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Assessing the potential of genomic testing dairy heifers to increase genetic gains and financial returns

Interim report

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Background

This project will investigate the benefits of genomic testing dairy heifers. Historically, estimated breeding values have been the only information available to farmers to base breeding decisions on. These parent averages are only 35% accurate when it comes to predicting future performance. There are now a number of commercial genomic DNA testing options available in the UK market that provide the opportunity to increase the accuracy of breeding values from 35% to between 60 – 70%.

The increase in accuracy from genomic testing provides dairy farmers with an opportunity to increase the rate of genetic gain within their herd because they do not have to wait until an animal is at the end of her 1st lactation before receiving this information. Until this point, the parent average information is based upon breeding proof information from its sire and dam and does not contain any of the animal's own performance data.

However, the tests do add an extra £25 to £30 onto rearing costs, which is off-putting considering these animals will not start 'paying back' their rearing costs until their 2nd lactation. Consequently, the cost benefit to genomic testing animals needs to be quantifiable.

This project sets out to understand what the cost benefit for genomic testing would be based on individual farm heifer rearing cost information, genetic profile and compare the correlation between parent average and genomic testing with future performance.

The project started on 1st December 2017 and will run until 30th November 2020.

Recruitment & Testing

A total of 9 participating farms in North Wales were recruited into the project that are all Holstein/Friesian herds with a large number of heifers to select from. The heifers were selected for testing based on their birth date in order to fit in with the project timeline, which resulted in 432 heifers eligible across the 9 farms. In addition to these, there were a number of animals that had already been genomically tested as part of other projects that could be included within the results.

Once the heifers for testing were identified and their tests were requested from the milk recording company, there was an issue with data quality for some animals. This mainly involved having the correct breed codes and sire/dam ID's for the heifers, which will be a lesson learnt from the project.

The genomic testing was performed in April 2018 by a farm technician to reduce testing and sampling errors. The results arrived back in June and July 2018.

Genomic Results

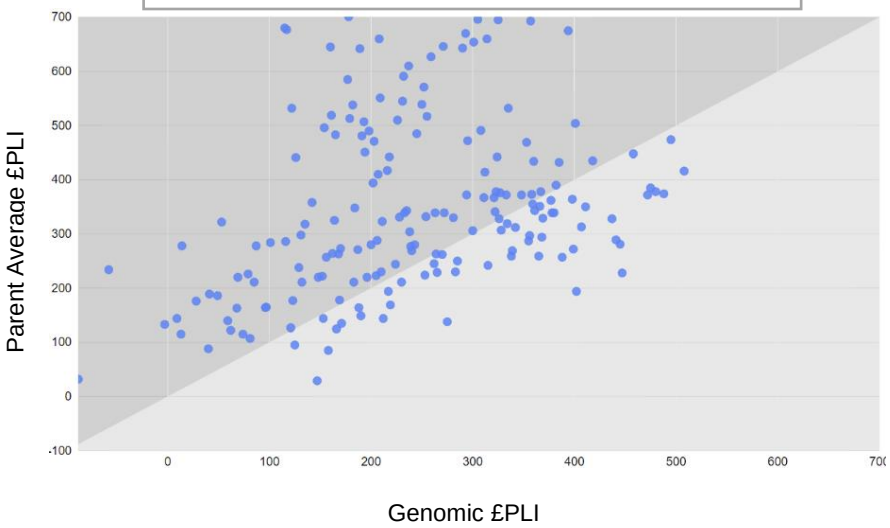
One of the additional benefits of genomic testing is that it will identify any incorrect sires. Twenty one (4.8%) of the heifers tested had mis-identified sires which could either be due to the dam being served naturally by the wrong bull or an incorrect semen straw. The tests were able to correctly identify 20 out of 21 sires for these heifers and amendments to their parentage were made accordingly.

When assessing the genomic results, for this project we focussed on the Profitable Lifetime Index (£PLI) as this is a composite index incorporating milk production, fertility, feet & legs,

longevity, udder conformation, SCC and maintenance. It is designed to be a genetic ranking index to assess the additional profitability the animal will deliver over its lifetime when compared to an animal with £0 PLI.

