Section 7

Dairy Cow **Breeding**

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Introduction

Breeding contributes half the performance gains in dairy herds. Genetic gain from good breeding decisions is cumulative and permanent. Introducing superior genetic material into a herd will remain for several generations and can be built upon. On the other hand, poor sire selection decisions, can have serious and long-term repercussions for the future profitability of the herd. Evidence from a diverse range of environments around the world shows that cross-breeding offers dairy farmers a genuine opportunity to counteract the negative affects of past selection programmes.

1. **What are the key principles of dairy breeding?**
2. **What is meant by genomic selection?**
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4. **How can I increase bull 'reliability'?**
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1 What are the key principles of dairy breeding?

- Herd economic breeding index (EBI) must increase year-on-year, recognisable as higher EBIs in the younger animals.
- Genetic gain in individual component traits can be achieved by selecting a team of bulls with superior average genetic merit to the herd; the genetic merit of the bulls can be obtained from the active bull list and the genetic merit of the herd can be obtained from HerdPlus® reports.
- To increase herd EBI by at least €5 annually, the average EBI of the team of bulls used should be at least €120 greater than the EBI of the herd.
- Mate sufficient early calving cows to generate ample replacement heifers (accounting for losses); approximately six AI straws are required per heifer milking in the parlour in two years.
- Cross-breeding can be used to increase profitability further through exploitation of heterosis, (or hybrid vigour). This is the additional benefit in performance observed in cross-breeds over and above their parental mean (see also chapter on bull selection).

2 What is meant by genomic selection?

- Genomic selection is simply a fancy term for "breeding using DNA".
- DNA is the backbone of genes which cause differences in performance among animals. DNA is passed from parents to offspring and is therefore fundamental to breeding. Animals with the best DNA are selected as parents of the next generation.
- DNA is the same in all cells of the body and remains the same throughout life.
- If we know how each piece of DNA effects performance, by taking a DNA sample of a calf, we can predict its performance later in life.
- Genomic selection currently constitutes approximately one-third of the EBI of the animal; the remainder is from the traditional method of genetic evaluation of the parents.
- Reliability of EBI from genomic selection currently averages 54% but varies between animals; this means that fluctuations in animal EBIs over time may still happen, but to a lesser extent than previously.

3 How important is EBI?

- The economic breeding Index (EBI), launched in 2001, describes the expected profitability per lactation of the progeny of the individual.
- An animal EBI of €200 means the progeny of that animal, on average, will yield €200 more profit per lactation than the average progeny of an individual of EBI €0, producing in a similar environment. Similarly the progeny of the €200 individual will yield €50 more profit per lactation than the progeny of an individual with an EBI of €150.
- The EBI is currently made up of six sub indexes.

Milk production sub index – includes milk, fat and protein yield.

Fertility sub index – includes calving interval (measure of fertility) and survival to the subsequent lactation.

Maintenance sub index – includes the cost of growing and maintaining the progeny of an animal differing in size (i.e. bigger animals require more feed to attain that weight and also maintain that weight).

Calving performance sub index – includes calving difficulty, gestation length and calf mortality.

Beef performance sub index – includes traits associated with cull cow value and progeny carcass value.

Health sub index – includes udder health and lameness.

How to
Increase herd EBI

- Determine the genetic merit of your herd from HerdPlus® for EBI and the main component traits of fat yield, protein yield, calving interval and survival.
- Select only bulls from the ICBF active bull list.
- Select a team of bulls (at least 4) plus 1–2 easy calving bulls for use on heifers; it might be easier to eliminate bulls which are not suitable for your farm rather than immediately trying to select suitable bulls.

- Ensure average of bull team is genetically superior to the average genetic merit of your herd to ensure genetic gain.
- Ensure no bull is mated to a related cow.

4 How can I increase bull 'reliability'?

Reliability

- Young animals have a low reliability for EBI which means that their EBI may fluctuate as more information on the animal or its relatives accumulates.
- For a given quantity of information, the reliability will be greater for the milk production traits in the EBI and lower for the fertility and survival traits.
- The risk associated with low reliability of individual sires may be overcome by using "teams" of sires. Although the EBI and reliability of the EBIs of individual bulls may be low, the reliability of their team EBI can be much better.

For example, four sires each with a reliability of 60% and respective EBIs of €230, €240, €250, and €260; the reliability of this team of bulls is 90% and their daughters on average will have an EBI of €245.

5 What developments can we expect in dairy breeding?

- Genomic selection is now the accepted method of genetic evaluation in most dairy populations.
- Reliability of animal EBI from genomically selected animals (and relatives) will increase with time as research and data availability improve.
- The economic values in the EBI will continually be updated, as necessary, in line with expected changes in prices and costs of production.
- New traits, especially those related to health, product quality, and environmental footprint may soon enter the EBI.
- An index to identify beef bulls for use on dairy cows to maximise profit from the sale of resulting calves will soon be available.

