+2	-1.9	-10	-20	+.07	-1.36	-.4	+.18	+13	+.49	+.49	+1.00	+10.1	+0	+8	-75	-1.0	+28	-3	+.20	+.15	+.003	+5	-40	+35	+26	+61	+84
1980	+1	-1.6	-8	-17	+.08	-1.33	-.3	+.18	+13	+.49	+.49	+1.00	+10.1	+0	+7	-71	-.9	+29	-3	+.20	+.14	+.003	+5	-40	+36	+26	+62	+85
1981	+0	-1.3	-6	-13	+.08	-1.28	-.2	+.19	+13	+.49	+.49	+.99	+10.1	+0	+7	-66	-.8	+28	-3	+.20	+.14	+.003	+6	-38	+38	+26	+64	+89
1982	+0	-.9	-4	-10	+.09	-1.23	-.2	+.20	+12	+.49	+.49	+1.00	+10.2	+0	+7	-62	-.8	+27	-3	+.20	+.14	+.002	+7	-36	+39	+26	+65	+91
1983	+0	-.4	-2	-5	+.10	-1.19	+.0	+.20	+12	+.48	+.49	+.96	+10.2	+0	+8	-54	-.6	+26	-2	+.20	+.13	+.002	+10	-34	+43	+26	+68	+98
1984	-1	+.0	+0	-1	+.10	-1.16	+.0	+.21	+12	+.48	+.49	+1.02	+10.2	+0	+8	-50	-.5	+25	+11	+.20	+.14	-.001	+11	-32	+45	+26	+71	+103
1985	-2	+.4	+2	+1	+.10	-1.12	+.1	+.20	+12	+.48	+.49	+.98	+10.2	+1	+8	-45	-.4	+25	-2	+.20	+.14	-.002	+12	-31	+45	+26	+71	+104
1986	-2	+.7	+4	+4	+.11	-1.06	+.2	+.21	+12	+.48	+.49	+1.00	+10.3	+1	+9	-41	-.4	+24	-1	+.21	+.14	-.003	+15	-27	+46	+27	+72	+108
1987	-3	+1.1	+6	+8	+.11	-1.01	+.3	+.20	+12	+.49	+.49	+1.04	+10.3	+1	+10	-36	-.3	+23	-1	+.20	+.14	-.004	+16	-26	+47	+26	+74	+112
1988	-3	+1.4	+8	+11	+.12	-.94	+.3	+.22	+12	+.48	+.49	+1.01	+10.3	+1	+10	-32	-.2	+22	+0	+.21	+.14	-.004	+19	-23	+48	+27	+75	+116
1989	-3	+1.6	+10	+15	+.12	-.87	+.4	+.22	+11	+.48	+.50	+1.00	+10.4	+2	+11	-26	-.2	+21	+0	+.22	+.14	-.003	+21	-20	+50	+27	+77	+121
1990	-3	+1.8	+11	+18	+.13	-.80	+.4	+.24	+11	+.48	+.50	+.99	+10.4	+2	+12	-22	-.1	+20	+1	+.22	+.14	-.003	+23	-19	+51	+27	+79	+125
1991	-3	+1.9	+13	+21	+.13	-.74	+.5	+.25	+11	+.48	+.50	+.97	+10.3	+3	+12	-18	-.1	+19	+2	+.23	+.13	-.003	+24	-17	+52	+28	+79	+126
1992	-2	+2.0	+14	+24	+.14	-.68	+.5	+.28	+10	+.48	+.50	+1.00	+10.4	+3	+13	-16	+.0	+19	+3	+.23	+.13	-.002	+26	-15	+54	+27	+81	+131
1993	-2	+1.9	+16	+26	+.14	-.61	+.5	+.27	+10	+.49	+.50	+.99	+10.3	+3	+14	-13	+.0	+18	+4	+.24	+.13	-.001	+29	-10	+53	+28	+81	+134
1994	-1	+1.9	+17	+29	+.14	-.54	+.5	+.29	+10	+.49	+.50	+.99	+10.3	+4	+15	-10	+.0	+17	+5	+.24	+.13	+.001	+31	-8	+55	+28	+83	+139
1995	-1	+1.8	+18	+32	+.15	-.48	+.5	+.29	+9	+.49	+.50	+1.01	+10.3	+4	+16	-8	+.0	+16	+6	+.25	+.13	+.002	+32	-6	+57	+28	+85	+142
1996	+0	+1.8	+20	+35	+.15	-.40	+.5	+.29	+9	+.49	+.50	+1.00	+10.3	+4	+16	-4	+.0	+16	+7	+.25	+.13	+.003	+34	-3	+57	+28	+85	+144
1997	+0	+1.8	+21	+38	+.16	-.34	+.5	+.32	+9	+.49	+.50	+.98	+10.2	+5	+17	-1	+.0	+15	+9	+.25	+.14	+.004	+36	-1	+59	+28	+87	+149
1998	+0	+1.8	+23	+41	+.16	-.28	+.5	+.36	+9	+.49	+.51	+1.00	+10.1	+5	+18	+1	+.1	+14	+10	+.26	+.14	+.004	+38	+2	+60	+29	+88	+152
