



**Canadian Hereford Association**

Pan American Hereford Cattle Evaluation

Spring 2016

EPD Averages, Tools and Trends

Includes:

Introduction to Genomically Enhanced EPD

Maternal Productivity Index

Feedlot Merit Index

Heritabilities and Correlations

Averages and Percentile Breakdowns: Active Sires, Active Dams, Calves

Information on the usage of EPD Graphs

Information on Accuracy and Possible Change of EPDs

Genetic Trend: EPD Means by Birth Year

### Introduction

The following information is for use in analysing the Expected Progeny Differences (EPDs) from the Spring 2016 Pan American Cattle Evaluation (PACE). The EPDs are calculated by the Agricultural Business Research Institute (ABRI) in Australia, and use the combined datasets of the Canadian, American, Uruguay, and Argentina Hereford Associations. The resulting EPD values are directly comparable across the Hereford breed within North America, Uruguay, and Argentina. The EPDs are not directly comparable between different breeds of cattle.

The multiple trait analysis for calving ease includes both birth weight and calving ease scores. While birth weight is highly correlated with calving difficulty, the trait we are truly interested in is calving ease. Because of the inclusion of birth weight in the CE EPD evaluation, selection for CE alone will tend to reduce birth weights as well. CE EPD is reported as the probability of calves being born unassisted to first calf heifers. MCE EPD is reported as the probability that **daughters** of an animal will have their first calf without assistance. A larger value represents easier calving, or less calving assistance being required.

Scrotal size is correlated with fertility traits, and age at puberty. The SC EPD is reported in centimetres. It is recommended that all sires used meet the recommended minimum scrotal requirements, and pass a semen test prior to breeding, regardless of the SC EPD.

Cow Weight is evaluated as a fully correlated trait in the multi-trait evaluation, which means that its relationship with all other traits in the evaluation is taken into account during the calculations.

The Spring 2016 EPD includes the presentation of **Genomically Enhanced (GE) EPD**. These EPD are based on pedigree and performance data, but also include information obtained from SNP DNA testing. SNP stands for Single Nucleotide Polymorphism and the tests basically examine strings of an animal's DNA for single point changes in DNA base pairs that are related to differences in performance.

This SNP testing serves to improve the accuracy of the evaluation for these tested animals and their direct descendants by providing direct measurement of the DNA that the animal possesses and passes on to their progeny. As animals add progeny records, the relative influence of the DNA test is reduced in the calculation of the EPD.

While EPD on individual animals may be affected, inclusion of genomic testing results does not change the overall averages of the EPD in the population. The additional genomic data enhances the accuracy values associated with the EPD. The impact on accuracy is shown in the table on page 3. The DNA SNP test information provides significant levels of new information in less proven animals.

## Canadian Hereford Association – Spring 2016 EPD Statistics

**Resulting blended accuracy values provided by DNA tests based on initial accuracy of the animal's EPD and increasing explanation of variance by the test.**

Pre-Test BIF Acc	Genetic Correlation of Test										
	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
0.00	0.00	0.01	0.02	0.05	0.08	0.13	0.20	0.29	0.40	0.56	1.00
0.10	0.10	0.10	0.11	0.13	0.16	0.20	0.25	0.33	0.42	0.57	1.00
0.20	0.20	0.20	0.21	0.22	0.24	0.27	0.31	0.37	0.45	0.59	1.00
0.30	0.30	0.30	0.31	0.32	0.33	0.35	0.38	0.42	0.49	0.60	1.00
0.40	0.40	0.40	0.40	0.41	0.42	0.43	0.45	0.48	0.53	0.62	1.00
0.50	0.50	0.50	0.50	0.51	0.51	0.52	0.53	0.55	0.58	0.65	1.00
0.60	0.60	0.60	0.60	0.60	0.61	0.61	0.62	0.63	0.65	0.69	1.00
0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.71	0.71	0.72	0.74	1.00
0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.81	0.82	1.00
0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	1.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

It is important to note individual traits, such as milk or growth are affected by many genes, and that DNA tests are “associated” with various traits and may not explain all of the observed differences or variance in a trait. The current DNA panel and the resulting prediction equations are associated with the published EPD traits (Genetic Correlation) and explain a portion of the variation within the trait (Percent of Variance Explained). This is shown in the following table.

**Genetic Correlation and Percent of Variance explained for each trait, by the current training panel and prediction equations.**

Trait	Genetic Correlation	Percent of Variance Explained
CE	0.68	0.46
BW	0.68	0.46
WW	0.52	0.27
YW	0.60	0.36
Milk	0.37	0.14
MCE	0.51	0.26
SC	0.43	0.18
MCW	0.64	0.41
Fat	0.48	0.23
REA	0.49	0.24
Marb	0.43	0.18
Avg	0.53	0.28

Lower accuracy EPD are more likely to experience changes due to the inclusion of genomic data than higher accuracy EPD. The EPD will also have a larger boost in accuracy for those animals with less phenotypic data and thus lower initial accuracies.

It is also important to note that genomic information may affect MPI and FMI values for animals due to the impact on the component traits in each of these indexes.

Animals with EPD that are “Genomically Enhanced” are noted on the CHA website with the GE-EPD logo.



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### How to get the most out of the cow weight EPD:

The cow weight model allows us to weigh cows during a 60 day window either side of the calf weaning date, providing breeders with more flexibility, although it is recommended to weigh cows at the same time you weigh calves at weaning. Cow Weight records are adjusted to 5 years of age. Management groups are determined by the calf management group, unless the cow has experienced special treatment.

- 1) Weigh every cow every year – the analysis will sort out which weights to use
- 2) Weigh cows when calves are weighed at weaning
- 3) Management groups are not required, unless a cow has experienced different management than her calf
- 4) If also recording body conditions scores, please do so at the same time as weighing

**Table 1. Expected Progeny Difference Abbreviations**

Abbreviation	Meaning	Unit
EPD	Expected Progeny Difference	
CE	Calving Ease	% Unassisted Calving
BW	Birth Weight	Pounds
WW	Weaning Weight	Pounds
YW	Yearling Weight	Pounds
Milk	Milk	Pounds
TM	Total Maternal	Pounds
MCE	Maternal Calving Ease	% Unassisted Calving
SC	Scrotal	Centimetres
CW	Cow Weight	Pounds
Stay	Stayability	% Probability
MPI	Maternal Productivity Index	Standard units
FMI	Feedlot Merit Index	Standard units
REA	Rib-Eye Area	Square Inches
MARB	Intramuscular Fat	Score
FAT	Back Fat	Inches

The Maternal Productivity Index (MPI) is printed, together with its component traits of Pan American Weaning Weight, Milk, and Cow Weight and Canadian Stayability as computed by ABRI.

## Maternal Productivity Index

The purpose of the MPI value is to use science to identify a variety of maternal traits that are important to profitability and combine them in an easy-to-use format so that producers can easily make effective selection decisions. This is accomplished by looking at the relative economic importance of the traits involved and then combining them on this basis. The approach looked at both inputs and outputs to/from the production system. It is important to note that the MPI is a robust index. This means that there can be significant market changes without changing the ranking of the animals in the index. For example, the price of weaned calves can change significantly, without affecting the ranking of animals included in the index calculation.

