PROGRESS IN BREEDING FOR THE NORTHERN IRELAND DAIRY SECTOR

Alistair Carson, AFBI Hillsborough & Marco Winters, DairyCo

Summary

The key messages in this paper are:-

1. The trends in genetic merit of milk recorded cows of Northern Ireland are heading in the right direction with continuing increases in genetic merit for milk production traits, but now gains are also being made in udder health and lifespan traits. Furthermore the decline in genetic merit for fertility which has occurred over the last two decades is now coming to a halt.

2. The Profitable Lifetime Index (PLI) ranks sires (and females) on the economic merit of their daughters and provides the basis for appropriately balanced breeding decisions. Moving forward, the PLI will continue to develop to include further new traits and to take into consideration changing market outlooks, new environmental considerations and developments in production systems.

3. Sire proofs work in practice with close relationships between the genetic merit of cows and their performance in Northern Ireland herds. A simple new tool being developed by AFBI will allow a rapid evaluation of the herd genetic merit relative to herd performance, helping to inform future breeding and management decisions.

4. Looking to the future, the rate of genetic progress can be much quicker within our industry. For this, we need to address (a) low levels of performance recording (milk recording and animal health and fertility recording) and (b) relatively low use of the PLI by producers for sire selection. To tackle low trait recording needs commitment from producers to record more and integrated databases to make best use of all records. Increasing awareness of the PLI amongst all sectors of the industry (the aim of this conference) will increase its adoption by producers.

Trends in genetics and performance

Milk production per cow in Northern Ireland herds has increased on average by 110 litres/cow per year over the last 20 years. For milk recorded cows with genetic evaluations, milk yield PTAs (Predicted Transmitting Abilities) have increased by 41.8 kg per year equating to an increase in estimated breeding value of 83.6 kg of milk. So, if the rate of genetic progress in the national herd matched that of milk recorded herds then over three quarters of the increase in milk production per cow could be attributed to increases in genetic merit for milk production.

It is well established that selection for production alone causes negative effects on health and fertility traits such as udder health and reproductive performance. Until the early 2000's selection programmes were largely focussed solely on production traits. Thus it is not surprising that the average PTA for calving interval in milk recorded cows increased on average by 5 days over the period from 1990 to 2000. Thereafter, the decline in genetic merit for calving interval has slowed off as the index of total economic merit in the UK, the PLI, began to incorporate fitness traits. The PLI reflects the profitability differences of progeny over their lifetime

The PLI is the best way to combine information on the growing number of traits which have now genetic information available. Each trait is weighted by its appropriate economic value. The predicted genetic response to selection on PLI indicates that alongside increased production, lifespan will increase, somatic cell count will decrease, feet and legs and udder traits will improve and the decline in fertility traits will have nearly been brought to a standstill. In practice what we have seen, is that alongside the predicted improvements, we have also seen that the bulls being used on farm show in fact a reversal in the decline in fertility.

New developments in PLI

New national genetic evaluations are now available for calving ease (both direct and maternal). These will be incorporated into the next generation PLI which may also include mastitis incidence, cow mature weight and calf mortality. In addition the relative emphasis for traits within the PLI continually develops to take into consideration changing market outlooks, new environmental considerations and developments in production systems. This is an important on-going activity to

ensure that index weights are appropriate for the markets being addressed and that index weights remain appropriate for the majority of producers. AFBI is currently carrying out work in this area, with the Scottish Agricultural College and DairyCo, examining the relative weightings for production and non-production traits within the PLI for a 8,000 litre system with costs and returns considered representative of a Northern Ireland system. Findings from this work will be incorporated into the new PLI which will be launched by DairyCo for the UK dairy industry next year. Initial analyses indicate that the relative emphasis on production and non production traits within the PLI will not change significantly as increases in milk returns are balanced against increases in cost of production with little change in the relative economic values of the various traits.

PLI sire rankings

Sires ranked on PLI by DairyCo are published on www.dairycobreeding.org.uk. This list typically contains details of over 500 Holstein Friesian sires in each proof run. CAFRE publish a shortlist of the top 100 Holstein Friesian sires ranked on PLI available in Northern Ireland after every proof run on the Rural Portal website (www.ruralni.gov.uk) which can be accessed by following the links to Dairy, Breeding and Genetics and Top 100 sires available in Northern Ireland. Sire proofs are calculated three times per year (April, August and December) with, in the last run, the top 50 sires available in Northern Ireland having a PLI of £165 and above. Thus, these sires will lead to a financial improvement in their daughters of at least £165 compared with sires with a PLI of £0.

For the last couple of years O-Man (O-Bee Manfred Justice) and his sons have been at the top of the PLI rankings. So, of course, care is required to avoid inbreeding when finalising sire choice. Computer mating programmes are available from Holstein UK, and several of the AI companies, which calculate the level of inbreeding for every suggested mating. It is recommended to avoid any which raise the level beyond 6.25 percent, and for cows which have already reached this point, choose an outcross bloodline which will bring this level back down.