1999	+0	+1.9	+24	+44	+.17	-.23	+.5	+.41	+9	+.49	+.51	+.98	+10.1	+5	+18	+4	+.1	+12	+11	+.27	+.15	+.006	+37	+3	+62	+29	+91	+155
2000	+0	+1.9	+26	+46	+.17	-.18	+.5	+.44	+9	+.49	+.51	+1.00	+10.1	+6	+19	+7	+.1	+10	+12	+.29	+.17	+.005	+39	+7	+61	+30	+91	+157
2001	+1	+1.9	+28	+50	+.18	-.14	+.5	+.44	+9	+.49	+.51	+1.00	+10.0	+6	+19	+10	+.1	+9	+14	+.31	+.19	+.005	+39	+9	+64	+31	+95	+162
2002	+1	+1.9	+29	+53	+.18	-.10	+.5	+.47	+9	+.49	+.51	+.97	+10.1	+6	+20	+13	+.1	+7	+15	+.33	+.21	+.005	+40	+11	+65	+33	+98	+167
2003	+2	+1.9	+31	+55	+.18	-.05	+.5	+.48	+9	+.49	+.50	+.92	+10.1	+6	+21	+15	+.2	+5	+17	+.36	+.23	+.006	+42	+14	+66	+34	+100	+172
2004	+2	+1.8	+32	+58	+.19	+.00	+.5	+.50	+9	+.49	+.50	+.89	+10.2	+7	+21	+17	+.2	+4	+18	+.38	+.25	+.006	+42	+16	+68	+35	+103	+176
2005	+2	+1.8	+33	+61	+.19	+.06	+.5	+.53	+9	+.49	+.50	+.88	+10.2	+7	+22	+20	+.2	+2	+20	+.41	+.27	+.007	+42	+17	+70	+37	+107	+181
2006	+3	+1.8	+35	+63	+.20	+.13	+.5	+.56	+10	+.49	+.50	+.92	+10.1	+7	+22	+22	+.2	+0	+21	+.42	+.29	+.008	+44	+20	+69	+38	+107	+183
2007	+3	+1.7	+37	+66	+.20	+.20	+.5	+.59	+9	+.49	+.50	+.96	+10.0	+7	+23	+24	+.2	+0	+23	+.44	+.30	+.008	+44	+24	+70	+39	+109	+185
2008	+3	+1.7	+39	+69	+.20	+.26	+.5	+.59	+10	+.49	+.50	+1.03	+9.9	+7	+23	+27	+.2	-1	+24	+.47	+.32	+.010	+45	+26	+70	+40	+111	+189
2009	+4	+1.6	+40	+72	+.20	+.32	+.5	+.60	+11	+.50	+.50	+1.05	+10.0	+7	+24	+29	+.2	-2	+25	+.48	+.33	+.012	+45	+27	+72	+41	+113	+192
2010	+4	+1.6	+41	+74	+.21	+.38	+.5	+.63	+11	+.50	+.50	+1.10	+10.2	+7	+23	+31	+.2	-3	+27	+.46	+.36	+.012	+46	+28	+74	+40	+114	+194
2011	+4	+1.5	+43	+77	+.21	+.42	+.5	+.65	+12	+.50	+.50	+1.05	+10.3	+8	+24	+33	+.2	-5	+28	+.47	+.38	+.012	+48	+32	+75	+41	+116	+198
2012	+5	+1.5	+44	+80	+.22	+.49	+.5	+.68	+13	+.50	+.50	+1.02	+10.3	+8	+24	+35	+.2	-6	+30	+.48	+.41	+.012	+48	+33	+76	+42	+118	+201
2013	+5	+1.4	+46	+82	+.22	+.55	+.5	+.69	+13	+.51	+.50	+1.02	+10.3	+8	+24	+37	+.2	-7	+31	+.50	+.42	+.013	+49	+36	+76	+43	+118	+202
2014	+5	+1.4	+48	+86	+.22	+.63	+.5	+.71	+14	+.51	+.50	+1.05	+10.4	+8	+24	+40	+.3	-8	+33	+.52	+.45	+.013	+50	+38	+77	+44	+121	+207
2015	+5	+1.4	+50	+89	+.23	+.69	+.5	+.72	+15	+.51	+.50	+1.10	+10.6	+8	+24	+44	+.3	-10	+35	+.53	+.48	+.011	+51	+40	+78	+45	+122	+209
2016	+5	+1.3	+51	+92	+.23	+.74	+.5	+.73	+15	+.51	+.50	+1.10	+10.8	+8	+24	+47	+.3	-11	+37	+.54	+.52	+.010	+51	+40	+80	+46	+126	+214
2017	+6	+1.3	+54	+96	+.24	+.83	+.5	+.75	+16	+.51	+.49	+1.15	+11.0	+8	+25	+52	+.3	-14	+39	+.55	+.55	+.010	+53	+45	+80	+47	+127	+218