### Relative Economic Weights used in calculating the MPI

<b>Weaning Weight</b>	\$1.17 / lb
<b>Milk</b>	\$0.98 / lb
<b>Cow Weight</b>	-\$0.14 / lb
<b>Stayability</b>	\$2.39 / %

Pan American EPDs as calculated by ABRI in the PACE, as well as the trait of Stayability calculated by ABRI using Canadian data are included.

Selection on the basis of MPI will result in the following selection emphasis: 27% Wng WT, 24% Milk, 15% Cow WT, 34% Stayability.

### MATERNAL PRODUCTIVITY INDEX

**Weaning Weight (WW)** – the Pan American weaning weight EPD in pounds. A larger EPD value indicates a heavier offspring due to genes for pre-weaning growth.

**Milk** – the Pan American milk EPD in pounds. A larger EPD value indicates more ability of daughters to provide a good pre-weaning environment for their calves.

**Cow Weight (CW)** – the Pan American mature cow weight EPD in pounds at weaning. A larger EPD value indicates a larger mature weight of an animal's daughters as weighed at weaning.

\* **Stayability (Stay)** – the stayability EPD and accuracy. Stayability is a probability value and a higher EPD value indicates that an animal's daughters are more likely to survive in the herd to produce 3 consecutive calves. It is calculated as the number of calves produced given that a female becomes a dam divided by the number of possible calves and is expressed as a percentage value.

**Maternal Productivity Index (MPI)** – this is the maternal productivity value calculated from the combination of traits and their relative weightings and then standardised to a mean of 100 and a standard deviation of 25. This allows for rapid comparison of animals and an understanding of where the animal fits within the Hereford population.

MPI is calculated in two steps:

1. The economic weighting is applied to the EPD from the genetic evaluations. Step 1 is calculated as follows:

$$1.168 \times \text{Wng WT} + 0.9818 \times \text{Milk} - 0.1364 \times \text{Cow WT} + 2.39 \times \text{Stay}$$

2. The MPI is expressed as a ratio and standardized to a mean of 100 and a standard deviation of 25 units. MPI is calculated as follows:

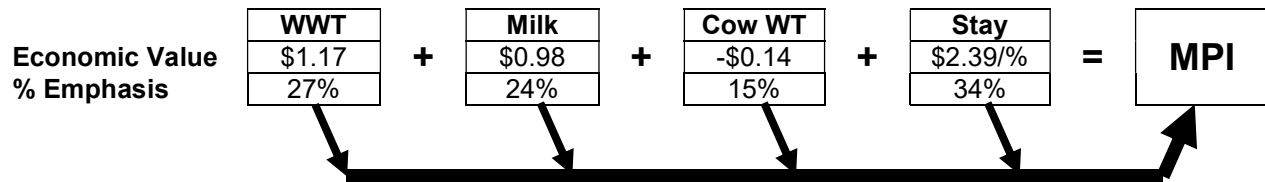
$$\text{MPI} = 25 \times (\text{Step 1 Result} - 36.92) \div 14.12 + 100.$$

The mean or average from Step 1 (multiplying the economic values over the whole dataset) is 36.92 and the standard deviation of the entire dataset is 14.12.

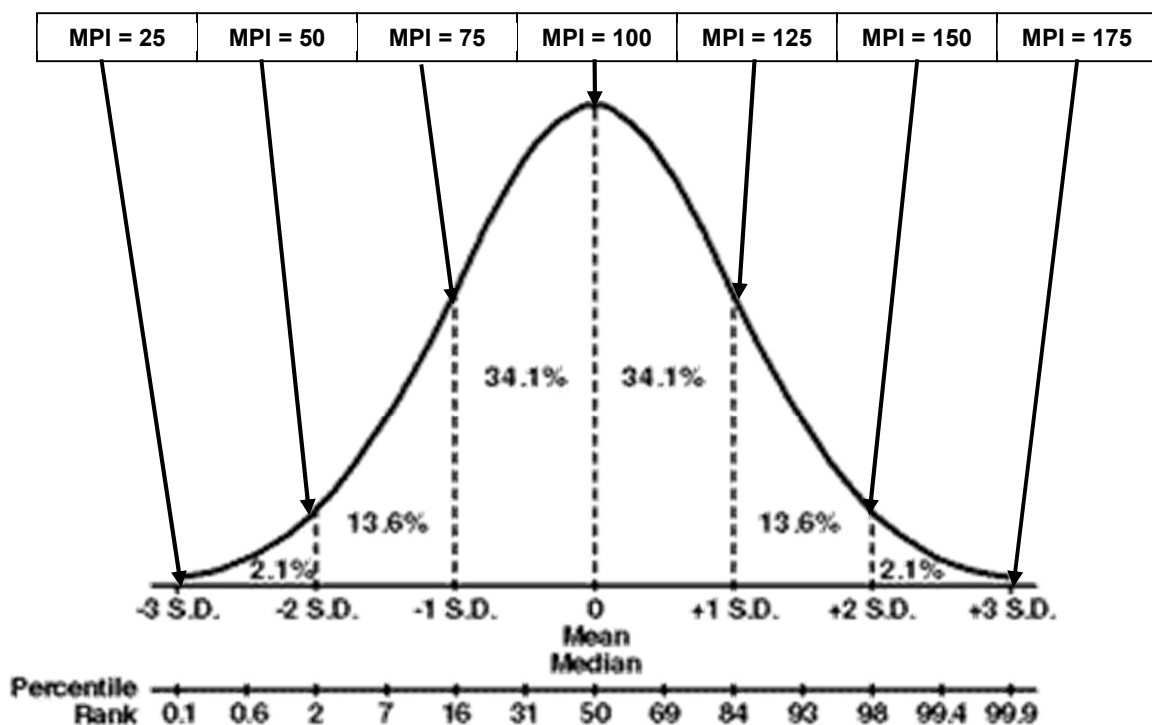
## Canadian Hereford Association – Spring 2016 EPD Statistics

MPI was calculated on a dataset of 836,928 animals. If selection were done strictly on the basis of MPI then selection emphasis on the component traits would occur as follows: 27% Wng WT, 24% Milk, 15% Cow WT, 34% Stayability.

\* - indicates those EPDs that were calculated by ABRI using a Canadian dataset only.



### AN IMPORTANT NOTE ON STANDARD CURVES



**Figure 1. A Standard Curve Representing Various MPI Values Across the Hereford Population**

The MPI is expressed as a standardised value. This means that the average MPI for all animals in the evaluation is 100. A cow with an MPI of 125 would be 1 standard deviation above the mean and a cow with an MPI of 150 would be 2 standard deviations above the mean.

Figure 1 shown above represents a standard curve. 0 or the mean median represents an MPI of 100. +1 S.D. represents an MPI of 125, and so on. An animal with an MPI of 125 would rank in the 84<sup>th</sup> percentile.

The figure shows that 34.1% of the Hereford animals will have an MPI between 100 and 125, 13.6% will have a value from 125 to 150 and 2.1% will be over 150.

**Please note that MPI is only fully calculated once per year (the Spring evaluation).**

### Feedlot Merit Index

To compliment the current Maternal Productivity Index (MPI), the CHA's Breed Improvement Committee enlisted the assistance of Dr. Mike MacNeil to develop a Feedlot Merit Index (FMI). Indices like our MPI and the new FMI enable producers and commercial customers to use one number, which encompasses many traits, to aid in their selection decisions. This selection strategy also avoids the danger of single-trait selection. Like MPI, differences in FMI are standardized to a mean of 100, and a standard deviation of 25. A difference in FMI between bulls represents a difference between the **progeny** of those bulls to be more profitable feeder cattle.

