Comparison between EPDs and EBVs of boars tested in US and Canada

Update March 2007

Canadian breeders have been using US genetics for several years and the trend is expected to continue. It is therefore important to have a proper comparison of genetic evaluations in the US with those in Canada, In the US; national evaluations are provided by National Swine Registry (NSR) under the Swine Testing and Evaluation System (STAGES) while in Canada they are provided by CCSI. Although both systems provide evaluations for essentially the same traits, it is usually difficult to compare evaluations because of differences in genetic levels between the two countries and because of differences in how breeding values are expressed. For example, CCSI provides Estimated Breeding Values (EBVs) whereas STAGES computes Estimated Progeny Differences (EPDs). US genetic evaluations for backfat and lean yield are expressed in inches and pounds, whereas the Canadian system uses millimeters and kilograms.

An increasing number of pigs now have breeding values in both systems, and could be the base for a preliminary work aiming at comparing CCSI and STAGES genetic evaluations. CCSI worked closely with NSR in developing the comparisons. One of the output of this kind of project is to provide conversion formulas to translate US breeding values into Canadian equivalents (and reversely), which could be beneficial to breeders in both countries when they plan to import genetics.

Overview of boars with progeny in both countries

General statistics about CCSI EBVs and STAGES EPDs for Fat, Age and Litter Size are given in tables 1, 2 and 3. Joint distributions of the EBVs are provided in the following pages.
Many factors explain the differences in EBVs between the two countries, such as differences in trait definition or adjustments, differences in genetic parameters, statistical models and base-adjustments, differences in genetic levels, etc.

Table 1. Average breeding values for Backfat in Canada (CCSI) and the US (STAGES) for sires born since 1990 with at least 5 progeny in each country

Breed	# sires	CCSI EBV	STAGES EBV (1)	Diff (2)	Correlation
Duroc	24	2.37 ± 1.40	0.61 ± 1.73	1.76	0.77
Landrace	29	1.50 ± 1.31	-0.63 ± 2.66	2.13	0.65
Yorkshire	42	0.94 ± 1.19	-0.21 ± 2.61	1.15	0.53

(1) STAGES EPD converted into EBV, and expressed in mm
(2) CCSI EBV – STAGES EBV

Table 2. Average breeding values for Age in Canada (CCSI) and the US (STAGES) for sires born since 1990 with at least 5 progeny in each country

Breed	# sires	CCSI EBV	STAGES EBV (1)	Diff (2)	Correlation
Duroc	24	9.52 ± 4.46	2.33 ± 5.84	7.19	0.57
Landrace	29	8.18 ± 5.64	-0.60 ± 4.22	8.78	0.64
Yorkshire	42	8.57 ± 6.52	2.67 ± 5.02	5.90	0.34

