Lifetime Performance Index (LPI) Formula
- August 2015 -

$$\text{LPI} = \left[\begin{array}{l} \text{Production} \\ \text{Component} \\ \text{x Emphasis} \\ \text{x Factor} \end{array} + \begin{array}{l} \text{Durability} \\ \text{Component} \\ \text{x Emphasis} \\ \text{x Factor} \end{array} + \begin{array}{l} \text{Health \&} \\ \text{Fertility} \\ \text{Component} \\ \text{x Emphasis} \\ \text{x Factor} \end{array} \right] + \text{Constant}$$

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	1835	50	.5790	31	.7077	19	.8811
Brown Swiss	855	50	.6112	30	.7190	20	.9536
Canadienne	940	48	.4900	32	.8041	20	.7904
Guernsey	611	50	.5132	30	.7040	20	.7364
Holstein	1821	40	.5884	40	.7329	20	.6934
Jersey	985	57	.6979	33	.7202	10	.6599
Milking Shorthorn	1040	54	.5449	31	.7950	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	Milk Yield	-27	-57	-283	-15	219	120	-113
	Fat Yield	-2	-1	-5	-1	7	7	-4
	Protein Yield	-1	-1	-5	-2	8	5	-3
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	4.0	3.8	4.0	3.8	4.0	2.8	3.6
	Fat Deviation		0.2		0.2		0.5	0.4
	Protein Yield	6.0	5.7	6.0	5.7	6.0	5.7	5.4
	Protein Deviation		0.3		0.3		1.0	0.6

Durability Component (DUR):

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

Where HL = Herd Life, MS = Mammary System, F&L = Feet and Legs, 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	4.7	4.0	4.0	4.0	2.0	2.0	2.6
	Mammary System	3.1	3.2	3.2	3.2	4.0	4.0	4.0
	Feet & Legs	2.2	1.6	2.2	2.4	3.0	3.0	2.6
	Dairy Strength			0.6	0.4	1.0	1.0	0.8
	Rump		1.2					

Health & Fertility Component (H&F):

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

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

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	5.3	4.0	5.0	6.7	6.7	3.0	2.0
	Mastitis Resistance	3.7				3.3	7.0	
	Somatic Cell Score		3.0	2.6	2.0			4.8
	Udder Depth		1.0	1.6	1.0			2.4
	Milking Speed	0.5	2.0	0.8	0.3			0.8
	Lactation Persistency	0.5						