2018	+6	+1.3	+56	+100	+.24	+.95	+.6	+.78	+17	+.51	+.49	+1.19	+11.2	+8	+25	+57	+.4	-17	+42	+.57	+.57	+.011	+53	+47	+81	+48	+129	+220
2019	+6	+1.2	+58	+104	+.25	+1.02	+.6	+.83	+17	+.50	+.49	+1.22	+11.2	+8	+25	+62	+.4	-19	+46	+.61	+.61	+.010	+53	+48	+85	+50	+135	+228
2020	+6	+1.2	+60	+108	+.26	+1.08	+.6	+.87	+19	+.50	+.48	+1.28	+11.3	+8	+25	+65	+.5	-20	+49	+.66	+.64	+.011	+55	+50	+87	+53	+140	+237

EPD and $Value Percentile Breakdowns Sires - Current Sires

TOP PCT	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HP	CEM	Milk	MW	MH	$EN	CW	Marb	RE	Fat	$M	$W	$F	$G	$B	$C
		Production								Management					Maternal					Carcass					$Values			
1%	+17	-3.2	+87	+153	+.34	-.81	+1.3	+2.16	+34	+.30	+.32	-1.97	+18.1	+16	+39	+124	+1.3	+21	+76	+1.37	+1.17	-.054	+88	+92	+125	+86	+193	+311
2%	+16	-2.6	+83	+147	+.33	-.46	+1.2	+1.99	+32	+.33	+.34	-1.62	+17.1	+16	+38	+117	+1.2	+18	+72	+1.24	+1.09	-.046	+84	+88	+120	+80	+185	+300
3%	+15	-2.2	+81	+143	+.33	-.30	+1.2	+1.88	+31	+.34	+.35	-1.40	+16.5	+15	+37	+112	+1.1	+16	+69	+1.17	+1.04	-.041	+81	+85	+117	+77	+180	+294
4%	+14	-2.0	+79	+140	+.32	-.20	+1.1	+1.79	+30	+.35	+.36	-1.21	+16.2	+15	+36	+108	+1.0	+14	+67	+1.12	+1.00	-.038	+80	+84	+115	+75	+177	+289
5%	+14	-1.8	+78	+138	+.31	-.13	+1.1	+1.73	+29	+.36	+.37	-1.08	+15.8	+14	+35	+104	+1.0	+13	+65	+1.08	+.97	-.035	+78	+82	+113	+72	+173	+285
10%	+13	-1.0	+73	+130	+.30	+.09	+1.0	+1.52	+27	+.39	+.40	-.58	+14.6	+13	+33	+93	+.9	+7	+60	+.94	+.87	-.024	+73	+77	+106	+66	+164	+271
15%	+11	-.6	+70	+125	+.29	+.24	+.9	+1.37	+25	+.41	+.42	-.26	+13.9	+12	+31	+85	+.8	+3	+56	+.84	+.80	-.017	+70	+73	+101	+61	+157	+261
20%	+11	-.2	+68	+120	+.28	+.35	+.8	+1.25	+24	+.43	+.43	+.00	+13.3	+12	+30	+79	+.7	+0	+53	+.77	+.74	-.012	+67	+70	+98	+57	+152	+254
25%	+10	+.1	+65	+116	+.27	+.45	+.8	+1.16	+22	+.44	+.45	+.21	+12.8	+11	+29	+74	+.6	-3	+51	+.71	+.70	-.007	+65	+68	+95	+54	+147	+248
30%	+9	+.4	+64	+113	+.26	+.53	+.7	+1.08	+21	+.46	+.46	+.40	+12.3	+11	+28	+69	+.5	-6	+48	+.66	+.66	-.003	+63	+65	+92	+52	+143	+242
35%	+8	+.6	+62	+110	+.26	+.61	+.7	+1.00	+20	+.47	+.47	+.59	+11.9	+10	+27	+65	+.5	-8	+46	+.61	+.62	+.001	+61	+63	+89	+49	+139	+237
40%	+8	+.8	+60	+107	+.25	+.69	+.6	+.93	+19	+.48	+.48	+.75	+11.5	+10	+27	+61	+.4	-10	+44	+.56	+.59	+.005	+59	+61	+87	+47	+135	+231
45%	+7	+1.0	+58	+104	+.25	+.76	+.6	+.85	+18	+.49	+.48	+.92	+11.1	+9	+26	+57	+.4	-12	+42	+.52	+.56	+.008	+57	+59	+85	+45	+132	+226
50%	+7	+1.3	+57	+101	+.24	+.83	+.5	+.78	+17	+.50	+.49	+1.08	+10.7	+9	+25	+53	+.3	-14	+40	+.48	+.52	+.012	+55	+57	+83	+42	+128	+221
