

Understanding the Economic Breeding Index (EBI).

What is EBI?

EBI is a single figure profit index aimed at helping farmers identify the most profitable bulls and cows for breeding dairy herd replacements. It comprises of information on seven sub-indexes related to profitable milk production. These are; (1) Milk production, (2) Fertility, (3) Calving performance, (4) Beef Carcass (5) Cow Maintenance (6) Cow Management and (7) Health. A summary of the sub-indexes, including traits and relative weightings for traits in the EBI are given in **Table 1**. The economic values in the index are based on data collected from Irish Dairy Farms and the Dairy Industry. These values were last updated in December 2013.

Table 1. Economic values and % emphasis of the various traits in the EBI formula.

2014 Economic values and % emphasis for traits in the EBI				
Sub-Index	Trait	Economic Weight	Trait Emphasis	Overall Emphasis
Production	Milk	-€0.09	10.6%	33%
	Fat	€1.04	3.4%	
	Protein	€6.64	18.9%	
Fertility	Calving Interval	-€12.43	24.0%	35%
	Survival	€12.01	10.9%	
Calving	Direct Calving Difficulty	-€3.52	2.8%	9%
	Maternal Calving Difficulty	-€1.73	1.3%	
	Gestation Length	-€7.49	4.1%	
	Calf Mortality	-€2.58	1.0%	
Beef	Cull Cow Weight	€0.15	0.7%	9%
	Carcass Weight	€1.38	5.1%	
	Carcass Conformation	€10.32	1.7%	
	Carcase Fat	-€11.71	1.1%	
Maintenance	Cull Cow Weight	-€1.65	7.2%	7%
Management	Milking Time	-€0.25	2.1%	4%
	Milking Temperament	€33.69	1.9%	
Health	Lameness	-€54.26	0.6%	3%
	SCC	-€43.49	1.8%	
	Mastitis	-€77.10	0.8%	

Genetic Evaluations

Knowing the genetic merit of your herd is a key component to successfully improving traits of importance on your farm. The observed performance (e.g. 305 day milk yield) of an individual cow depends on two things:

- a) the genetic merit of the cows
- b) the environment in which she is performing

Genetic evaluations attempt to disentangle the effects of genes and the environment in order to select animals that have high genetic merit, and not those that perform well simply because they are well managed and fed. For example, if Cow X has a much higher genetic merit for milk yield than Cow Y, Cow Y will need much more feed to milk the same as cow X. Alternatively, if Cow X and Y are fed the same, Cow X will outperform Cow Y for milk yield. Genetic evaluations allow us to directly compare animals that are performing in many environments, by removing the part of the observed performance that is due to the environment and management of the cows.

We cannot directly alter the genetic merit of an individual cow, however improvements can be made for specific traits in the offspring of the cow provided she is bred to a sire that is better than she is for those traits. Therefore it is important to know both the genetic merit of the cow and the sire in order to make genetic improvements in traits of economic importance.

How do I interpret the Predicted figures for Milk kg, Fat kg, etc. on my EBI Report?

We call these Predicted Transmitting Ability figures (PTAs). An animal's PTA indicates the amount of a particular trait an animal is expected to pass on to its progeny relative to the base population (See **Table 2**). The PTA is equal to half of its own Breeding Value since a cow only passes on half her genes to her offspring. All values on the EBI report are expressed as PTA's. Information on bulls (in catalogues, bull search, etc.) is also presented in terms of PTA.

	Milk kg	Fat kg	Prot kg	Fat%	Prot%	CI days	Surv%
Base Cow Performance	5743	224	195	3.90	3.39	400	82.5

Table 2. Base Population Performance – 2005 born cows, calved and milk recorded in 2007.

The daughters of a bull with a PTA of 150kg for milk yield would be expected to produce, on average, 100kg more milk per lactation than the daughters of a bull with a PTA of 50kg if their dams have equal genetic merit. The actual difference will not be exact for comparing individual daughters because no two daughters would get exactly the same combination of genes or be exposed to exactly the same environment. Thus, daughters of the same sire may have varying performance.

Example:

Cow 1939 (**Fig 1**, below) has a Milk kg PTA of **+27kg** which means that she would be expected to produce 54 kg more milk than the base cow (27kg x 2 = 54kg). If she is mated to a bull with a Milk kg of **+73kg** the resultant offspring will have a potential for milk (i.e. Breeding Value) of **+100kg**.

FB	Heifer ID	Sire ID	Sire EBI	C. Date	Milk Kg	Milk	Fertility	Calving Health	Beef Mainten Mgmt	EBI €
Name		Dam FB	Dam EBI	Age	Fat Kg %					
Breed		MG Sire ID	MGS EBI	Lact.	Prot Kg %					Rel%
1939		ZBT	180		27	€ 56	€ 94	€ 42	€ -20	€ 191 *
		1745	97	1y 9m	13.1 0.2			€ 6	€ 13	
HO 81.3% FR 18.8%		FLT	158		6.8 0.1				€ 0	52 %

Fig 1. Example of an animal's PTA in the EBI Report

Does this mean the offspring, assuming a heifer, will actually milk 100Kg more than the "base cow" (i.e. 5743kg + 100kg = 5843kg)? The answer always depends on the level of management – the heifer will be genetically capable of milking 100kg more than the base cow but how much she physically outperforms the base cow will be dependent on the management of the animal. In a higher input environment she could perform much more than this or in a lower input environment it may be less than this.

Key Point: Although the potential of the offspring heifer is **+100kg**, she will only pass on half of this to her own offspring, therefore her PTA for milk kg is **+50kg** (½ her Breeding Value) and this is what is displayed on the EBI report.

In simple terms, in order to improve the potential of a cow's offspring to milk more, you need to use bulls that have a higher PTA for milk kg than the cow itself. The same applies to all other traits, be it milk solids yield, fat and protein % or calving interval and survival.

When selecting a team of bulls for your cows you should pick bulls that are higher than the herd PTA for the traits you want to improve. To improve individual cow weaknesses use the cow PTA to help you determine the best bull to use on her.