The goals of the FMI are to monitor and keep costs reasonable for the cow/calf and feedlot producer, while still deriving the best returns from carcasses, keeping in mind the price discrimination that occurs based upon carcass merit and the predominant breed composition of the Canadian commercial cow herd. This index is designed for use in terminal situations only (i.e. no replacements retained in a herd).

Dr. MacNeil is one of the leading experts on economic indices of this type. He identified the economically relevant traits affecting profitability as follows: calving ease, weaning weight, average daily gain, feed intake, yield grade, and marbling score. A number of simulations were run to arrive at the proper economic weightings which would place positive pressure on the traits that provide profitable carcasses. Weaning, growing, and finishing phases, along with calf survival and related costs were all incorporated into the model. The genetic co-variances between the economically relevant traits listed above and the EPDs we currently publish were determined as well, to allow the weightings to be correctly applied to our published EPDs.

The FMI is an excellent tool to increase the carcass potential of the progeny of bulls that are sold into terminal sire programs. Moderate and balanced selection for both MPI & FMI will produce progeny with traits that are desirable for maternal and feeder cattle.

For more specific information on the calculation and standardization of FMI, please refer to the section describing how MPI is calculated. FMI was calculated on a dataset of 831,563 animals.

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### Heritabilities and Correlations

Heritability is the term used to describe the observed variation in a trait that can be explained by genetic factors. The most up to date heritability estimates have been incorporated based on work done at AGBU, and represent variation in the Canadian and U.S. Hereford populations. These heritability estimates are the most accurate tool to represent genetic variation in the Hereford breed. Heritabilities used in the current evaluation are shown below.

Correlations are used to describe the relationships between traits. Correlations may range from **minus 1.0 to plus 1.0**. Correlations occur for a couple of reasons. Some genes may influence more than one trait, for example some of the genes that increase weaning weight may also result in higher yearling weights. This means that we can use weaning weight information to better predict the yearling weight EPD of an animal. A positive correlation means that as one trait increases the other does as well. A negative correlation means that when one trait increases the other decreases. Correlations of 0 mean that the traits have no relationship to each other. Some of the correlations used in the evaluation are shown below.

**Table 2. Heritabilities and Correlations used in the Joint Hereford PACE**

(Heritabilities are on the Diagonal / Genetic Correlations are above the Diagonal)															
	CE	BW	WW	YW	MILK	MCE	SC	Cow Wt	Stay	Scan REA	Scan FAT	Scan % IMF	REA	FAT	MARB
CE	0.10	-0.40	0.00	0.00	0.00	-0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BW		0.43	0.53	0.54	0.00	0.00	0.03	0.35	-0.23	0.18	-0.15	-0.07	0.10	-0.10	-0.10
WW			0.20	0.80	0.00	0.00	0.19	0.40	-0.22	0.59	0.28	0.02	0.40	0.10	0.00
YW				0.36	0.00	0.00	0.24	0.50	0.00	0.55	0.23	-0.09	0.40	0.05	0.05
MILK					0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MCE						0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SC							0.37	0.10	0.00	0.05	0.05	0.05	0.05	0.05	0.05
Cow Wt								0.38	-0.22	0.00	0.00	0.00	0.34	0.00	0.00
Stay									0.11	0.00	0.00	0.00	0.00	0.00	0.00
Scan REA										0.26	0.18	0.00	0.75	-0.05	0.02
Scan FAT											0.30	0.39	-0.09	0.85	0.30
Scan% IMF												0.26	-0.16	0.25	0.70
REA													0.36	-0.20	-0.10
FAT														0.30	0.30
Marb															0.53

Correlations have the largest impact on those animals with no data on a specific trait, which are only being evaluated based on the correlation or association between traits. For example, animals that do not have a scrotal measurement reported may have a scrotal EPD that is largely based on relative yearling weight performance. These animals may see significant changes in their EPD for scrotal size if a scrotal record is reported. The best way to ensure that evaluation reflects relative genetic merit is to collect data on the trait of interest.



## Canadian Hereford Association – Spring 2016 EPD Statistics

### Averages and Percentile Breakdowns

A Percentile table is used to show the relative ranking of an animal within the Hereford breed. Active Sires are those bulls that have sired at least 1 calf recorded over the last 2 years (for comparison of active bulls/herdsires). Active Dams are those cows with calves recorded in the last 2 years (for comparison of females in use in your cow herd). Calves are those animals born within the last 2 years (2014/2015) (for comparison of yearling and two year old animals in the population).

