Lifetime Performance Index (LPI) Formula
- April 2024 -

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

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		Durability		Health & Fertility	
		Emphasis	Factor	Emphasis	Factor	Emphasis	Factor
Ayrshire	2036	46	.5690	32	.7454	22	.9461
Brown Swiss	971	55	.5520	27	.6805	18	.8108
Canadienne	919	55	.4456	30	.6615	15	.8185
Guernsey	646	50	.5356	35	.7454	15	.6897
Holstein	2302	40	.5442	40	.7631	20	.6778
Jersey	1089	50	.5991	30	.6324	20	.7690
Milking Shorthorn	1091	56	.5450	30	.8259	14	1.0169

Production Component (PROD):

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

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	-522	-355	-325	-331	-521	-284	-208
	Fat Yield	-25	-13	-7	-13	-31	-20	-14
	Protein Yield	-20	-13	-6	-11	-23	-14	-7
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):

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

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

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						