55%	+6	+1.5	+55	+98	+.23	+.90	+.5	+.71	+16	+.51	+.50	+1.25	+10.4	+8	+24	+49	+.3	-15	+38	+.44	+.49	+.015	+53	+55	+80	+40	+125	+216
60%	+5	+1.7	+53	+95	+.23	+.96	+.4	+.64	+14	+.52	+.51	+1.42	+10.0	+8	+24	+45	+.2	-17	+36	+.40	+.46	+.019	+52	+53	+78	+38	+121	+211
65%	+5	+1.9	+51	+92	+.22	+1.04	+.4	+.56	+13	+.53	+.52	+1.59	+9.6	+7	+23	+41	+.2	-19	+34	+.36	+.42	+.023	+50	+51	+76	+37	+118	+206
70%	+4	+2.1	+49	+88	+.21	+1.12	+.3	+.48	+12	+.55	+.53	+1.79	+9.2	+7	+22	+36	+.1	-21	+32	+.32	+.39	+.026	+48	+49	+73	+35	+114	+201
75%	+3	+2.4	+47	+85	+.21	+1.19	+.3	+.39	+11	+.56	+.54	+2.00	+8.7	+6	+21	+31	+.0	-23	+30	+.28	+.35	+.031	+45	+46	+71	+33	+110	+195
80%	+2	+2.7	+45	+80	+.20	+1.29	+.2	+.29	+9	+.57	+.56	+2.23	+8.2	+5	+20	+25	+.0	-26	+27	+.24	+.30	+.035	+43	+43	+68	+30	+105	+188
85%	+1	+3.0	+42	+75	+.19	+1.40	+.1	+.18	+7	+.59	+.57	+2.50	+7.6	+4	+19	+18	-.1	-28	+23	+.18	+.25	+.040	+40	+39	+64	+28	+99	+179
90%	+0	+3.5	+38	+68	+.18	+1.54	+.0	+.04	+4	+.61	+.59	+2.85	+6.8	+3	+18	+9	-.2	-32	+19	+.12	+.19	+.047	+36	+34	+59	+25	+91	+168
95%	-2	+4.2	+31	+54	+.16	+1.73	-.2	-.18	+0	+.65	+.62	+3.38	+5.6	+1	+15	-7	-.5	-37	+11	+.03	+.09	+.057	+30	+26	+49	+20	+77	+148
Total Animals	28,187	28,250	28,250	28,250	21,333	21,333	22,280	23,256	22,214	21,387	21,387	21,146	21,246	28,187	28,250	21,366	21,366	28,094	23,863	23,863	23,863	23,863	28,024	28,264	28,045	25,765	25,715	25,688
Avg. EPD	+6	+1.2	+56	+99	+.24	+.81	+.5	+.78	+16	+.50	+.49	+1.11	+10.7	+8	+25	+51	+.3	-13	+40	+.51	+.53	+.012	+54	+56	+82	+44	+127	+219

EPD and $Value Percentile Breakdowns Sires - Current Dams

TOP PCT	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HP	CEM	Milk	MW	MH	$EN	CW	Marb	RE	Fat	$M	$W	$F	$G	$B	$C
		Production								Management					Maternal					Carcass					$Values			
1%	+16	-2.6	+80	+140	+.32	-.52	+1.3	+1.98	+32	+.32	+.33	-1.79	+17.5	+16	+39	+110	+1.1	+18	+68	+1.30	+1.07	-.048	+85	+85	+116	+81	+180	+294
2%	+15	-2.1	+76	+134	+.31	-.38	+1.2	+1.82	+30	+.34	+.35	-1.43	+16.7	+15	+37	+101	+1.0	+16	+63	+1.18	+.99	-.040	+81	+81	+111	+76	+173	+284
3%	+14	-1.8	+74	+130	+.30	-.29	+1.1	+1.72	+29	+.36	+.37	-1.21	+16.2	+15	+36	+96	+1.0	+14	+61	+1.11	+.94	-.036	+79	+79	+108	+73	+169	+278
4%	+13	-1.6	+72	+127	+.30	-.22	+1.1	+1.64	+28	+.37	+.38	-1.05	+15.8	+14	+35	+92	+.9	+13	+59	+1.06	+.90	-.032	+78	+77	+106	+70	+165	+273
5%	+13	-1.4	+71	+125	+.29	-.17	+1.1	+1.59	+27	+.38	+.38	-.92	+15.5	+14	+35	+89	+.9	+12	+57	+1.02	+.87	-.029	+76	+76	+104	+68	+162	+269