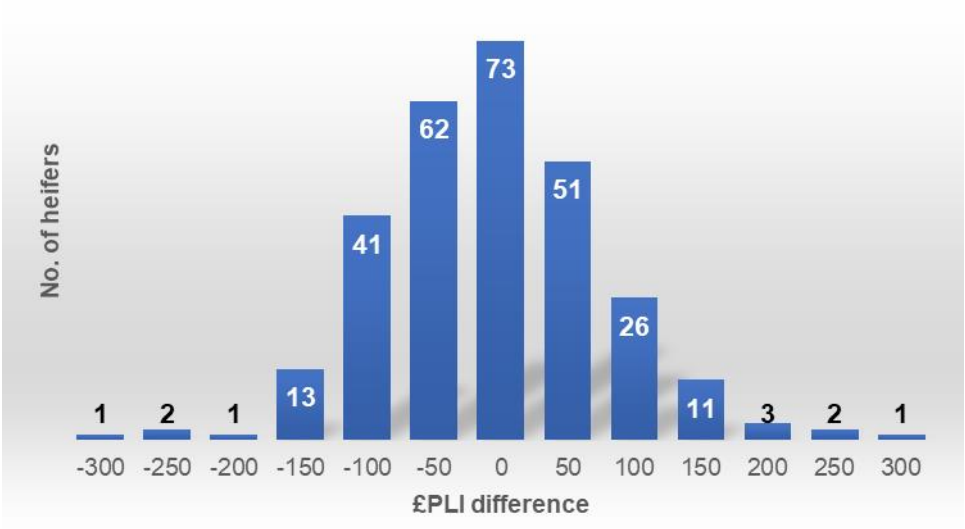
The graph below shows the difference between the parent average £PLI and the genomic £PLI result.

Graph 1. Parent Average £PLI vs Genomic



If the parent average and genomic results were the same, the dots would all sit along the diagonal line. To no surprise, we found that this wasn't the case and that instead, the parent average tends to over-estimate the £PLI. The average difference between the genomic and parent average PLI was -£30 but there was a large range, with one heifer increasing by £399 and another decreasing by £300 at the extremes. The change in £PLI can be more easily displayed through the below histogram graph.

Graph 2. Difference in £PLI of Genomic result compared to Parent Average



In order to understand how the change in £PLI would have an impact on farm, we used a hypothetical breeding situation where everything below £200 PLI would be bred to beef and not used to breed replacements from. This would be common practice on farm but the 'cut off' point would vary depending on a) breeding goals b) number of replacements required and c) herd health status.

The table below shows the number of animals that would have been bred to beef or used to breed replacements from by using either parent average value or the genomic result.

Table 1. Hypothetical Breeding Scenarios

£PLI Origin/Scenario	Bred to Beef	Bred to Dairy
Parent Average £PLI	52	235
Genomic £PLI	98	189

N.B. Only heifers whose parent average £PLI was known at time of genomic testing is used within this piece of analysis.

What these figures demonstrate is that 46 animals would have been incorrectly bred to dairy if using the parent average £PLI figure because of over-estimating their actual £PLI value. At this point, it is worth reiterating the genomic testing looks at that own animals' DNA sequence to estimate performance and is therefore almost double the accuracy of a parent average.

Because these 46 animals were bred to dairy instead of beef, it would mean that a farm would be breeding lower quality replacement heifers than they could have done if they'd have selected the right animals. Therefore, slowing down the rate of genetic progression for the herd and having knock on impacts on the quality of future generations.

Encouragingly, a much lower number of animals would have been incorrectly bred to beef. On a percentage basis, 73.5% of animals would be correctly bred, 5.2% incorrectly bred to beef and 21.3% incorrectly bred to dairy. These breeding mistakes would last for 2 crops of calves as an animal would not receive their own breeding value until they'd had at least 5 milk recordings in their first lactation, by which time they are likely to be in calf again.

By the time they reach their third lactation, they may not be given the opportunity to breed for replacements again as farms tend to breed replacements from the animals with higher genetic merit, which are usually the younger animals in the herd although this isn't always strictly true.

Consequently, the decision to invest in genomic testing when that animal is at pre-mating age, can have a lasting impact on the genetic quality and productivity of the herd for future generations.

Heifer Rearing Costs

The project also carried out a costing exercise for each of the participating farms' heifer rearing enterprise. Rearing youngstock is a large cost to the main dairy business and from Kite's own database, ranges in costs have been seen from £998 to £2,780 with an average of £1,433/head. These costs are not recouped until the animal reaches her third lactation therefore the decision of which heifers to rear should be taken seriously before investing time, resource and money into that animal.

The average cost for the group was calculated at £1,420/head with the lowest farm at £1,199 and highest at £1,570 giving a range in costs of £370 amongst the group. There was almost a 50/50 split in farms using contract rearers at some point during the heifer cycle.

The cost to rear heifers is one that needs to be taken into account when deciding upon genomic testing animals. A farm with additional replacements in the system and can therefore afford to be selective with their heifers, could offset the cost of testing by culling the poorest genetic animals or entering them into a fattening programme.

There is some scepticism within the industry that selling heifers that have been genomically tested automatically means they're selling the poorest animals; however, this is not the case. The genomic results mean that buyers have an additional level of knowledge about that animal, which gives added assurances to future performance and can therefore adjust their budget accordingly.

Future Plans

The project now enters a lull in activity while the heifers calve down in July 2019 through to the start of 2020 and start milking. The project farms will be collecting a series of information for us to analyse through their milk recording, such as:

- Calving date
- Milk yield & quality
- Mastitis and SCC level
- Number of heats, services and any PD's
- Lameness incidence

However, the project will mainly focus on comparing production information with genomic and parent average results due to data quality and volume restrictions. Although, there may be some non-statistical observations that could be made and we will also canvas that farmer's own opinion on the difference between the animals.