

Genomics and the use of this technology.

Genomics is an area of genetic evaluation that has been developing at a rapid rate and will continue to do so as geneticists learn more about the genome or the genes held within an animal's DNA.

Currently there are DNA markers of several traits to identify if the animals have the right genes to support the information that we collect as raw data to produce an EBV. However there is no SNP chip (DNA marker test) on the commercial market that is validated for the NZ Hereford population.

How do they go about developing DNA marker tests.

The first thing they do is develop what is known as a "training population data set". This is a population of animals with high accuracy EBV's and pedigrees. They benchmark their EBV performance for this population. They then go through the animals and try to compare/contrast the DNA of animals with large variation in traits and try to identify any differences in the DNA sequence. They then develop a genomic prediction equation which is then used and validated over the whole population to explain the variation between animals. This is not perfect. At the moment the amount of variation that can be explained is approximately 60% for most traits. However as more DNA samples are screened, the equations are modified and become more accurate and will explain more variation.

One of the challenges to date is that each population that is tested needs to be genetically linked to the training population via linked pedigrees. They found that Herefords in Argentina with no American influence had little correlation to the genomic equations developed based on the American population. However those herds with American influence did correlate sufficiently to the American populations and so the equations were providing information to support the existing EBVs.

This means that the further away the pedigree links from the American training population are the less powerful the DNA marker information is. You can develop your own training population in each country for each breed, but this requires significant financial investment.

Why do we want to use this technology?

This is a tricky question. To date the American Hereford Association in partnership with the USDA and Iowa State University's world renowned professor and Kiwi Dorian Garrick have invested approx. US\$100,000 to produce a training population and subsequently develop markers relevant to the American Hereford animal population. In the next 6 months they will release to their breeders new DNA markers relevant to their population that will help their breeders make quicker progress through more accurate information.

As time moves on, the genetics of our herd population evolve, and will move further away from the genetic links with the American Hereford Association training population. If we don't start collaborating with our American colleagues and piggybacking off the investment they have made, we will be left behind and if we ever changed our mind, then we would have to a) re-establish genetic links or b) develop our own training population data set.

What do the results of these tests provide?

The DNA marker tests provide information that will support the existing EBVs produced from the raw data that breeders measure on farm, such as 200 day weight.

The DNA marker information will improve the accuracy of the EBV's. The smaller the herd the more useful the DNA marker information will be. For example it may take an EBV accuracy of 50% up to 80%.

Currently you always get grumbles among breeders that the EBV's of Bull "A" have moved so much that the offspring will not perform as well as estimated when you made the decision to use him.

With DNA marker tests, this EBV movement problem will be reduced to a much lower level and at an early age.

You will be able to use yearling bulls with a lot more confidence and therefore theoretically be able to make faster genetic progress in the measured traits for you and your commercial clients. This is added value.

The other benefits of DNA markers are that if we adopt whole herd EBV recording and collect the full amount of data that is requested by Breedplan, then we will be able to find markers for hard to measure traits such as fertility and longevity – key drivers of commercial herd profitability.

The American Hereford Association have also requested that their breeders start collecting animal health data, such as cancer eye and vaginal prolapses so that researchers like Jon Beever, can develop markers for these traits. NZ breeders could also look at traits such as corkscrew penis. Do you think a marketing position of "Corkscrew penis free" is of value to your commercial clients – absolutely!!! This information is all stored in a secure and private system, independent of the Breed Association.

The actual costs of submitting DNA samples for use with a SNP chip is declining at a rapid rate for the breeder.

The questions that Breed Associations are now asking themselves around the world is: How do we get started, can we work together and what will the return on investment be?

Summary

Genomics technology is rapidly evolving. The longer we wait before adopting it, the more cost will be involved in developing valid genomic prediction equations.

Genomics technology will not replace raw data measurement on farm. In fact the more traits we can measure accurately on farm, the more traits we can ask them to search for. The results would be reported back to the breeder as a Breedplan EBV.

The benefits in the short term are from improving accuracy of the existing traits measured. This will be of more relevance to smaller herds. However as we increase the number of samples submitted, the benefits will increase over time as we identify new markers for existing and new traits adding power to EBVs, confidence to our decisions and faster genetic progress in targeted traits for our breeding programme, flowing on to our clients herds.

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