10%	+11	-.7	+66	+117	+.28	+.01	+.9	+1.38	+25	+.40	+.41	-.47	+14.4	+13	+33	+78	+.7	+8	+52	+.89	+.77	-.020	+72	+70	+98	+61	+153	+256
15%	+10	-.3	+63	+112	+.27	+.12	+.9	+1.25	+23	+.42	+.43	-.18	+13.7	+12	+31	+71	+.7	+5	+49	+.80	+.70	-.013	+69	+67	+94	+57	+147	+248
20%	+9	+.1	+61	+108	+.26	+.22	+.8	+1.15	+22	+.44	+.44	+.06	+13.2	+11	+30	+66	+.6	+2	+46	+.73	+.65	-.008	+67	+64	+91	+54	+142	+241
25%	+9	+.3	+59	+105	+.25	+.30	+.7	+1.06	+20	+.45	+.45	+.25	+12.7	+11	+29	+61	+.5	+0	+44	+.67	+.61	-.004	+64	+62	+88	+51	+138	+235
30%	+8	+.6	+57	+102	+.24	+.37	+.7	+.98	+19	+.46	+.46	+.43	+12.3	+10	+28	+57	+.5	-2	+42	+.63	+.57	+.000	+63	+60	+86	+48	+134	+230
35%	+7	+.8	+56	+99	+.24	+.44	+.7	+.91	+18	+.47	+.47	+.60	+11.9	+10	+28	+53	+.4	-4	+40	+.58	+.54	+.003	+61	+58	+84	+46	+131	+226
40%	+7	+1.0	+54	+96	+.23	+.50	+.6	+.84	+17	+.48	+.48	+.75	+11.5	+9	+27	+49	+.4	-6	+38	+.54	+.51	+.006	+59	+56	+82	+44	+128	+221
45%	+6	+1.2	+53	+94	+.23	+.57	+.6	+.78	+16	+.49	+.49	+.90	+11.2	+9	+26	+46	+.3	-7	+36	+.51	+.48	+.009	+57	+54	+80	+43	+125	+217
50%	+5	+1.4	+51	+91	+.22	+.63	+.5	+.72	+15	+.50	+.50	+1.05	+10.9	+9	+25	+42	+.3	-9	+35	+.47	+.45	+.012	+56	+52	+78	+41	+122	+213
55%	+5	+1.6	+50	+89	+.22	+.69	+.5	+.65	+14	+.51	+.50	+1.19	+10.5	+8	+25	+39	+.2	-11	+33	+.44	+.42	+.015	+54	+50	+76	+39	+119	+209
60%	+5	+1.8	+48	+86	+.21	+.76	+.5	+.59	+13	+.52	+.51	+1.34	+10.2	+8	+24	+35	+.2	-12	+31	+.40	+.39	+.018	+52	+48	+74	+38	+116	+205
65%	+4	+2.0	+47	+83	+.21	+.82	+.4	+.52	+12	+.53	+.52	+1.50	+9.8	+7	+23	+32	+.1	-14	+29	+.37	+.36	+.022	+51	+46	+72	+36	+113	+201
70%	+3	+2.2	+45	+80	+.20	+.89	+.4	+.45	+11	+.54	+.53	+1.66	+9.4	+7	+23	+28	+.1	-16	+27	+.34	+.33	+.025	+49	+44	+70	+34	+110	+196
75%	+3	+2.5	+43	+77	+.20	+.97	+.3	+.37	+9	+.55	+.54	+1.85	+9.0	+6	+22	+24	+.0	-18	+25	+.30	+.30	+.029	+47	+42	+68	+33	+107	+192
80%	+2	+2.8	+41	+73	+.19	+1.06	+.3	+.28	+7	+.57	+.55	+2.06	+8.6	+5	+21	+19	+.0	-20	+23	+.26	+.26	+.033	+45	+39	+66	+31	+103	+186
85%	+1	+3.1	+39	+69	+.18	+1.16	+.2	+.18	+6	+.58	+.57	+2.32	+8.0	+5	+20	+14	-.1	-22	+21	+.22	+.22	+.037	+42	+36	+63	+29	+99	+180
90%	+0	+3.5	+36	+64	+.17	+1.29	+.1	+.05	+4	+.60	+.58	+2.64	+7.3	+4	+18	+6	-.2	-26	+18	+.16	+.17	+.043	+39	+32	+59	+26	+93	+171
95%	-2	+4.1	+31	+54	+.16	+1.49	+.0	-.15	+1	+.64	+.61	+3.15	+6.2	+2	+16	-5	-.4	-31	+12	+.08	+.09	+.052	+34	+26	+52	+23	+84	+158
Total Animals	347,578	348,440	348,440	348,440	217,663	217,663	233,975	236,362	232,633	219,039	219,039	215,886	220,427	347,578	348,440	225,881	225,881	346,255	260,103	260,103	260,103	260,103	345,754	348,542	346,087	301,156	300,960	300,791