**Table 3. Active Sires – Averages & Percentile Breakdown**

	CE (%)	BW (lbs)	WW (lbs)	YW (lbs)	Milk (lbs)	TM (lbs)	MCE (%)	SC (cm)	CW (lbs)	Stay (%)	MPI	FMI	REA (in <sup>2</sup> )	FAT (in)	MARB (units)	
<b>Avg</b>	<b>1.0</b>	<b>3.2</b>	<b>50.0</b>	<b>81.0</b>	<b>21.0</b>	<b>46.0</b>	<b>1.3</b>	<b>0.9</b>	<b>89.0</b>	<b>-0.4</b>	<b>143.6</b>	<b>125.6</b>	<b>0.33</b>	<b>0.004</b>	<b>0.09</b>	<b>Avg</b>
<b>Min</b>	-18.5	-7.1	-9.0	-15.0	-13.0	-11.0	-11.2	-0.9	-10.0	-5.6	42.5	14.6	-0.78	-0.103	-0.47	<b>Min</b>
<b>Max</b>	13.3	12.4	89.0	148.0	51.0	87.0	9.2	2.7	182.0	5.7	190.3	224.7	1.57	0.163	1.07	<b>Max</b>
<b>Percentile Breakdown</b>																
<b>1%</b>	8.1	-2.3	73.0	121.0	39.0	68.0	6.4	1.9	35.0	3.4	177.6	186.0	0.97	-0.059	0.51	<b>1%</b>
<b>2%</b>	7.3	-1.3	70.0	115.0	37.0	65.0	5.8	1.8	43.0	2.8	173.3	178.3	0.90	-0.052	0.44	<b>2%</b>
<b>3%</b>	6.8	-0.8	68.0	112.0	35.0	64.0	5.4	1.7	48.0	2.6	171.1	172.8	0.85	-0.046	0.40	<b>3%</b>
<b>4%</b>	6.3	-0.5	67.0	109.0	34.0	63.0	5.2	1.6	51.0	2.3	168.7	170.0	0.81	-0.043	0.37	<b>4%</b>
<b>5%</b>	6.0	-0.2	66.0	107.0	33.0	62.0	4.9	1.5	53.0	2.1	167.1	167.8	0.77	-0.039	0.35	<b>5%</b>
<b>10%</b>	4.8	0.6	62.0	101.0	30.0	58.0	4.1	1.4	62.0	1.5	162.4	157.9	0.67	-0.029	0.27	<b>10%</b>
<b>15%</b>	4.1	1.2	60.0	97.0	29.0	56.0	3.5	1.2	67.0	1.1	159.0	151.1	0.60	-0.023	0.23	<b>15%</b>
<b>20%</b>	3.6	1.6	58.0	94.0	27.0	54.0	3.1	1.2	71.0	0.9	156.4	145.1	0.54	-0.018	0.20	<b>20%</b>
<b>25%</b>	3.1	2.0	56.0	92.0	26.0	53.0	2.8	1.1	75.0	0.6	154.0	141.1	0.50	-0.014	0.17	<b>25%</b>
<b>30%</b>	2.7	2.3	55.0	89.0	25.0	51.0	2.5	1.0	78.0	0.4	152.1	137.0	0.46	-0.010	0.14	<b>30%</b>
<b>35%</b>	2.3	2.6	54.0	87.0	24.0	50.0	2.2	1.0	81.0	0.2	150.0	133.8	0.43	-0.007	0.12	<b>35%</b>
<b>40%</b>	1.8	2.8	52.0	85.0	23.0	49.0	1.9	0.9	84.0	0.0	148.1	130.6	0.39	-0.004	0.10	<b>40%</b>
<b>45%</b>	1.4	3.1	51.0	83.0	22.0	48.0	1.6	0.9	86.0	-0.2	146.2	127.8	0.36	-0.001	0.09	<b>45%</b>
<b>50%</b>	1.0	3.3	50.0	81.0	21.0	46.0	1.3	0.8	89.0	-0.4	144.2	124.6	0.33	0.002	0.07	<b>50%</b>
<b>55%</b>	0.7	3.6	49.0	79.0	20.0	45.0	1.0	0.8	91.0	-0.5	141.9	121.8	0.29	0.005	0.05	<b>55%</b>
<b>60%</b>	0.4	3.8	48.0	77.0	20.0	44.0	0.8	0.7	94.0	-0.7	140.0	119.0	0.26	0.008	0.04	<b>60%</b>
<b>65%</b>	-0.1	4.0	46.0	75.0	19.0	43.0	0.5	0.7	97.0	-0.9	138.4	116.1	0.23	0.011	0.02	<b>65%</b>
<b>70%</b>	-0.5	4.3	45.0	73.0	18.0	41.0	0.2	0.6	99.0	-1.1	136.3	113.2	0.19	0.015	0.01	<b>70%</b>
<b>75%</b>	-0.9	4.6	43.0	70.0	16.0	39.0	-0.1	0.6	102.0	-1.3	133.6	109.7	0.16	0.020	-0.01	<b>75%</b>
<b>80%</b>	-1.5	4.9	42.0	67.0	15.0	38.0	-0.5	0.5	106.0	-1.6	131.4	105.9	0.12	0.025	-0.02	<b>80%</b>
<b>85%</b>	-2.1	5.3	39.0	64.0	13.0	35.0	-0.9	0.5	110.0	-1.9	128.2	102.0	0.07	0.031	-0.04	<b>85%</b>
<b>90%</b>	-2.9	5.8	37.0	59.0	11.0	32.0	-1.4	0.4	116.0	-2.2	124.3	96.0	0.01	0.039	-0.07	<b>90%</b>
<b>95%</b>	-4.3	6.5	32.0	53.0	7.0	28.0	-2.2	0.3	123.0	-2.9	118.3	87.0	-0.08	0.053	-0.11	<b>95%</b>
<b>100%</b>	-18.5	12.4	-9.0	-15.0	-13.0	-11.0	-11.2	-0.9	182.0	-5.6	42.5	14.6	-0.78	0.163	-0.47	<b>100%</b>
<b>Num</b>	<b>6394</b>	<b>6445</b>	<b>6445</b>	<b>6445</b>	<b>6440</b>	<b>6440</b>	<b>6394</b>	<b>6440</b>	<b>6445</b>	<b>1737</b>	<b>1736</b>	<b>1827</b>	<b>6443</b>	<b>6443</b>	<b>6443</b>	<b>Num</b>

Number (Num) is the number of active sires evaluated for each trait. Keep in mind that many more sires were evaluated; however active sires are those that have sired at least 1 calf reported in the last 2 years. There were roughly 6,445 active sires in the growth evaluation, 6,390 in the calving ease evaluation, and 6,445 in the carcass evaluation.

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**Table 4. Active Dams – Averages & Percentile Breakdown**

	<b>CE (%)</b>	<b>BW (lbs)</b>	<b>WW (lbs)</b>	<b>YW (lbs)</b>	<b>Milk (lbs)</b>	<b>TM (lbs)</b>	<b>MCE (%)</b>	<b>SC (cm)</b>	<b>CW (lbs)</b>	<b>Stay (%)</b>	<b>MPI</b>	<b>FMI</b>	<b>REA (in<sup>2</sup>)</b>	<b>FAT (in)</b>	<b>MARB (units)</b>	
<b>Avg</b>	<b>0.5</b>	<b>3.6</b>	<b>45.0</b>	<b>74.0</b>	<b>18.0</b>	<b>41.0</b>	<b>0.9</b>	<b>0.7</b>	<b>85.0</b>	<b>-0.3</b>	<b>137.1</b>	<b>120.4</b>	<b>0.25</b>	<b>0.002</b>	<b>0.06</b>	<b>Avg</b>
<b>Min</b>	-15.9	-8.4	-28.0	-45.0	-22.0	-26.0	-10.7	-0.7	-41.0	-8.2	85.6	7.7	-0.80	-0.124	-0.54	<b>Min</b>
<b>Max</b>	11.6	14.6	82.0	139.0	50.0	80.0	9.1	2.8	199.0	6.4	187.8	218.7	1.30	0.171	0.86	<b>Max</b>
<b>Percentile Breakdown</b>																
<b>1%</b>	6.5	-0.9	65.0	108.0	35.0	62.0	5.6	1.6	36.0	3.5	166.5	168.9	0.81	-0.050	0.40	<b>1%</b>
<b>2%</b>	5.7	-0.3	63.0	104.0	33.0	60.0	5.0	1.5	43.0	3.1	163.5	162.6	0.74	-0.043	0.34	<b>2%</b>
<b>3%</b>	5.2	0.1	61.0	101.0	32.0	59.0	4.6	1.4	48.0	2.8	161.2	158.6	0.69	-0.038	0.31	<b>3%</b>
<b>4%</b>	4.8	0.3	60.0	99.0	31.0	58.0	4.3	1.3	51.0	2.5	159.8	155.2	0.66	-0.035	0.29	<b>4%</b>
<b>5%</b>	4.6	0.5	59.0	98.0	30.0	57.0	4.1	1.3	53.0	2.4	158.5	152.8	0.63	-0.032	0.27	<b>5%</b>
<b>10%</b>	3.6	1.3	56.0	92.0	28.0	54.0	3.4	1.1	61.0	1.7	154.1	145.1	0.54	-0.024	0.21	<b>10%</b>
<b>15%</b>	3.0	1.7	54.0	89.0	26.0	51.0	2.9	1.1	66.0	1.4	150.9	139.8	0.48	-0.019	0.17	<b>15%</b>
<b>20%</b>	2.5	2.1	53.0	86.0	25.0	50.0	2.5	1.0	69.0	1.0	148.4	135.8	0.43	-0.015	0.14	<b>20%</b>
<b>25%</b>	2.1	2.4	51.0	84.0	24.0	48.0	2.1	0.9	73.0	0.8	146.3	132.5	0.39	-0.012	0.12	<b>25%</b>
<b>30%</b>	1.7	2.7	50.0	81.0	23.0	47.0	1.8	0.9	75.0	0.5	144.4	129.5	0.35	-0.009	0.10	<b>30%</b>
<b>35%</b>	1.4	2.9	49.0	79.0	22.0	45.0	1.6	0.8	78.0	0.3	142.5	126.9	0.32	-0.006	0.09	<b>35%</b>
<b>40%</b>	1.1	3.2	48.0	78.0	21.0	44.0	1.3	0.8	80.0	0.1	140.8	124.5	0.29	-0.004	0.07	<b>40%</b>
<b>45%</b>	0.8	3.4	47.0	76.0	20.0	43.0	1.1	0.8	83.0	-0.1	139.0	122.2	0.27	-0.002	0.06	<b>45%</b>
<b>50%</b>	0.5	3.6	46.0	74.0	19.0	42.0	0.9	0.7	85.0	-0.3	137.3	120.0	0.24	0.001	0.05	<b>50%</b>
<b>55%</b>	0.2	3.8	44.0	72.0	18.0	40.0	0.6	0.7	87.0	-0.5	135.6	117.8	0.21	0.003	0.04	<b>55%</b>
<b>60%</b>	-0.1	4.0	43.0	70.0	17.0	39.0	0.4	0.6	89.0	-0.7	133.9	115.5	0.19	0.006	0.02	<b>60%</b>
<b>65%</b>	-0.4	4.3	42.0	68.0	16.0	38.0	0.2	0.6	92.0	-0.9	132.2	113.1	0.16	0.008	0.01	<b>65%</b>
<b>70%</b>	-0.7	4.5	41.0	66.0	15.0	36.0	0.0	0.6	94.0	-1.1	130.3	110.6	0.13	0.011	0.00	<b>70%</b>
<b>75%</b>	-1.0	4.7	40.0	64.0	14.0	35.0	-0.3	0.5	97.0	-1.4	128.1	108.0	0.10	0.015	-0.02	<b>75%</b>
<b>80%</b>	-1.5	5.0	38.0	61.0	13.0	33.0	-0.6	0.5	100.0	-1.6	125.9	105.2	0.07	0.019	-0.03	<b>80%</b>
<b>85%</b>	-2.0	5.4	36.0	59.0	11.0	31.0	-1.0	0.4	103.0	-2.0	123.2	101.7	0.03	0.024	-0.05	<b>85%</b>
<b>90%</b>	-2.6	5.8	34.0	55.0	9.0	28.0	-1.5	0.4	108.0	-2.4	119.9	97.5	-0.02	0.031	-0.07	<b>90%</b>
<b>95%</b>	-3.7	6.5	31.0	50.0	5.0	24.0	-2.3	0.3	116.0	-3.1	115.2	90.0	-0.09	0.042	-0.11	<b>95%</b>
<b>100%</b>	-15.9	14.6	-28.0	-45.0	-22.0	-26.0	-10.7	-0.7	199.0	-8.2	85.6	7.7	-0.80	0.171	-0.54	<b>100%</b>
<b>Num</b>	<b>114731</b>	<b>116347</b>	<b>116368</b>	<b>116374</b>	<b>116172</b>	<b>116171</b>	<b>114731</b>	<b>114801</b>	<b>116184</b>	<b>19120</b>	<b>19120</b>	<b>20396</b>	<b>115232</b>	<b>115232</b>	<b>115232</b>	<b>Num</b>

