Lifetime Performance Index (LPI) Formula
- April 2021 -

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

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	1989	46	.5640	32	.7252	22	.9501
Brown Swiss	954	55	.5470	27	.6861	18	.8312
Canadienne	927	55	.4746	30	.6659	15	.8736
Guernsey	630	50	.5559	35	.7452	15	.7027
Holstein	2154	40	.5395	40	.8361	20	.6998
Jersey	1085	50	.5963	30	.6461	20	.7620
Milking Shorthorn	1063	56	.5294	30	.8151	14	.9950

Production Component (PROD):

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

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	-316	-185	-278	-129	-227	-103	-170
	Fat Yield	-15	-5	-6	-9	-16	-10	-11
	Protein Yield	-12	-6	-5	-6	-10	-6	-5
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):

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

$$[W_{DS} \times DS/5] + [W_{RP} \times RP/5]$$

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):

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

$$[W_{UD} \times UD/5] + [W_{MSP} \times (MSP-100)/5] + [W_{MT} \times (MT-100)/5]$$

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
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						