

Both EBI and Cross-breeding are breeding tools that can deliver more profit for farmers.

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Over the last number of months there has been some confusion amongst dairy farmers as to the value of EBI and the added benefits of cross-breeding when making breeding decisions at farm level. In this article we review the evidence to assist dairy farmers to make more informed breeding decision this Spring.

The value of EBI

The EBI was introduced in 2001 by ICBF and Teagasc, against a back-drop of declining animal and herd fertility performance in the national dairy herd. Since then, the index has evolved to incorporate some 15 traits in total, the most important of which are female fertility, cow survival and milk solids production (kg fat and protein), with these traits having a combined weighting of about 70% of the overall index. So has the EBI delivered at farm level?

Recent work presented at the Teagasc National Dairy conference compared the performance of 10,470 dairy herds that had herd EBI, female fertility and milk co-op performance data available. The data was from three sets of ICBF Herdplus reports that had been posted to herd-owners in the previous months. These were; (i) the herd EBI report, (ii) the Herd Calving & Fertility Report, and (iii) the Herd Co-op performance report (based on the 9 month period from Jan to Sept 2015).

Herds were categorised on the basis of herd EBI level, into 10 evenly spaced categories, such that the top 10% of herds (some 1,047 herds in total), had an average EBI of €176, the medium 10% category had an EBI of €135, and the bottom 10% of herds had an EBI of €63. Each level of herd EBI was then evaluated for a number of key performance indicators at farm level, including; (i) calving Interval (days), (ii) 6-week calving rate (Spring Season), (iii) % of the herd calving as 2 year old heifers (22-26 months), (iv) litres of milk supplied to the co-op/day, (v) kg of milk solids supplied to the co-op/day, (vi) average milk price (cpl) paid by the co-op and (vii) overall milk value/day (derived from litres delivered and milk price). Results are presented in Table 1.

Table 1. Herd performance based on EBI

Herd Level	EBI	CI Days	% 2 yr calv	Sp 6 wk calv rate	Litres/ cow/ day	MS/ cow/ day	Milk price cpl	Milk value/ cow/ day
Top 10%	€176	374.1	87.2	72.3	16.15	1.29	32.01	5.17
- 11 to 20%	€157	377.1	80.7	67.4	16.25	1.27	31.08	5.05
- 21 to 30%	€148	381.1	74.2	63.8	15.97	1.23	30.70	4.91

- 31 to 40%	€141	382.9	70.1	60.7	15.77	1.21	30.45	4.80
Mid 10%	€135	386.8	60.7	58.4	15.61	1.19	30.22	4.72
- 51 to 60%	€129	389.0	58.2	56.0	15.39	1.17	30.14	4.64
- 61 to 70%	€123	391.9	52.2	55.1	15.43	1.16	29.97	4.63
- 71 to 80%	€115	396.3	45.0	52.8	15.20	1.14	29.86	4.54
- 81 to 90%	€101	400.7	43.3	50.2	15.68	1.17	29.81	4.67
Btm 10%	€63	417.8	33.4	42.5	17.05	1.24	29.71	5.05
Overall	€129	389.8	60.5	57.9	15.85	1.21	30.39	€4.82

The results clearly demonstrate the value of EBI across the 10,470 dairy herds, with the high EBI herds consistently having much better fertility performance, with the top 10% herds approaching target levels with regard to excellent fertility performance. This is in contrast to the lower EBI herds which had much lower levels of herd fertility performance.

Trends in milk performance delivered to the co-op, were also very consistent, except for the bottom 10% of herds (in terms of EBI), which had a higher level of milk litres delivered, on the back of higher levels of concentrate feeding (a higher % of these herds were liquid milk/split calving herds). Subsequent analysis of this dataset has confirmed that the value of EBI was consistent for both Spring calving (about 80% of the herds) and liquid/Split calving systems (the remaining 20% of the herds).

It is important to note that this analysis was across all herds, regardless of breed, whether that was Holstein, Friesian, Jersey, Red-breeds or some combination of each this. So the clear message from Table 1 is that dairy farmers should decide their breed preference, and then look to maximise the EBI within that breed.

The value of cross-breeding

Many studies undertaken at Teagasc Moorepark over the past 10 years have observed improved animal performance among high EBI crossbred dairy cattle when compared to purebred contemporaries and quantified the value of this benefit to be €100-€150/lactation.

- The earliest research was conducted at Ballydague research farm during the period 2006 to 2010. This study included both pure bred Jersey and Holstein-Friesian in addition to crossbred cows. Clear benefits from crossbreeding were observed. The proportion of cows pregnant to first service (+ 21%), in-calf after 6 weeks breeding (+19%) and in-calf after 13 weeks breeding (+8%) were considerably higher for the Jersey × Holstein-Friesian compared with Holstein-Friesian (and pure Jersey cows). The economic analyses [incorporating differences in cull cow and male calf value] showed that with a fixed land base the herd of Jersey × Holstein-Friesian cows was 48% more profitable than a herd of either of the parent breeds. On a per cow basis, the improved profit equated to over €180 per cow per lactation.

