Lifetime Performance Index (LPI) Formula
- April 2019 -

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

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 Emphasis	Production Factor	Durability Emphasis	Durability Factor	Health & Fertility Emphasis	Health & Fertility Factor
Ayrshire	1945	46	.5834	32	.7124	22	.9641
Brown Swiss	929	55	.6117	27	.6871	18	.8580
Canadienne	933	55	.5193	30	.7145	15	.8812
Guernsey	637	50	.5281	35	.7642	15	.7314
Holstein	2044	40	.5446	40	.8308	20	.7024
Jersey	1062	55	.6089	30	.6541	15	.7756
Milking Shorthorn	1063	56	.5306	30	.8159	14	.9506

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	-204	-139	-337	-82	-20	25	-154
	Fat Yield	-11	-3	-9	-6	-6	-2	-11
	Protein Yield	-7	-4	-7	-3	-2	0	-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):

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

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):

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

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	5.0	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						