Number (Num) is the number of active dams that were evaluated for each trait. Many more dams were evaluated; however active dams are those females that have had a calf reported within the last 2 years. There were roughly 116,350 active females included in the growth evaluation, 114,730 evaluated for calving ease, and 115,230 for carcass merit.

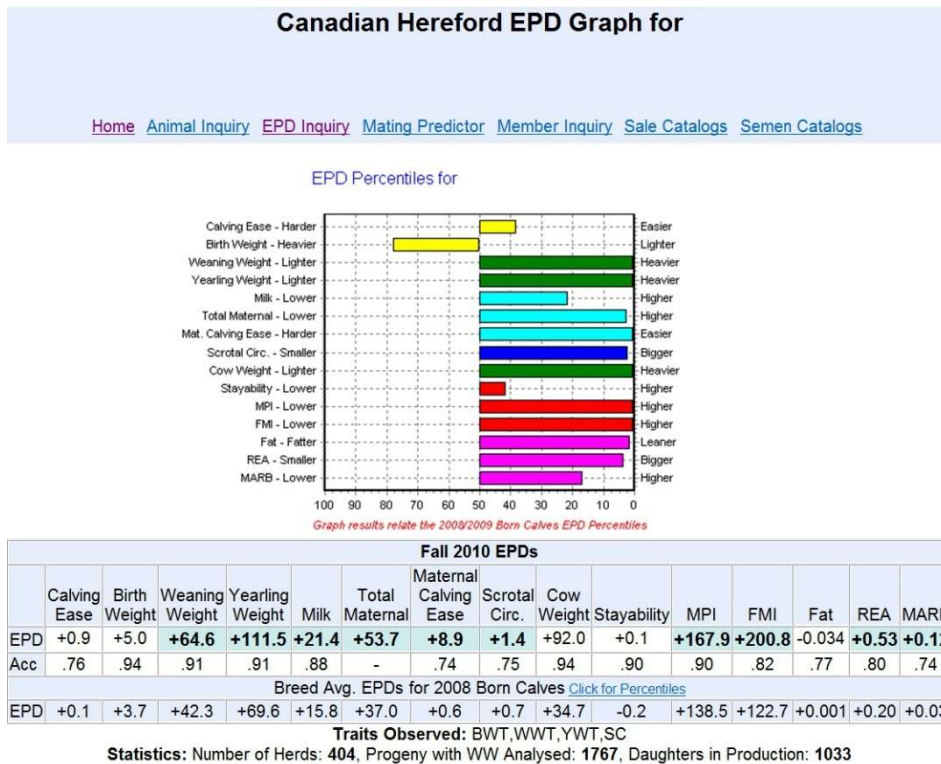
**Canadian Hereford Association – Spring 2016 EPD Statistics**  
**Table 5. Current Calves – Averages & Percentile Breakdown**