(1) STAGES EPD converted into EBV
(2) CCSI EBV – STAGES EBV

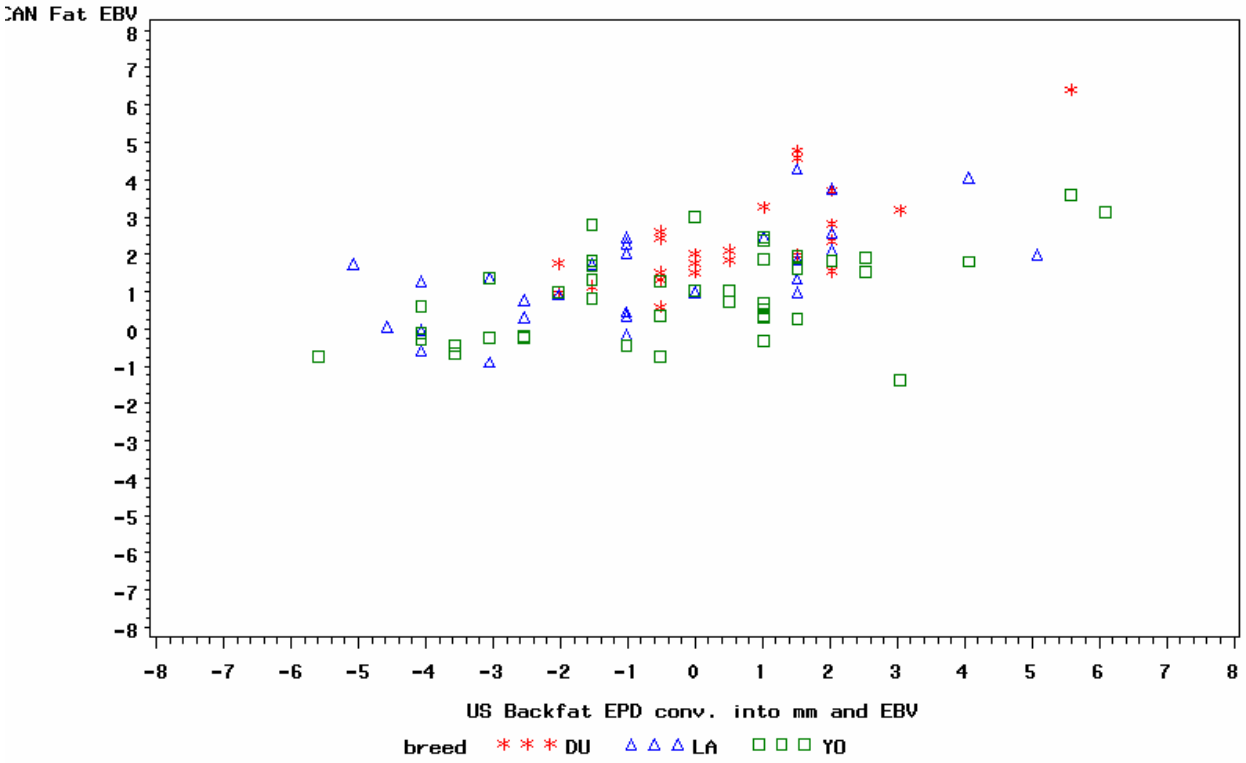
Table 3. Average breeding values for Litter Size in Canada (CCSI) and the US (STAGES) for sires born since 1990 with at least 5 progeny in each country e

Breed	# sires	CCSI EBV	STAGES EBV (1)	Diff (2)	Correlation
Duroc	15	-0.30 ± 0.53	0.09 ± 0.49	-0.39	0.49
Landrace	14	-1.61 ± 0.65	-0.32 ± 0.51	-1.29	0.20
Yorkshire	26	-2.01 ± 0.48	0.08 ± 0.72	-2.09	0.33