Avg. EPD	+6	+1.4	+51	+91	+.22	+.64	+.5	+.72	+15	+.50	+.50	+1.07	+10.9	+8	+25	+42	+.3	-9	+35	+.50	+.46	+.012	+55	+50	+78	+44	+122	+213

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NON-PARENT BULLS

TOP PCT	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HP	CEM	Milk	MW	MH	$EN	CW	Marb	RE	Fat	$M	$W	$F	$G	$B	$C
			Production							Management				Maternal						Carcass				$Values				
1%	+16	-3.0	+86	+151	+.34	-.31	+1.3	+2.15	+34	+.30	+.31	-2.02	+18.1	+16	+39	+126	+1.3	+17	+76	+1.39	+1.17	-.053	+88	+91	+121	+85	+190	+310
2%	+15	-2.5	+82	+145	+.33	-.16	+1.2	+1.99	+32	+.32	+.33	-1.68	+17.3	+15	+37	+118	+1.2	+15	+72	+1.28	+1.09	-.045	+85	+87	+116	+80	+183	+299
3%	+15	-2.1	+80	+141	+.32	-.06	+1.2	+1.89	+31	+.34	+.34	-1.45	+16.8	+15	+36	+113	+1.1	+13	+70	+1.22	+1.04	-.040	+83	+85	+113	+77	+178	+293
4%	+14	-1.8	+78	+139	+.32	+.01	+1.1	+1.81	+30	+.35	+.36	-1.28	+16.4	+15	+35	+109	+1.1	+11	+68	+1.17	+1.01	-.037	+81	+83	+110	+75	+175	+288
5%	+14	-1.6	+77	+136	+.31	+.07	+1.1	+1.74	+30	+.36	+.36	-1.14	+16.1	+14	+34	+106	+1.0	+10	+66	+1.12	+.98	-.034	+80	+81	+108	+73	+172	+284
10%	+12	-1.0	+72	+128	+.30	+.26	+1.0	+1.52	+27	+.39	+.39	-.65	+15.0	+13	+32	+96	+.9	+4	+61	+.99	+.89	-.024	+76	+76	+102	+66	+162	+271
15%	+11	-.5	+69	+123	+.29	+.39	+.9	+1.38	+26	+.41	+.41	-.32	+14.3	+12	+31	+88	+.8	+1	+57	+.90	+.82	-.018	+73	+72	+97	+62	+156	+262
20%	+10	-.2	+67	+118	+.28	+.49	+.8	+1.27	+24	+.43	+.43	-.05	+13.7	+12	+30	+82	+.7	-2	+54	+.83	+.77	-.012	+70	+69	+94	+59	+150	+255
25%	+10	+.1	+65	+115	+.27	+.58	+.8	+1.17	+23	+.44	+.44	+.18	+13.2	+11	+29	+77	+.6	-4	+52	+.77	+.73	-.007	+68	+67	+91	+56	+146	+249
30%	+9	+.4	+63	+112	+.27	+.66	+.7	+1.09	+22	+.45	+.45	+.38	+12.8	+11	+28	+73	+.6	-6	+50	+.72	+.69	-.003	+66	+64	+89	+53	+142	+244
35%	+8	+.6	+61	+109	+.26	+.73	+.7	+1.01	+21	+.47	+.46	+.57	+12.3	+10	+27	+69	+.5	-8	+48	+.67	+.66	+.001	+64	+62	+86	+51	+139	+239
40%	+8	+.8	+60	+106	+.25	+.80	+.6	+.93	+20	+.48	+.47	+.76	+11.9	+10	+26	+65	+.5	-10	+46	+.62	+.62	+.004	+62	+60	+84	+49	+135	+234
45%	+7	+1.1	+58	+103	+.25	+.87	+.6	+.85	+19	+.49	+.48	+.94	+11.6	+9	+26	+61	+.4	-12	+44	+.58	+.59	+.008	+61	+58	+82	+47	+132	+230
50%	+7	+1.3	+57	+101	+.24	+.94	+.6	+.78	+18	+.50	+.49	+1.11	+11.2	+9	+25	+57	+.4	-13	+42	+.54	+.56	+.011	+59	+56	+80	+45	+129	+226
55%	+6	+1.5	+55	+98	+.24	+1.00	+.5	+.71	+17	+.51	+.50	+1.29	+10.8	+8	+25	+53	+.3	-15	+41	+.50	+.53	+.015	+57	+55	+79	+43	+126	+221
