



Lifetime Performance Index (LPI) Formula - April 2022

March 19, 2022

$$LPI = \left(\begin{array}{l} \text{Production} \\ \text{Component} \\ \times \text{Emphasis} \\ \times \text{Factor} \end{array} + \begin{array}{l} \text{Durability} \\ \text{Component} \\ \times \text{Emphasis} \\ \times \text{Factor} \end{array} + \begin{array}{l} \text{Health \&} \\ \text{Fertility} \\ \text{Component} \\ \times \text{Emphasis} \\ \times \text{Factor} \end{array} \right) + \text{Constant}$$

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	2004	46	.5685	32	.7215	22	.9561
Brown Swiss	959	55	.5440	27	.6786	18	.8349
Canadienne	932	55	.4565	30	.6653	15	.8759

Guernsey	644	50	.5540	35	.7523	15	.6923
Holstein	2200	40	.5408	40	.8243	20	.6967
Jersey	1087	50	.5970	30	.6387	20	.7483
Milking Shorthorn	1065	56	.5389	30	.7992	14	1.0363

Production Component (PROD):

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

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	Milk Yield	-372	-221	-256	-179	-328	-146	-195
	Fat Yield	-18	-7	-5	-8	-22	-13	-13
	Protein Yield	-14	-8	-4	-7	-15	-8	-6

Relative Weights Within the Durability Component	Herd Life	4.0	4.0	2.0	3.4	2.0	2.0	2.6
	Mammary System	3.8	3.2	5.5	3.2	3.7	4.0	4.0
	Feet & Legs	2.2	1.6	2.5	2.4	2.1	4.0	2.6
	Hoof Health					0.7		
	Dairy Strength				1.0	1.0		0.8
	Rump		1.2			0.5		

Health & Fertility Component (H&F):

$$H\&F = [W_{DF} \times (DF-100)/5] + [W_{MR} \times (MR-100)/5] + [W_{SCS} \times (SCS-100)/5] + [W_{UD} \times UD/5] + [W_{MSP} \times (MSP-100)/5] + [W_{MT} \times (MT-100)/5]$$

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

Parameter	Trait	Ayrshire	Brown Swiss	Canadienne	Guernsey	Holstein	Jersey	Milking Shorthorn
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Relative Weights Within the Health & Fertility Component	Daughter Fertility	4.0	4.0	4.0	6.7	6.7	5.0	2.0
	Mastitis Resistance	1.0				3.3	5.0	
	Somatic Cell Score		3.0	3.0	2.0			4.8
	Udder Depth		1.0	2.0	1.0			2.4
	Milking Speed	3.0	2.0	1.0	0.3			0.8
	Milking Temperament	2.0						

Previous LPI update documents

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Brian has dedicated his professional career of nearly 35 years involved in the genetic improvement of dairy cattle in Canada. He is well-known for his numerous

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