(1) STAGES EPD converted into EBV
(2) CCSI EBV – STAGES EBV

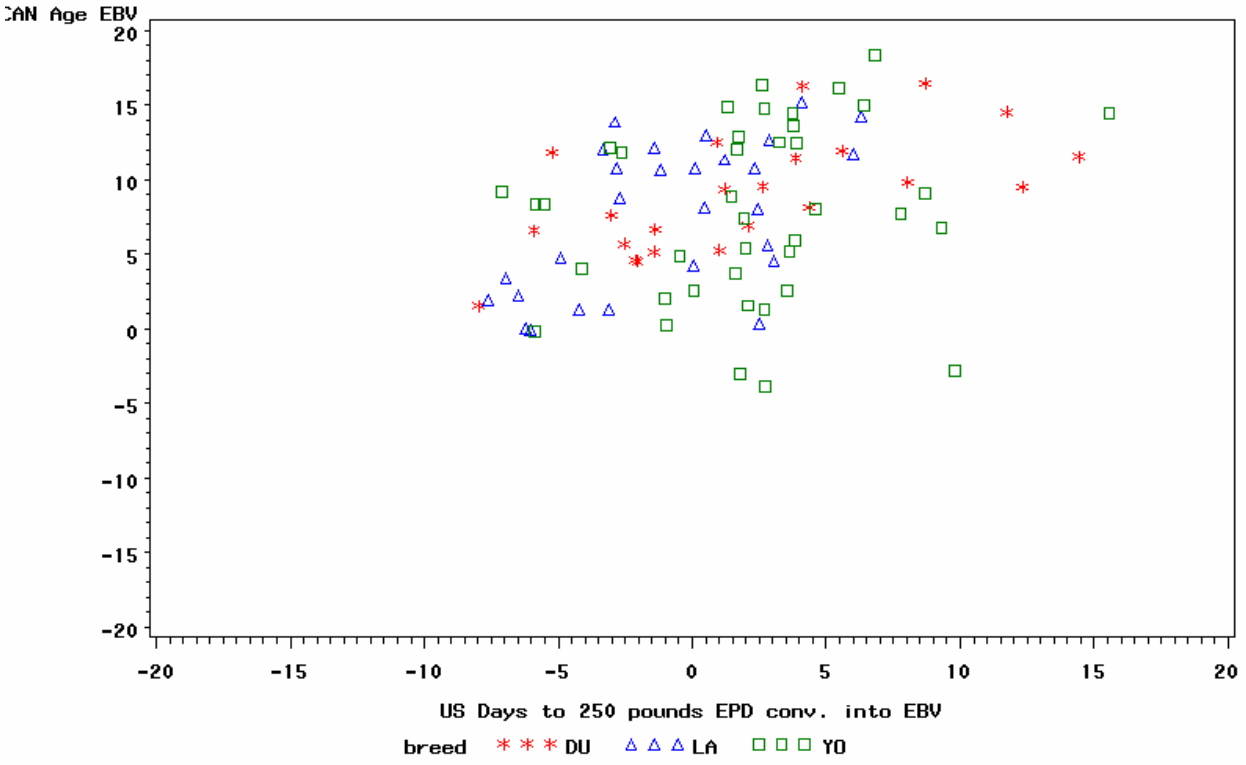
Joint distribution of US BFEPD (conv. into EBV) and Canadian Fat EBV

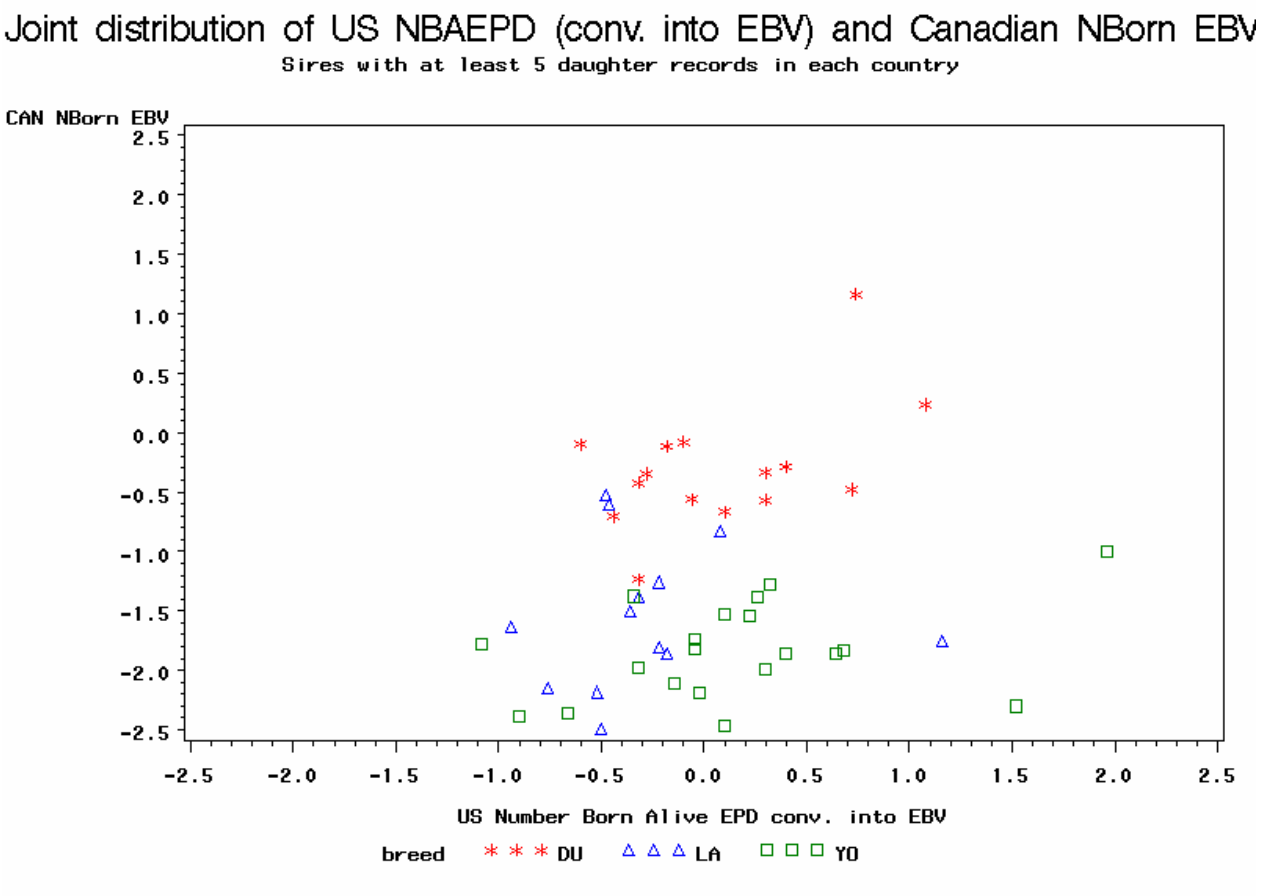
Sires with at least 5 progeny tested in each country



