



Lifetime Performance Index (LPI) Formula - April 2020 -

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

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	1975	46	.5587	32	.7238	22	.9552
Brown Swiss	940	55	.5756	27	.6811	18	.8586
Canadienne	922	55	.4823	30	.6636	15	.8859
Guernsey	638	50	.5455	35	.7673	15	.7245
Holstein	2102	40	.5415	40	.8341	20	.7073
Jersey	1076	55	.5995	30	.6556	15	.7523
Milking Shorthorn	1077	56	.5234	30	.8376	14	.9863

Production Component (PROD):

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

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	Milk Yield	-261	-169	-320	-139	-115	-31	-148
	Fat Yield	-13	-4	-8	-8	-11	-6	-10
	Protein Yield	-9	-6	-6	-4	-6	-3	-4
EBV Standard Deviations	Milk Yield	620	500	450	550	740	760	450
	Fat Yield	25	20	11	23	28	34	19
	Fat Deviation	.21	.20	.20	.27	.28	.38	.16
	Protein Yield	21	17	7	15	21	25	11
	Protein Deviation	.11	.12	.13	.10	.12	.16	.09
Relative Weights Within the Production Component	Fat Yield	5.0	4.5	4.5	4.5	6.0	4.5	4.5
	Fat Deviation		0.5	0.5	0.5		0.5	0.5
	Protein Yield	5.0	4.5	4.5	4.5	4.0	4.5	4.5
	Protein Deviation		0.5	0.5	0.5		0.5	0.5

Durability Component (DUR):

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

Where HL = Herd Life, MS = Mammary System, F&L = Feet and Legs, HH = Hoof Health, DS = Dairy Strength and RP = Rump, 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	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):

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

Where DF = Daughter Fertility, MR = Mastitis Resistance, SCS = Somatic Cell Score, UD = Udder Depth, MSP = Milking Speed and LP = Lactation Persistency. The relative weights for each trait (i.e.: W_{DF} , W_{MR} , W_{SCS} , W_{UD} , W_{MSP} 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	Daughter Fertility	5.0	4.0	4.0	6.7	6.7	4.0	2.0
	Mastitis Resistance	3.0				3.3	6.0	
	Somatic Cell Score		3.0	3.0	2.0			4.8
	Udder Depth		1.0	2.0	1.0			2.4
	Milking Speed	1.0	2.0	1.0	0.3			0.8
	Lactation Persistency	1.0						