	<b>CE (%)</b>	<b>BW (lbs)</b>	<b>WW (lbs)</b>	<b>YW (lbs)</b>	<b>Milk (lbs)</b>	<b>TM (lbs)</b>	<b>MCE (%)</b>	<b>SC (cm)</b>	<b>CW (lbs)</b>	<b>Stay (%)</b>	<b>MPI</b>	<b>FMI</b>	<b>REA (in<sup>2</sup>)</b>	<b>FAT (in)</b>	<b>MARB (units)</b>	
<b>Avg</b>	<b>1.2</b>	<b>3.2</b>	<b>49.0</b>	<b>79.0</b>	<b>21.0</b>	<b>45.0</b>	<b>1.4</b>	<b>0.8</b>	<b>87.0</b>	<b>-0.3</b>	<b>140.4</b>	<b>122.7</b>	<b>0.31</b>	<b>0.004</b>	<b>0.09</b>	<b>Avg</b>
<b>Min</b>	<b>-17.2</b>	<b>-8.1</b>	<b>-23.0</b>	<b>-34.0</b>	<b>-10.0</b>	<b>-22.0</b>	<b>-6.9</b>	<b>-1.1</b>	<b>-22.0</b>	<b>-5.7</b>	<b>85.4</b>	<b>18.1</b>	<b>-0.75</b>	<b>-0.093</b>	<b>-0.52</b>	<b>Min</b>
<b>Max</b>	<b>12.8</b>	<b>13.4</b>	<b>85.0</b>	<b>150.0</b>	<b>46.0</b>	<b>78.0</b>	<b>8.9</b>	<b>2.7</b>	<b>185.0</b>	<b>4.9</b>	<b>185.5</b>	<b>225.5</b>	<b>1.41</b>	<b>0.165</b>	<b>1.00</b>	<b>Max</b>
<b>Percentile Breakdown</b>																
<b>1%</b>	7.5	-1.5	68.0	111.0	35.0	64.0	5.4	1.6	46.0	2.7	168.2	172.6	0.85	-0.044	0.41	<b>1%</b>
<b>2%</b>	6.6	-0.8	65.0	107.0	33.0	62.0	4.9	1.5	52.0	2.3	165.5	165.4	0.77	-0.038	0.36	<b>2%</b>
<b>3%</b>	6.0	-0.4	64.0	105.0	32.0	61.0	4.6	1.5	55.0	2.1	163.7	161.3	0.72	-0.034	0.33	<b>3%</b>
<b>4%</b>	5.6	-0.1	63.0	103.0	31.0	60.0	4.3	1.4	58.0	1.9	162.3	158.3	0.69	-0.031	0.31	<b>4%</b>
<b>5%</b>	5.3	0.1	62.0	102.0	31.0	59.0	4.2	1.4	60.0	1.8	161.2	155.8	0.66	-0.029	0.29	<b>5%</b>
<b>10%</b>	4.3	0.9	59.0	96.0	29.0	56.0	3.5	1.2	66.0	1.3	157.4	147.5	0.57	-0.021	0.24	<b>10%</b>
<b>15%</b>	3.7	1.4	57.0	93.0	27.0	54.0	3.1	1.1	71.0	1.0	154.7	142.2	0.52	-0.016	0.20	<b>15%</b>
<b>20%</b>	3.2	1.8	56.0	91.0	26.0	53.0	2.8	1.1	74.0	0.7	152.5	138.4	0.48	-0.012	0.17	<b>20%</b>
<b>25%</b>	2.8	2.1	54.0	88.0	25.0	52.0	2.5	1.0	77.0	0.5	150.6	135.1	0.44	-0.009	0.15	<b>25%</b>
<b>30%</b>	2.4	2.4	53.0	86.0	24.0	50.0	2.2	1.0	79.0	0.3	148.9	132.2	0.41	-0.007	0.13	<b>30%</b>
<b>35%</b>	2.1	2.6	52.0	84.0	24.0	49.0	2.0	0.9	82.0	0.2	147.3	129.6	0.38	-0.004	0.12	<b>35%</b>
<b>40%</b>	1.7	2.8	51.0	83.0	23.0	48.0	1.8	0.9	84.0	0.0	145.7	127.3	0.36	-0.002	0.10	<b>40%</b>
<b>45%</b>	1.4	3.1	50.0	81.0	22.0	47.0	1.6	0.9	86.0	-0.2	144.2	125.0	0.33	0.000	0.09	<b>45%</b>
<b>50%</b>	1.1	3.3	49.0	79.0	21.0	46.0	1.3	0.8	88.0	-0.3	142.6	122.8	0.31	0.003	0.08	<b>50%</b>
<b>55%</b>	0.8	3.5	48.0	78.0	21.0	45.0	1.1	0.8	90.0	-0.5	141.0	120.6	0.28	0.005	0.06	<b>55%</b>
<b>60%</b>	0.5	3.7	47.0	76.0	20.0	44.0	0.9	0.8	92.0	-0.7	139.3	118.4	0.26	0.008	0.05	<b>60%</b>
<b>65%</b>	0.2	3.9	46.0	74.0	19.0	43.0	0.7	0.7	94.0	-0.8	137.6	116.2	0.23	0.010	0.04	<b>65%</b>
<b>70%</b>	-0.1	4.2	45.0	72.0	18.0	41.0	0.5	0.7	96.0	-1.0	135.8	113.8	0.21	0.013	0.03	<b>70%</b>
<b>75%</b>	-0.4	4.4	44.0	70.0	17.0	40.0	0.2	0.6	98.0	-1.2	133.8	111.3	0.18	0.017	0.01	<b>75%</b>
<b>80%</b>	-0.8	4.7	42.0	68.0	16.0	38.0	0.0	0.6	101.0	-1.4	131.6	108.5	0.15	0.021	0.00	<b>80%</b>
<b>85%</b>	-1.3	5.0	40.0	65.0	15.0	36.0	-0.3	0.6	104.0	-1.6	129.0	105.2	0.11	0.026	-0.02	<b>85%</b>
<b>90%</b>	-1.9	5.5	38.0	62.0	12.0	33.0	-0.8	0.5	108.0	-2.0	125.5	100.8	0.06	0.032	-0.04	<b>90%</b>
<b>95%</b>	-2.9	6.2	35.0	56.0	9.0	29.0	-1.4	0.4	115.0	-2.5	120.0	93.8	0.00	0.042	-0.07	<b>95%</b>
<b>100%</b>	<b>-17.2</b>	<b>13.4</b>	<b>-23.0</b>	<b>-34.0</b>	<b>-10.0</b>	<b>-22.0</b>	<b>-6.9</b>	<b>-1.1</b>	<b>185.0</b>	<b>-5.7</b>	<b>85.4</b>	<b>18.1</b>	<b>-0.75</b>	<b>0.165</b>	<b>-0.52</b>	<b>100%</b>
<b>Num</b>	<b>152548</b>	<b>159432</b>	<b>159423</b>	<b>159422</b>	<b>159206</b>	<b>159206</b>	<b>152548</b>	<b>158755</b>	<b>159410</b>	<b>25161</b>	<b>25161</b>	<b>28153</b>	<b>159291</b>	<b>159291</b>	<b>159291</b>	<b>Num</b>

Current calves are those born in the last 2 years. Number (Num) is the number of calves that were evaluated for each trait. There were roughly 159,430 calves included in the growth evaluation, 152,550 in the calving ease evaluation and 159,290 in the carcass merit evaluation.

## Canadian Hereford Association – Spring 2016 EPD Statistics EPD Graphs on the CHA Website

The screen below appears when you select an animal on the CHA website under the EPD or Animal searches. What you may not be aware of is that there is a pictorial representation available of every animal's EPD **ranking** within the population.



Once you click on the graphic or the [View] link, this graph appears. It gives you a quick snapshot view of the animal's **ranking** within the population for each EPD. The graph is based upon the calf percentile table, so if you trying to compare older animals (i.e. animals with progeny), it is better to use the Active Sires and Active Dams percentile tables presented earlier in this document to determine rankings. If you are looking for yearling, 2 year old bulls, or replacement females, the graph on website is accurate. **Always keep in mind that EPDs do not represent actual values and EPDs must be used as a comparison between two or more animals.**

## Genomically Enhanced EPD

Animals with EPD that contain DNA SNP test information are noted on the CHA animal search site through the appearance of the Genomically Enhanced EPD (GE EPD) logo on their pedigree page.



## Canadian Hereford Association – Spring 2016 EPD Statistics

### Accuracy and Possible Change of EPDs

EPDs change because we are continually collecting more information on Hereford cattle. As well, researchers continue to find ways to better describe genetic relationships; this results from model improvements, such as the multi-trait analysis performed by ABRI.