Joint distribution of US DaysEPD (conv. into EBV) and Canadian Age EBV

Sires with at least 5 progeny tested in each country




Joint distribution of US NBAEPD (conv. into EBV) and Canadian NBorn EBV
Sires with at least 5 daughter records in each country
CAN NBorn EBV
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5
US Number Born Alive EPD conv. into EBV
breed * * * DU △ △ △ LA □ □ □ YO

Development of conversion formulas

Two different models were tested. As a first approach, it was assumed a 1 unit increase in Canadian breeding valued for each 1 unit increase in US breeding value (no scaling), after US EPDs were converted into EBV equivalents. The conversion formula was: Canadian EBV = US EBV + μ

The model used was: Y = μ + e, where Y is the observed difference between Canadian and US EBVs, m is the conversion factor, and e is a random residual with heterogeneous variance: $R^2_{CAD}.\sigma^2_a(1-R^2_{US}.R^2_{CAD})$. where R^2_{US} is the repeatability of the US EBV, R^2_{CAD} is the repeatability of the Canadian EBV and σ^2_a is the genetic variance of the trait. Repeatabilities for US EPDs were estimated based on the number of progeny. A generalized least square mean of μ was computed for each trait and breed. Results are given in table 4.

Table 4. Conversion factors - Canadian EBV = US EBV + μ

Trait	Breed	μ
Backfat	Duroc	+1.988 ± 0.250
	Landrace	+2.154 ± 0.335
	Yorkshire	+1.313 ± 0.346
Age	Duroc	+7.823 ± 0.996
	Landrace	+8.763 ± 0.824
	Yorkshire	+7.355 ± 1.032
Litter Size	Duroc	-0.415 ± 0.105
	Landrace	-1.301 ± 0.113
	Yorkshire	-2.141 ± 0.113

In a second model, it was assumed that Canadian and US scales were different.

The model used was: C = μ + b×F + e

where F is the US EBV, C, is the deregressed Canadian EBV, b is a scale conversion factor, μ is an intercept, and e is a random residual with heterogeneous variance.

The Canadian EBVs were deregressed according to: $C = \frac{EBV - \bar{x}}{R^2_{CAD}}$ where x is the sample mean.