60%	+5	+1.7	+54	+96	+.23	+1.07	+.5	+.63	+15	+.53	+.51	+1.47	+10.4	+8	+24	+50	+.3	-16	+39	+.46	+.50	+.018	+56	+53	+77	+41	+123	+217
65%	+5	+1.9	+52	+93	+.23	+1.14	+.4	+.56	+14	+.54	+.52	+1.67	+10.0	+7	+23	+46	+.2	-18	+37	+.42	+.47	+.022	+54	+51	+75	+39	+120	+213
70%	+4	+2.1	+50	+90	+.22	+1.21	+.4	+.48	+13	+.55	+.53	+1.87	+9.6	+7	+23	+41	+.2	-20	+35	+.38	+.44	+.026	+52	+49	+73	+37	+117	+208
75%	+3	+2.4	+49	+87	+.21	+1.29	+.3	+.39	+12	+.56	+.54	+2.10	+9.2	+6	+22	+37	+.1	-22	+33	+.33	+.40	+.030	+50	+47	+71	+35	+113	+203
80%	+3	+2.7	+47	+84	+.21	+1.38	+.3	+.30	+10	+.58	+.56	+2.35	+8.7	+6	+21	+32	+.1	-24	+31	+.28	+.36	+.034	+48	+44	+68	+33	+109	+197
85%	+2	+3.0	+44	+79	+.20	+1.48	+.2	+.18	+8	+.60	+.57	+2.64	+8.1	+5	+20	+26	+.0	-27	+28	+.23	+.31	+.040	+45	+41	+66	+31	+104	+190
90%	+0	+3.4	+41	+73	+.19	+1.61	+.1	+.04	+6	+.62	+.59	+3.02	+7.3	+4	+19	+18	-.1	-30	+24	+.16	+.25	+.046	+42	+37	+62	+28	+98	+182
95%	-2	+4.1	+35	+63	+.17	+1.80	+.0	-.18	+2	+.66	+.62	+3.58	+6.2	+2	+17	+6	-.3	-36	+19	+.06	+.17	+.056	+37	+31	+55	+24	+89	+168
Total Animals	165,275	167,864	167,864	167,864	79,657	79,657	83,392	89,785	83,267	78,796	78,796	78,598	78,316	165,275	167,864	78,316	78,316	167,678	93,529	93,529	93,529	93,529	167,295	169,750	167,706	132,881	132,873	132,707
Avg. EPD	+6	+1.2	+57	+100	+.24	+.94	+.5	+.78	+17	+.50	+.49	+1.16	+11.2	+9	+25	+57	+.4	-13	+42	+.56	+.57	+.011	+58	+56	+81	+46	+130	+225

NON-PARENT COWS

TOP PCT	CED	BW	WW	YW	RADG	DMI	YH	SC	Doc	Claw	Angle	PAP	HP	CEM	Milk	MW	MH	$EN	CW	Marb	RE	Fat	$M	$W	$F	$G	$B	$C
			Production							Management				Maternal						Carcass				$Values				
1%	+16	-2.9	+86	+152	+.35	-.34	+1.4	+2.15	+34	+.30	+.31	-2.00	+17.9	+16	+38	+127	+1.3	+18	+79	+1.42	+1.20	-.056	+87	+91	+121	+86	+193	+313
2%	+15	-2.3	+82	+145	+.34	-.18	+1.3	+1.99	+32	+.33	+.33	-1.61	+17.1	+15	+37	+120	+1.2	+15	+74	+1.32	+1.12	-.048	+84	+87	+116	+81	+185	+303
3%	+14	-2.0	+80	+141	+.33	-.09	+1.2	+1.88	+31	+.34	+.35	-1.38	+16.6	+15	+35	+115	+1.1	+13	+72	+1.26	+1.08	-.043	+82	+84	+112	+78	+180	+296
4%	+14	-1.8	+78	+138	+.32	-.02	+1.2	+1.80	+30	+.36	+.36	-1.21	+16.2	+14	+34	+111	+1.1	+11	+69	+1.21	+1.04	-.040	+81	+82	+110	+76	+177	+291
5%	+13	-1.6	+77	+135	+.32	+.05	+1.1	+1.74	+30	+.36	+.36	-1.07	+15.9	+14	+34	+108	+1.1	+10	+68	+1.17	+1.02	-.036	+79	+80	+108	+74	+174	+287
10%	+12	-.9	+72	+127	+.30	+.24	+1.0	+1.52	+27	+.39	+.39	-.57	+14.8	+13	+32	+97	+.9	+4	+62	+1.04	+.92	-.026	+75	+74	+101	+67	+163	+272
15%	+11	-.4	+68	+121	+.29	+.38	+.9	+1.37	+26	+.42	+.41	-.25	+14.1	+12	+30	+90	+.8	+1	+59	+.96	+.85	-.020	+72	+70	+97	+63	+157	+263