Accuracy is based on the amount of performance information available on the animal and its' close relatives – particularly the number of progeny analysed. Accuracy is also based on the heritability of the trait and the genetic correlations with other recorded traits. Hence accuracy indicates the “confidence level” of the EPD. The higher the accuracy value the lower the likelihood of change in the animal’s EPD as more information is analyzed for that animal and its’ relatives. Even though an EPD with a low accuracy may change in the future, it is still the best estimate of an animal’s genetic merit for that trait. As more information becomes available, an EPD is just as likely to increase in value as it is to decrease.

While an EPD is still a better measure of an animal’s genetic merit than a rank or an index, it is important to be aware of the potential risks associated with using low accuracy sires. As EPDs are used for improving accuracy of selection, it is important to consider the accuracy value associated with the EPD value.

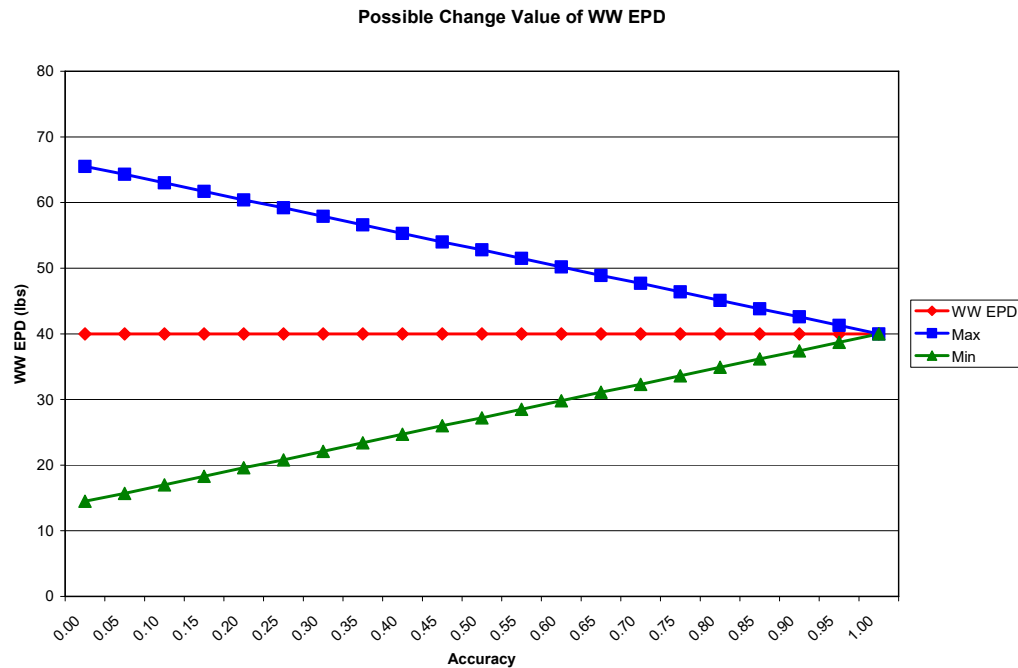
Accuracy values range from .00 to .99. The following table is given for interpreting accuracy.

Accuracy	Interpretation
< 0.10 - PE	Very low accuracy. EPDs should be considered a preliminary estimate. They could change substantially as more performance information becomes available.
0.10 to 0.25	Low accuracy, usually based on the animal’s own records and pedigree. Useful for screening “best bet” animals. Still subject to substantial changes with more information, particularly when the performance of progeny are analysed.
0.25 to 0.40	Medium accuracy and includes some progeny information. Becoming a more reliable indicator of the animal’s value as a parent.
0.40 to 0.70	High accuracy. Some progeny information included. Unlikely that the EPD will change very much with the addition of more progeny data.
> 0.70	Very high accuracy estimate of the animal’s true breeding value.

When two animals have similar EPDs the one with the higher accuracy could be the safer choice, assuming other factors are equal.

The graph shows the potential range of EPDs for WW for an animal with increasing accuracy. Consider each point **◆** as a different animal. Every animal has a WW EPD of 40.0 lbs. As more information is added from progeny and relatives the EPD may change to any point between the maximum **■** and the minimum **▲** values. As the accuracy increases the potential change in the EPD is reduced. This is what is referred to as risk. A sire with a low accuracy EPD, faces a higher risk that the EPD may change, because the EPD is based on less information than an EPD with higher accuracy.

# Canadian Hereford Association – Spring 2016 EPD Statistics



**Figure 2. Possible Change Value and Range of a Weaning Weight EPD based on Accuracy Value**

The table of possible change values shows the expected range of change that can occur in an EPD as more information is collected (accuracy increases). While a few animals may experience changes outside of this range, it is not likely. If we look at the example of Yearling Weight an animal may have a YW EPD of +40 and an ACC of 0.40. The possible change value is  $\pm 13.5$ . This means that as more information is added to the evaluation the EPD may change, but should remain within the range of 26.5 and 53.5 ( $40 - 13.5$  and  $40 + 13.5$ ) 95 times out of 100.

**Table 6. Possible Change Values for EPD by Accuracy Level (95% Confidence Interval)**

ACC	CE (%)	BW (lbs)	WW (lbs)	YW (lbs)	Milk (lbs)	MCE (%)	SC (cm)	REA (in <sup>2</sup> )	Fat (in)	MARB (units)	ACC
0.00	$\pm 12.6$	$\pm 5.4$	$\pm 25.5$	$\pm 42.6$	$\pm 18.4$	$\pm 12.6$	$\pm 1.22$	$\pm 0.69$	$\pm 0.091$	$\pm 0.48$	0.00
0.05	12.0	5.1	24.3	40.4	17.5	12.0	1.16	0.65	0.086	0.46	0.05
0.10	11.3	4.8	23.0	38.3	16.6	11.3	1.10	0.62	0.082	0.43	0.10
0.15	10.6	4.6	21.7	36.2	15.7	10.6	1.04	0.58	0.077	0.41	0.15
0.20	10.0	4.3	20.4	34.0	14.8	10.0	0.98	0.55	0.073	0.38	0.20
0.25	9.3	4.0	19.2	31.9	13.8	9.3	0.92	0.51	0.068	0.36	0.25
0.30	8.7	3.8	17.9	29.8	12.9	8.7	0.86	0.48	0.064	0.34	0.30
0.35	8.0	3.5	16.6	27.7	12.0	8.0	0.80	0.45	0.059	0.31	0.35
0.40	7.4	3.2	15.3	25.5	11.1	7.4	0.73	0.41	0.055	0.29	0.40
0.45	6.7	3.0	14.0	23.4	10.1	6.7	0.67	0.38	0.050	0.26	0.45
0.50	6.1	2.7	12.8	21.3	9.2	6.1	0.61	0.34	0.045	0.24	0.50
0.55	5.5	2.4	11.5	19.2	8.3	5.5	0.55	0.31	0.041	0.22	0.55
0.60	4.9	2.1	10.2	17.0	7.4	4.9	0.49	0.27	0.036	0.19	0.60
0.65	4.2	1.9	8.9	14.9	6.5	4.2	0.43	0.24	0.032	0.17	0.65
0.70	3.6	1.6	7.7	12.8	5.5	3.6	0.37	0.21	0.027	0.14	0.70
0.75	3.0	1.3	6.4	10.6	4.6	3.0	0.31	0.17	0.023	0.12	0.75
0.80	2.4	1.1	5.1	8.5	3.7	2.4	0.24	0.14	0.018	0.10	0.80
0.85	1.8	0.8	3.8	6.4	2.8	1.8	0.18	0.10	0.014	0.07	0.85
0.90	1.2	0.5	2.6	4.3	1.8	1.2	0.12	0.07	0.009	0.05	0.90
0.95	0.6	0.3	1.3	2.1	0.9	0.6	0.06	0.03	0.005	0.02	0.95
1.00	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.000	0.00	1.00

A buyer is always advised to use more than just the EPDs, regardless of accuracy when making purchase decisions.

