Réseau laitier canadien
Canadian Dairy Network

Lifetime Profit Index (LPI) Formula
- April 2015 -

$$\text{LPI} = \left[\text{Production Component} \times \text{Emphasis} \times \text{Factor} + \text{Durability Component} \times \text{Emphasis} \times \text{Factor} + \text{Health \& Fertility Component} \times \text{Emphasis} \times \text{Factor} \right] + \text{Constant}$$

Where the relative emphasis placed on each of the three main components in each breed is presented in the following table along with the multiplicative factors for each component.

Breed	LPI Constant	Production		Durability		Health & Fertility	
		Emphasis	Factor	Emphasis	Factor	Emphasis	Factor
Ayrshire	1828	54	.6022	31	.7367	15	.9878
Brown Swiss	850	54	.6112	31	.7146	15	.9278
Canadienne	921	54	.6112	31	.8182	15	.8011
Guernsey	609	54	.5132	31	.7216	15	.7364
Holstein	1816	51	.6120	34	.7329	15	.7396
Jersey	992	57	.6979	33	.7202	10	1.0347
Milking Shorthorn	1040	54	.5662	31	.8063	15	1.2286

Production Component (PROD):

$$\text{PROD} = [W_{PY} \times (PY - Avg_{PY})/SD_{PY}] + [W_{PD} \times PD/SD_{PD}] + [W_{FY} \times (FY - Avg_{FY})/SD_{FY}] + [W_{FD} \times FD/SD_{FD}]$$

Where PY = Protein Yield, PD = Protein Deviation, FY = Fat Yield and FD = Fat Deviation, which are standardized using the appropriate averages (Avg) and standard deviations (SD) and then multiplied by their respective relative weight (W), all of which are breed specific as outlined in the following table.

Parameter	Trait	Ayrshire	Brown Swiss	Canadienne	Guernsey	Holstein	Jersey	Milking Shorthorn
EBV Averages[1]	Protein Yield	-1	-1	-5	-2	8	5	-3
	Fat Yield	-2	-1	-5	-1	7	7	-4
EBV Standard Deviations	Protein Yield	21	17	7	15	21	25	11
	Protein Deviation	.11	.12	.13	.10	.12	.16	.09
	Fat Yield	25	20	11	23	28	34	19
	Fat Deviation	.21	.20	.20	.27	.28	.38	.16
Relative Weights Within the Production Component	Protein Yield	5.7	5.7	5.1	5.7	5.7	5.7	5.1
	Protein Deviation	0.3	0.3	0.9	0.3	0.3	1.0	0.9
	Fat Yield	3.8	3.8	3.4	3.8	3.8	2.8	3.4
	Fat Deviation	0.2	0.2	0.6	0.2	0.2	0.5	0.6

Durability Component (DUR):

$$DUR = [W_{HL} \times (HL - 100)/5] + [W_{MS} \times MS/5] + [W_{F\&L} \times F\&L/5] + [W_{DS} \times DS/5]$$

Where HL = Herd Life, MS = Mammary System, F&L = Feet and Legs, DS = Dairy Strength and each trait is standardized using the appropriate averages and standard deviations and then multiplied by their respective relative weight (W) that is breed specific as outlined in the following table.

Parameter	Trait	Ayrshire	Brown Swiss	Canadienne	Guernsey	Holstein	Jersey	Milking Shorthorn
Relative Weights Within the Durability Component	Herd Life	2.0	3.6	3.6	3.6	2.0	2.0	3.2
	Mammary System	4.0	3.2	3.2	3.2	4.0	4.0	3.6
	Feet & Legs	3.0	2.4	2.4	2.4	3.0	3.0	2.4
	Dairy Strength	1.0	0.8	0.8	0.8	1.0	1.0	0.8

Health & Fertility Component (H&F):

$$H\&F = [W_{SCS} \times -1 \times (SCS-3.00)/0.23] + [W_{UD} \times UD/5] + [W_{MSP} \times (MSP-100)/5] + [W_{DF} \times (DF-100)/5] + [W_{LP} \times (LP-100)/5]$$

Where SCS = Somatic Cell Score, UD = Udder Depth, MSP = Milking Speed, DF = Daughter Fertility and LP = Lactation Persistency. The relative weights for each trait (i.e.: W_{SCS}, W_{UD}, W_{MSP}, W_{DF} and W_{LP} respectively), which are specific to each breed, are provided in the following table.

Parameter	Trait	Ayrshire	Brown Swiss	Canadienne	Guernsey	Holstein	Jersey	Milking Shorthorn
Relative Weights Within the Health & Fertility Component	Somatic Cell Score	2.0	2.0	4.8	2.0	2.0	4.2	4.8
	Udder Depth	1.0	1.0	2.4	1.0	1.0	2.1	2.4
	Milking Speed	0.3	3.0	0.8	0.3	0.3	0.7	0.8
	Daughter Fertility	4.0	4.0	2.0	6.7	6.7	3.0	2.0
	Lactation Persistency	2.7	0.0	0.0	0.0	0.0	0.0	0.0

Application

The Lifetime Profit Index formula for each breed is applied to all males and females in the CDN database. In terms of order of priority of genetic evaluations used for each trait, official domestic evaluations take precedence, followed by an Interbull MACE evaluation and finally, when no other evaluation is available, a Parent Average is used.

In the Holstein, Ayrshire, Jersey and Brown Swiss breeds, genomic evaluations take precedence, when available, over any traditional genetic evaluation.