20%	+10	-.1	+66	+117	+.28	+.48	+.8	+1.26	+24	+.43	+.42	+.02	+13.5	+12	+29	+84	+.7	-2	+56	+.89	+.80	-.014	+70	+67	+93	+60	+152	+256
25%	+9	+.2	+64	+113	+.28	+.57	+.8	+1.16	+23	+.45	+.44	+.25	+13.0	+11	+28	+79	+.7	-4	+53	+.83	+.76	-.010	+68	+65	+90	+57	+147	+250
30%	+9	+.4	+62	+110	+.27	+.66	+.7	+1.07	+22	+.46	+.45	+.46	+12.6	+11	+28	+74	+.6	-6	+51	+.77	+.72	-.005	+66	+62	+88	+54	+143	+244
35%	+8	+.7	+60	+107	+.26	+.73	+.7	+.99	+21	+.47	+.46	+.65	+12.2	+10	+27	+70	+.6	-8	+49	+.73	+.68	-.002	+64	+60	+86	+52	+140	+240
40%	+8	+.9	+59	+105	+.26	+.80	+.6	+.91	+20	+.48	+.47	+.83	+11.8	+10	+26	+66	+.5	-10	+47	+.68	+.65	+.002	+62	+58	+84	+49	+136	+235
45%	+7	+1.1	+57	+102	+.25	+.87	+.6	+.83	+19	+.50	+.48	+1.01	+11.4	+9	+26	+62	+.5	-11	+45	+.63	+.62	+.006	+60	+57	+82	+47	+133	+231
50%	+6	+1.3	+56	+100	+.25	+.94	+.6	+.76	+17	+.51	+.49	+1.19	+11.0	+9	+25	+58	+.4	-13	+43	+.59	+.59	+.009	+59	+55	+80	+46	+130	+226
55%	+6	+1.5	+54	+97	+.24	+1.01	+.5	+.69	+16	+.52	+.50	+1.37	+10.7	+8	+24	+54	+.4	-14	+41	+.55	+.55	+.013	+57	+54	+78	+44	+127	+222
60%	+5	+1.7	+53	+95	+.23	+1.08	+.5	+.61	+14	+.53	+.51	+1.55	+10.3	+8	+24	+51	+.3	-16	+39	+.51	+.52	+.016	+55	+51	+77	+42	+124	+218
65%	+5	+1.9	+52	+92	+.23	+1.15	+.4	+.53	+14	+.54	+.52	+1.74	+9.9	+8	+23	+46	+.3	-18	+38	+.47	+.49	+.020	+54	+50	+75	+40	+121	+213
70%	+4	+2.1	+50	+89	+.22	+1.23	+.4	+.45	+13	+.56	+.53	+1.94	+9.4	+7	+22	+42	+.2	-19	+35	+.42	+.45	+.024	+52	+48	+73	+38	+118	+209
75%	+3	+2.4	+48	+86	+.21	+1.31	+.3	+.36	+11	+.57	+.54	+2.16	+9.0	+6	+22	+38	+.1	-21	+33	+.37	+.42	+.028	+50	+46	+71	+36	+114	+203
80%	+3	+2.6	+46	+83	+.21	+1.40	+.3	+.25	+10	+.58	+.56	+2.42	+8.5	+6	+21	+32	+.1	-23	+31	+.32	+.38	+.032	+48	+43	+69	+34	+110	+198
85%	+2	+3.0	+44	+79	+.20	+1.51	+.2	+.14	+8	+.60	+.57	+2.72	+7.9	+5	+20	+26	+.0	-26	+28	+.26	+.33	+.037	+45	+40	+66	+32	+106	+191
90%	+1	+3.4	+41	+73	+.19	+1.64	+.1	-.01	+6	+.62	+.59	+3.10	+7.1	+4	+19	+18	-.1	-29	+24	+.19	+.27	+.044	+42	+37	+62	+29	+100	+182
95%	-1	+4.0	+35	+63	+.17	+1.84	+.0	-.24	+2	+.66	+.62	+3.67	+6.0	+3	+17	+7	-.3	-35	+19	+.08	+.18	+.054	+37	+30	+56	+25	+91	+169
Total Animals	125,053	127,244	127,244	127,244	47,065	47,065	50,511	46,607	49,233	47,132	47,132	46,800	47,751	125,053	127,244	46,607	46,607	125,249	54,147	54,147	54,147	54,147	124,878	128,397	125,306	92,929	92,926	92,828
Avg. EPD	+6	+1.3	+56	+99	+.25	+.94	+.6	+.75	+17	+.51	+.49	+1.23	+11.0	+9	+25	+58	+.4	-13	+43	+.61	+.59	+.009	+58	+55	+81	+47	+131	+226

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