6 Why consider cross-breeding?

A successful cross-breeding strategy can:

- Introduce favourable genes from another breed selected more strongly for traits of interest
- remove the negative effects associated with inbreeding depression for many traits to capitalise on what is known as heterosis or hybrid vigour (HV).

HV means that cross-bred animals usually perform better than that expected based on the average of their parents. HV is generally higher in traits related to fitness and health i.e. traits which have lower heritabilities. Heterosis for production traits is usually in the range of 0 to 5%, whereas heterosis for traits related to fertility is usually in the range 5 to 25%.

Research conducted independently by both Teagasc Moorepark and ICBF indicates that the average benefit from crossing two dairy breeds (over and above that explained by the EBI) is €100 per lactation per cow.

7 What breeds should I use?

Norwegian Red

- Originates from a long-term breeding program in Norway that has been selecting for improved fertility and health for many decades.
- Teagasc Moorepark research has shown that lactation milk solids yield is lower for the pure-bred Norwegian Red cows compared to their Holstein-Friesian counterparts, but there is little difference in milk solids yield between the Holstein-Friesians and the Norwegian Red cross-breds. Milk somatic cell count was lower in the Norwegian Red pure-breds and cross-breds.
- The beef merit of male calves from Norwegian Red X Holstein-Friesian mothers is similar to that from Holstein-Friesian mothers.
- Research shows that Norwegian Red X Holstein Friesian cows generated €130 more profit per lactation than Holstein-Friesian cows – largely due to better fertility and survival in the herd of the cross-bred cows.

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Jersey

- Research at Teagasc Ballydague farm shows that although the pure-bred Jersey and Jersey cross-bred cows produced less milk yield that their Holstein-Friesian counterparts, milk solids yields of both pure-breds was similar while the milk solids yield of the first cross Jersey was the best. Under the current milk pricing system for manufacturing milk in Ireland the milk of the cross-breds is more valuable.
- Although there was little difference in reproductive performance between the pure-bred Jersey and Holstein-Friesian, the reproductive performance of the first-cross Jersey cross-bred was far superior to that of both pure-breds.
- Jersey cross-bred cows had higher intake per unit live weight and produced more milk solids per unit intake than Holstein-Friesian cows. This greater feed efficiency makes these animals well suited to a grass-based production system.
- Even including the lower calf and cull cow price of the Jersey cross-breds compared to their Holstein-Friesian counterparts, the first cross Jersey in the Ballydague study was €180 per lactation more profitable than the Holstein-Friesian cows in the study.

Dual purpose breeds

In some countries dual-purpose breeds such as Fleckvieh (Simmental) from Austria, Montbeliarde and Normande from France, Brown Swiss from Switzerland and Austria and the Rotbundt DN from Germany are considered the breeds of choice for cross-breeding. These breeds tend to offer superior beefing qualities resulting in increased revenue from male calf and cull cow sales. However, some of these breeds are more likely to present issues with late maturity, heavier calves at birth and increased gestation lengths, compared to Holstein-Friesian and hence are less suited to the rigours of seasonal calving systems.

Evidence from New Zealand suggests that Jersey cross-bred cows are well suited to intensive seasonal grass-based dairy production. The popularity of cross-breeding in New Zealand is due to high productivity in pasture-based environments, superior reproductive performance/survival and consequential benefits in terms of profit. Under the quota regime, the high milk fat content associated with the Jersey, coupled with the inevitable reduction in male calf and cull cow values, meant that the use of Jersey genetics in Ireland was not deemed an attractive option. However, with the advent of post-quota, 'A+B-C' systems of milk payment and a greater focus on cost reduction/increased milk solids output per unit of land area, there is an increasing realization that cross-breeding with Jersey may offer substantial performance benefits in Ireland.

8 Are there any downsides to cross-breeding?

- Increased variation: if both parental breeds differ considerably for a given characteristic (e.g. animal size) then considerable variation in this trait can be experienced with multiple crosses.
- An Irish national breeding programme currently only exists for Holstein-Friesian due primarily to a lack of high quality pure-bred dams of alternative breeds in Ireland. However, good national breeding programmes for other breeds such as the Norwegian Red and Jersey exist elsewhere and genetically elite sires for Ireland can be selected from these countries.
- Unfavourable qualities of other breeds: one of the most commonly cited reasons for lack of interest by farmers in using Jersey cross-breds is the sale value of calves and cull cows. However, because of the superior fertility of the Jersey cross-bred, less cull cows will be sold.
- Although surplus Jersey cross calves are worth considerably less than calves from many other breeds, the loss in revenue is far outweighed by other performance characteristics (e.g., superior fertility) of the cross-bred. Reduced calf value and cull cow value are included in all Teagasc economic analyses using actual data obtained from studies.