Genomic evaluations

Genomic (DNA) data are now being incorporated into genetic evaluations as well as the more conventional source of ancestry and performance information. Inclusion of genomic data in national evaluations has the potential to increase genetic progress by around 50% over the next 10-15 years. Its use in national selection indexes is new, and requires the identification of known sequences within DNA (termed SNP's) and the subsequent association of these sequences with actual performance for production and non-production traits.

Later this year DairyCo will produce, for the first time, listings of young sires based on genomic evaluations. Reliabilities achieved from genomic evaluations on young bulls are currently around 65% (compared with 35% for pedigree index; up to 99% for well proven and used AI sires). As an animal accumulates progeny information so the genomic (and parent average) component contributing to its index reduces.

Genomics also looks set to enable disease resistance to be incorporated into breeding programmes. For example, AFBI are currently working in partnership with Edinburgh Biosciences Institute, funded by BBSRC, looking at possible DNA markers for TB resistance.

Association between genetic merit and performance on farms

Data from Northern Ireland herds demonstrates the close link between genetic evaluations and actual performance. For example, within dairy herds 71% of the variation in first lactation milk yield was associated with the PTA of the animal for milk yield. In terms of genetic variation, a 1 kg increase in milk PTA is expected to equate to a 2 kg increase in milk yield potential. In our study from farms across Northern Ireland a 1 kg increase in milk PTA was in fact associated with a 2.9 kg increase in milk yield. This is likely to be due to issues such as the fact that on many farms concentrates are fed to yield thus animals of higher genetic merit tend to be fed higher levels of concentrates.

At herd level a strong relationship was also found between genetic merit and performance. For example, 41% of the variation in milk yield between herds could be attributed to differences in average PTA for milk yield of the herd. In the study of

data from farms across Northern Ireland a 1 kg increase in milk PTA for the herd was associated with a 3.1 kg increase in milk yield. Herds of higher genetic merit for milk production tend to feed more concentrates, thus increasing the differences between herds in milk yield. In terms of fertility, a good association was also found between fertility index of the sire used and the reproductive performance of his daughters.

Analysis of genetic evaluations and performance data for Northern Ireland herds is leading to the development of a tool which will benchmark the genetic merit of herds, enabling the strengths and weaknesses of herd genetic make-up. It will also enable identification of the required genetic merit for a range of traits to achieve target levels of performance at individual farm level, providing important selection criteria for sire selection.

Genetic evaluations in Northern Ireland

Looking to the future, the rate of genetic progress can be much quicker within our industry. The main issues we need to look at for increasing genetic progress are dealt with below.

Increase performance recording

At present, approximately one third of herds in Northern Ireland milk record, with 43% of the total cows. This is significantly below most of the other main dairy producing countries (e.g. % of cows milk recorded - 87% Netherlands, 64% New Zealand, 55% GB). A co-ordinated effort is required in our industry to increase the adoption of milk recording and to exploit the potential use of herd data collected from the sophisticated parlour and management software programmes which are now in place on many farms.

Comprehensive recording of fertility and animal health traits is absolutely essential for progress in these parameters. Whilst Northern Ireland herds supply data for genetic evaluations as detailed in Table 1, there is room for much more data to be provided which will lead to significant benefits for genetic evaluations.

Table 1. Performance data collected on NI herds which are used for genetic evaluations (live cows included in the Aug 2011 genetic evaluations)

Trait grouping	Individual traits	Numbers of NI records
Production	milk, fat and protein yield	58,847 cows (=100%)
Longevity	Lifespan (no. of lactn's survived)	100% of cows
Health	Locomotion score (linear scale)	<40% of cows
	Udder and Feet & legs score	<40% of cows
	Somatic cell count	100% of cows
	Mastitis events (reported cases)	<1% of cows
Fertility	Non-Return 56 days (lact 1)	<20% of cows
Calving difficulty	Calving Ease score	<2% of cows

To tackle low trait recording needs commitment from producers to record more and integrated databases to make best use of all records.

Currently just under 60,000 cows have genetic evaluations representing 21% of milking cows. Again this is below other countries (e.g. 50% GB).

Use of national selection index

Selection based on PLI will lead to the greatest increase in economic merit of our dairystock. Consequently, the fact that survey data indicated that PLI was not a main selection criterion used by dairy producers here represents a very significant barrier to genetic improvement. Today's conference provides the launch of a co-ordinated initiative organised by AgriSearch, CAFRE and AFBI to promote the appropriate use of PLI in the dairy industry in Northern Ireland. DairyCo, who are responsible for genetic evaluations in the UK, is playing an important role in this work.

AI usage in Northern Ireland

The widespread use of proven superior genetics is a key factor in genetic progress. Whilst there is extensive use of AI on dairy farms, survey data from a couple of years ago indicates that AI usage is somewhat below that of the main dairy producing countries.

Conclusions

Using PLI for sire selection is the basis for ensuring the maximum gains in overall genetic merit. For increasing the rate of genetic progress in our industry we need more performance records (integrated databases are the key), greater use of AI, and increased emphasis on PLI in sire selection. The PLI will continue to develop to take on more traits and to take account of changing market outlooks.

To address the issues in this paper requires an overall breeding strategy for the Northern Ireland dairy sector with the goal to maximise genetic gains for a sustainable industry. This conference can represent a start to this process.

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