- More recently, crossbred cows have been incorporated into a comparative stocking rate study at Teagasc's Curtins Research Farm. The EBI value of both the Holstein-Friesian and crossbred cows is similar at just over €200. The study has run for 3 years. The Jersey crossbred cows are delivering an additional 70 kg per ha annually.
- At Clonakilty Agricultural College, the trial includes a comparison between Jersey × Holstein-Friesian and straight Holstein-Friesians. The EBI of both groups is again similar (€177 and €175). This study has also run for 3 years at this point. The Jersey crossbred cows are delivering more milk solids per cow per lactation (457 kg vs 449 kg). They were 10% lighter (-54 kg), had 18 percentage units higher pregnancy rate to first service and 10 percentage units higher 6-week in-calf rate.
- Our most recent research, an analysis of 40 commercial dairy herds with data from 2010 to 2012, represents the first evaluation of crossbred and straight bred cattle within commercial high EBI dairy herds, and again the results are consistently in line with the research findings from Teagasc research herds: high EBI Jersey × Holstein-Friesian cows produced 25 kg milk solids per cow year more than the mean of high EBI purebred Holstein-Friesian and Jersey cattle. Moreover, the crossbred cattle also achieved a 7.5 day shorter calving interval compared to the purebred contemporaries within these herds.
- A similar piece of research conducted during development of the 'Culling' or 'COW' index found that crossbred cows had a 9 day shorter calving interval, a 6% greater pregnancy rate in the first six weeks of the breeding season, and a 3% greater survival rate to the next lactation. Lifetime financial heterosis was estimated to be just under €550.
- This research study at Ballydague also identified an innate advantage by way of intake capacity with the Jersey breed. Jersey cows consumed 4 per cent of bodyweight in grass DM/day. This compared to 3.4 per cent for the Holstein-Friesian and 3.65 per cent for the Jersey crossbred cows. The importance or value of this trait is not appreciated in practice by many at farm level. This trait is critical to the high productivity per unit area achieved with the Jersey and Jersey crossbred cows in the studies outlined above. Detailed anatomical investigations conducted on animals post slaughter revealed the physiological mechanisms underpinning the differences in intake capacity observed, which tended to be more physical in nature than metabolic. Selection within the Holstein-Friesian breed using EBI will inevitably improve fertility and longevity, but not this unique capability.

The research evidence from Moorepark and elsewhere is categorical and consistently shows that high EBI crossbred dairy cattle outperform high EBI purebred contemporaries both within research studies and on commercial dairy farms because of lower replacement costs and greater herd productivity. On that basis, dairy herds which combine high EBI Holstein-Friesian and high EBI alternative breeds will continue to reap the added benefits of crossbreeding in addition to the benefits of genetic progress in EBI.

Ensuring Progress – ongoing work between Teagasc and ICBF

The increasing differential in EBI between the top Holstein-Friesian and the top Jersey sires that currently exists is due to a combination of factors: 1) the success of Ireland's national breeding programme, the essential ingredient of which has been the incorporation of Genomic Selection, 2) a lack of a national Jersey breeding programme. Based on the research findings presented, Teagasc and ICBF have embarked on a number of major joint strategic initiatives to evaluate the potential long term benefits of cross-breeding. These include

1. COW Index. The Cow Own Worth Index has been developed to rank dairy females on expected lifetime profitability, considering total genetic merit (both additive, e.g., EBI, and non-additive genetics e.g., heterosis, effects) and environmental or circumstantial effects. In the coming months the COW index will be trialled and refined (on both a within and across herd basis), ahead of a potential roll-out later this year.
2. Multi-breed genomics. Research on the potential for genomics in Jerseys underway. Target to have Jersey genomic test proofs by September 2016.
3. G€N€ IRELAND. Work is underway to promote/encourage the uptake of high EBI JE and JEX test bulls as part of G€N€ IRELAND 2016. In addition a longer term cost:benefit analysis will be undertaken in conjunction with Abacus Bio NZ, to evaluate the potential benefits of having a National Breeding program for Jerseys.
4. NextGen Jersey Herd. Teagasc to establish a nucleus herd of Elite Jersey females, based on the same principles as the *Next Generation* Holstein-Friesian herd.
5. Heterosis. Teagasc and ICBF to continually review and validate best estimates of economic heterosis/benefit of crossbreeding as the breeding programme develops. At this stage this is estimated to be €100-€150 (based on a comparison of the two pure breeds, Holstein and Jersey). Work is currently being undertaken to re-estimate this figure, in light of improvements in the EBI of the National dairy herd, and the fact that most dairy herds are now made up of a combination of the Holstein and Friesian breeds, within which there is also a natural level of heterosis.

Ultimately, success is dependent on the level of demand for Jersey genetics at commercial farm level. Irish dairy farmers must be willing to embrace the programme by progeny testing the best young test sires that will emerge. This is a fundamental step along with the steps outlined in facilitating the realisation of high EBI jersey sires to further advance genetic progress within crossbred dairy herds.

Breeding Decisions this Spring

So what does this mean for dairy farmers? Notwithstanding the substantial progress that has been achieved within the Irish dairy herd since the introduction of EBI, national statistics reveal that there is considerable scope for improvement in both productivity and reproductive performance of Irish dairy herds. Regardless of whether choosing to crossbreed or remain with a purebred black and white herd, based on the results from Table 1, a team of bulls of high overall EBI (in excess of €300) should be selected for the 2016 breeding season on every farm.