The variance of each residual is: $\frac{\sigma^2_a(1-R^2_{US}.R^2_{CAD})}{R^2_{CAD}}$

Table 5. Conversion factors Canadian EBV = x + μ + b×US EBV

Trait	Breed	x	μ	b
Backfat	Duroc	2.374	-0.306 ± 0.317	0.758 ± 0.165
	Landrace	1.515	0.621 ± 0.241	0.526 ± 0.095
	Yorkshire	0.915	0.117 ± 0.194	0.335 ± 0.068
Age	Duroc	9.516	-4.238 ± 2.230	1.202 ± 0.359
	Landrace	7.890	-1.485 ± 1.678	1.992 ± 0.419
	Yorkshire	8.371	-1.025 ± 2.485	0.972 ± 0.403
Litter Size	Duroc	-0.332	-0.318 ± 0.775	1.362 ± 1.555
	Landrace	-1.499	-1.226 ± 0.757	-1.487 ± 1.275
	Yorkshire	-2.172	0.812 ± 0.801	0.817 ± 1.101

The first model gives a better accuracy. Using model 2, it was not possible to show if the slope was different from 1. More data would be required in order to validate this assumption. For now, conversion factors estimated from the first model could be used.

Now, any pig evaluated in the STAGES system can be evaluated using Canadian equivalent EBVs More data on US boars imported in Canada and Canadian boars imported in US will be useful to update the conversion formulas..

New web applications are available in the Member Services area of CCSI website for comparing US EPDs to Canadian equivalent. The applications are 'US EBVs' and 'EBV-Calculator' and are available in the 'Reports' section. Conversion formulas will be updated and will get more accurate as more data accumulate. They will help importers of US genetics to better estimate the genetic merit of imported animals before they actually have progeny born in Canada, and thus allow a more efficient selection using US genetics in the Canadian Swine Improvement Program.

US EBVs Report (Report section of CCSI website)

US EBVs (20070129)

Breed	US Registration	
Duroc		Search... List All...

98 US Durocs Found
Displaying records 1 to 50...

These are the EBVs as received from the National Swine Registry (Jan-29-2007).
Click on a tattoo to go to PigsOnTheWeb.

tattoo	birth date	sex	US Reg#	US EBVs			Canadian EBV Equivalents				
				Born Alive	Age	Fat	Born Alive	Age	Fat	Sire	Dam
				EPD	EPD	EPD	EBV	EBV	EBV	index	index
USA 5111R (DU)	Dec-01-2005	M	281106008	0.11	-2.88	0.0	- 0.16	2.41	2.20	70	74
USA 379R (DU)	Oct-21-2005	M	280616009	0.18	1.22	0.0	- 0.02	10.61	2.20	27	50
USA 278R (DU)	Aug-28-2005	M	279036008	-0.04	-1.11	0.0	- 0.46	5.95	2.20	51	51
USA 246R (DU)	Aug-27-2005	M	279033006	0.32	-1.22	0.01	0.26	5.73	2.71	49	75
USA 166R (DU)	Aug-24-2005	M	279967006	-0.01	-0.22	-0.01	- 0.40	7.73	1.69	46	50
USA 732P (DU)	Jun-23-2004	M	268380002	-0.3	-0.63	-0.01	- 0.98	6.91	1.69	50	32
USA 723P (DU)	Jun-22-2004	M	268379003	0.07	-0.23	-0.01	- 0.24	7.71	1.69	46	55
USA 701P (DU)	Jun-21-2004	M	268492001	0.09	-2.08	0.01	- 0.20	4.01	2.71	58	64
USA 621P (DU)	Jun-19-2004	M	268370001	0.02	-2.49	-0.01	- 0.34	3.19	1.69	70	68
USA 613P (DU)	Jun-18-2004	M	268491003	0.02	0.59	-0.04	- 0.34	9.35	0.17	50	54

EBV-Calculator (Report section of CCSI website)

Conversion of US EPDs to Canadian EBV Equivalent

US Registration	Breed	NB EPD	Age EPD	Fat EPD	
xxxxxxxxxx	Duroc				Convert...

Information from US	US EPD			Canadian EBV Equivalents				
	Born Alive	Age	Fat	Born Alive	Age	Fat	Sire Line Index	Dam Line Index
US Registration	pigs	days	inches	pigs	days	mm	points	points
xxxxxxxxxx	0.6	-3.6	-0.05	0.82	0.97	- 0.34	98	127

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