

# Lifetime Profit Index (LPI) Formula - February 2007 -

LPI = Production Durability Health & Fertility
Component Component x Emphasis x Factor x Factor x Factor

Production Durability Health & Fertility Component x Emphasis x Emphasis x Factor

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	Production		Durab	ility	Health & Fertility		
	Emphasis	Factor	Emphasis	Factor	Emphasis	Factor	
Ayrshire	54	0.8984	36	1.3060	10	1.7727	
Brown Swiss	57	1.1458	33	1.4591	10	1.9857	
Canadienne	57	1.1430	33	1.5515	10	2.3909	
Guernsey	57	1.1454	33	1.6123	10	2.2031	
Holstein	54	1.2946	36	1.4260	10	1.6330	
Jersey	57	1.4078	33	1.3849	10	2.1055	
Milking Shorthorn	57	1.4084	33	1.5543	10	1.9853	

## **Production Component (PROD):**

 $\mathsf{PROD} = [\mathsf{W}_{\mathsf{PY}}\mathsf{x}(\mathsf{PY}\mathsf{-}\mathsf{Avg}_{\mathsf{PY}})/\mathsf{SD}_{\mathsf{PY}}] + [\mathsf{W}_{\mathsf{PD}}\mathsf{x}\mathsf{PD}/\mathsf{SD}_{\mathsf{PD}}] + [\mathsf{W}_{\mathsf{FY}}\mathsf{x}(\mathsf{FY}\mathsf{-}\mathsf{Avg}_{\mathsf{FY}})/\mathsf{SD}_{\mathsf{FY}}] + [\mathsf{W}_{\mathsf{FD}}\mathsf{x}\mathsf{FD}/\mathsf{SD}_{\mathsf{FD}}]$ 

Where PY = Protein Yield, PD = Protein Deviation, FY = Fat Yield and FD = Fat Deviation, which are standardized using the appropriate averages (Avg) and/or 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 <sup>1</sup>	Protein Yield	-2	3	-3	-1	9	4	-4
	Fat Yield	-2	4	-3	2	9	4	-5
EBV Standard Deviations	Protein Yield	16	20	8	21	25	25	15
	Protein Deviation	.10	.10	.17	.11	.12	.16	.09
	Fat Yield	20	25	13	25	31	34	22
	Fat Deviation	.18	.17	.23	.31	.30	.35	.19
Relative Weights Within the Production Component	Protein Yield	5.7	5.7	5.7	5.7	5.7	5.1	5.1
	Protein Deviation	0.3	0.3	0.3	0.3	0.3	0.9	0.9
	Fat Yield	3.8	3.8	3.8	3.8	3.8	3.4	3.4
	Fat Deviation	0.2	0.2	0.2	0.2	0.2	0.6	0.6

### **Durability Component (DUR):**

DUR = 
$$[2 \times (HL - 3.00)/0.20] + [4 \times MS/5] + [3 \times F&L/5] + [1 \times DS/5]$$

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/or standard deviations and then multiplied by their respective relative weight, all of which are common to all breeds as outlined in the above formula.

#### **Health & Fertility Component (H&F):**

$$H&F = [W_{SCS} \times (SCS-3.00)/0.23] + [W_{UD} \times UD/5] + [W_{MSP} \times (MSP-85)/4.8] + [W_{DF} \times (DF-Avg)/3]$$

Where SCS = Somatic Cell Score, UD = Udder Depth, MSP = Milking Speed and DF = Daughter Fertility. The relative weights for each trait (i.e.:  $W_{SCS}$ ,  $W_{UD}$ ,  $W_{MSP}$  and  $W_{DF}$  respectively) as well as the EBV average (Avg) for Daughter Fertility, which is 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	3.0	3.0	3.0	3.0	3.0	4.8	4.8
	Udder Depth	1.5	1.5	1.5	1.5	1.5	2.4	2.4
	Milking Speed	0.5	0.5	0.5	0.5	0.5	0.8	8.0
	Daughter Fertility	5.0	5.0	5.0	5.0	5.0	2.0	2.0
EBV Average for Daughter Fertility		62	68	69	63	66	70	70

#### **Application**

The Lifetime Profit Index formula for each breed is applied to bulls and cows in Canada that have official genetic evaluations for production and type traits. In any case when an official genetic evaluation for a specific trait is not available, namely for Milking Speed or Daughter Fertility, the LPI is based on any preliminary genetic evaluation that is available or, otherwise, a value equal to breed average is used.

For foreign sires in the Holstein, Ayrshire, Jersey, Brown Swiss and Guernsey breeds that have MACE evaluations available for production and type traits, Somatic Cell Score and Direct Herd Life, the LPI formula for the respective breed is used to compute MACE LPI (MLPI) values. In these cases, the MACE evaluation for Direct Herd Life is combined with a predicted Herd Life value based on MACE proofs for various traits and fixed values for Milking Speed and Daughter Fertility are used for all foreign bulls of the same breed.