## Canadian Hereford Association – Spring 2016 EPD Statistics

### Genetic Trend

EPDs express relative genetic differences between animals. Because of the use of pedigree information, we are able to calculate the relative change in genetic merit of Hereford cattle over time. Looking at the graph on the next page we can see that BW has stabilized over the last several years, while WW, YW, Milk and Total Maternal traits are increasing at a relatively rapid pace. This reflects the selection emphasis of Pan American producers on growth. BW has seen a slight decline for the last several years, WW has been increasing at around 1 pound per year, and YW has been increasing from 1.5 to 2 pounds per year for the last several years. Milk has been increasing at just over 0.5 pounds per year for the last several years. SC has also increased over the last several years, as has REA and MARB. FAT shows a very slight increase.

**Table 7. Genetic Trend – All Animals by Birth Year**

Year	CE (%)	BW (lbs)	WW (lbs)	YW (lbs)	Milk (lbs)	TM (lbs)	MCE (%)	SC (cm)	CW (lbs)	Stay (%)	MPI	FMI	REA (in <sup>2</sup> )	FAT (in)	MARB (units)	Year
2015	1.3	3.2	49.8	80.6	22.1	47.1	1.5	0.9	88.2	-0.3	143.6	123.9	0.33	0.005	0.10	2015
2014	1.1	3.3	48.2	78.2	20.3	44.4	1.3	0.8	87.1	-0.3	141.1	123.1	0.31	0.003	0.09	2014
2013	0.8	3.4	47.1	76.4	19.2	42.8	1.1	0.8	86.3	-0.3	138.6	122.3	0.29	0.002	0.07	2013
2012	0.7	3.5	46.1	74.8	18.4	41.5	1.0	0.8	85.5	-0.2	137.2	121.7	0.27	0.001	0.07	2012
2011	0.5	3.6	45.1	73.3	17.7	40.3	0.9	0.7	84.6	-0.3	135.8	120.7	0.25	0.001	0.06	2011
2010	0.4	3.6	44.1	72.0	17.1	39.2	0.8	0.7	83.9	-0.2	134.2	120.1	0.23	0.000	0.05	2010
2009	0.3	3.7	43.0	70.4	16.5	38.1	0.7	0.7	82.9	-0.3	133.0	119.3	0.21	0.001	0.05	2009
2008	0.1	3.7	42.0	68.8	15.7	36.8	0.6	0.7	82.1	-0.3	131.5	119.0	0.19	0.000	0.04	2008
2007	0.1	3.7	41.1	67.4	15.1	35.8	0.5	0.6	81.3	-0.2	130.0	118.8	0.18	0.000	0.03	2007
2006	0.0	3.7	40.0	65.7	14.5	34.6	0.4	0.6	80.3	-0.2	128.5	117.9	0.16	-0.001	0.02	2006
2005	-0.1	3.7	39.0	64.2	13.7	33.3	0.2	0.6	79.6	-0.1	126.2	116.9	0.14	-0.002	0.02	2005
2004	-0.1	3.7	37.8	62.4	13.1	32.1	0.2	0.6	78.3	-0.2	124.6	115.3	0.12	-0.002	0.02	2004
2003	-0.2	3.7	36.8	61.0	12.7	31.1	0.1	0.5	77.3	-0.1	123.2	114.6	0.09	-0.002	0.01	2003
2002	-0.3	3.7	35.8	59.5	12.2	30.2	0.0	0.5	76.2	-0.1	121.9	113.9	0.08	-0.002	0.01	2002
2001	-0.3	3.7	34.9	58.0	11.6	29.1	0.0	0.5	75.3	-0.1	120.0	112.5	0.06	-0.002	0.01	2001
2000	-0.4	3.7	34.1	56.7	11.2	28.3	-0.1	0.5	74.3	0.0	119.0	110.9	0.05	-0.002	0.00	2000
1999	-0.3	3.6	33.1	55.2	10.6	27.1	-0.1	0.5	72.9	0.0	117.1	109.6	0.03	-0.003	0.00	1999
1998	-0.3	3.5	32.3	54.0	10.2	26.3	-0.1	0.4	71.9	0.0	115.4	108.0	0.02	-0.003	0.00	1998
1997	-0.4	3.5	31.2	52.4	9.8	25.4	-0.2	0.4	70.5	0.1	113.8	106.7	0.01	-0.003	0.00	1997
1996	-0.4	3.4	30.4	51.0	9.2	24.5	-0.2	0.4	69.6	0.1	111.5	104.4	0.00	-0.003	0.00	1996
1995	-0.5	3.3	29.1	49.1	8.6	23.1	-0.2	0.4	67.8	0.2	108.9	102.3	-0.02	-0.003	-0.01	1995
1994	-0.5	3.2	27.9	47.3	7.9	21.9	-0.2	0.3	66.4	0.2	106.4	100.6	-0.03	-0.003	-0.01	1994
1993	-0.4	3.0	26.6	45.5	7.4	20.8	-0.1	0.3	64.7	0.3	104.9	99.2	-0.05	-0.004	-0.01	1993
1992	-0.4	2.8	25.3	43.5	6.9	19.6	-0.1	0.3	62.8	0.3	103.1	97.4	-0.06	-0.004	-0.01	1992
1991	-0.3	2.6	24.0	41.3	6.5	18.5	-0.1	0.3	60.5	0.4	101.4	95.6	-0.07	-0.004	-0.01	1991
1990	-0.1	2.4	22.2	38.6	6.2	17.3	0.0	0.2	57.4	0.5	100.2	94.6	-0.08	-0.004	-0.01	1990
1989	0.0	2.0	20.2	35.3	5.9	16.1	0.0	0.2	53.6	0.5	97.9	91.7	-0.10	-0.003	-0.01	1989
1988	0.2	1.7	18.4	32.4	5.8	15.0	-0.1	0.2	50.1	0.5	96.4	90.4	-0.12	-0.003	-0.01	1988
1987	0.4	1.4	16.4	29.3	5.8	14.0	0.0	0.2	46.1	0.5	94.6	86.6	-0.13	-0.002	-0.01	1987
1986	0.4	1.1	14.6	26.3	5.8	13.1	0.0	0.2	42.7	0.5	92.9	84.5	-0.15	-0.001	-0.01	1986
1985	0.6	0.8	12.7	23.3	5.6	12.0	0.0	0.1	39.4	0.6	91.3	81.6	-0.16	-0.001	-0.01	1985
1984	0.7	0.5	10.6	20.1	5.5	10.9	0.2	0.1	36.0	0.6	89.0	79.8	-0.18	-0.001	-0.01	1984
1983	0.7	0.2	8.4	16.6	5.3	9.5	0.1	0.1	32.3	0.5	86.7	76.0	-0.20	-0.001	-0.01	1983
1982	0.7	-0.1	6.3	13.3	5.1	8.2	0.2	0.1	29.0	0.5	84.6	74.2	-0.22	-0.001	-0.01	1982

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Figure 2. Genetic Trend – All Animals by Birth Year (Spring 2016 Analysis)

