GENOTYPING STRATEGIES

As of February 1, 2018, the cost of genotyping has been reduced from $45 to $33. The new fee structure applies to both the Low Density (LD) and the LD+ (includes BLAD, DUMPs and Coat Colour results) tests.

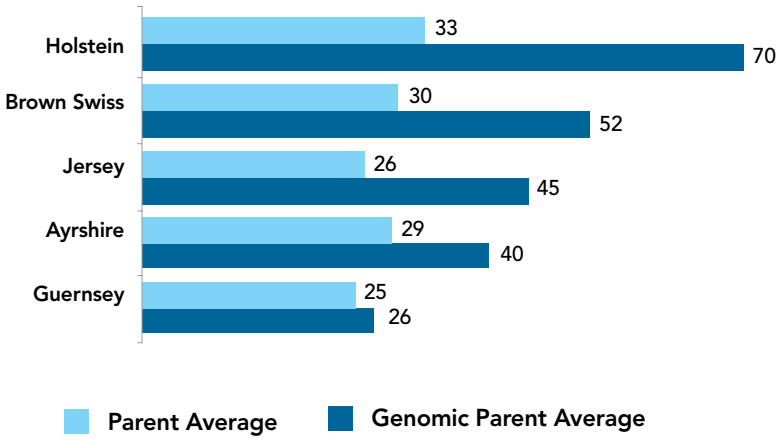
Genotyping, the science of DNA sequencing, is a technology that identifies "markers" along the genome in order to predict an animal's genetic potential for performance. These markers are scientifically known as Single Nucleotide Polymorphisms (SNPs). Their effects are calculated based on the breed's reference population, and used to help predict an animal's genetic potential for performance. The reference population refers to the population of animals that are genotyped and have performance data (classification and milk recording records).

When an animal is registered, it receives a genetic evaluation. This provides a genetic prediction of the animal's potential performance. Genetic evaluations are based on the contribution of four possible sources of information: [1] Parents, [2] Performance, [3] Progeny, and [4] DNA (genotype). If an animal is not genotyped, there will be no DNA data contributed and the animal will have a reliability range of 25% to 33%, depending on the dairy breed. By adding DNA information, the genetic evaluations become stronger, meaning the reliability of the evaluation becomes greater. Prior to genotyping, the only way to increase reliability would be to increase the amount of performance data and/or progeny data.

The Holstein breed has the largest reference population and therefore has the highest increase in reliability. There are several other dairy breeds that also benefit from genotyping, however, breeds with a small reference population do not. The increases in reliability for each dairy breed that benefits from genotyping are displayed in ***figure 1.***

Figure 1:

Average Reliability (%) for LPI (and Pro$) of genotyped heifers based on Parent Average before genomics versus Genomic Parent Average with genomics.



** Source Brian Van Doormaal, CDN*

Why Genomic Test?

- Provides a highly reliable genomic and genetic evaluation
- Allows better understanding of the genetic potential of animals in the herd
- Increases reliability and accuracy of genetic evaluations
- Optimizes mating decisions to accelerate genetic progress
- Optimizes mating of heifers, optimizes the proper use of sexed semen, beef semen and conventional semen
- A tool to help manage recessives and haploytypes that have the potential to cause lasting negative effects on your herd
- Allows greater return on investment for the cost of rearing heifers

In addition to increasing reliability, genotyping can be used for parent verification. It can confirm or revoke suggested parents and suggest possible parentage when unknown.

Microsatellite (MS) technology is the international norm/ISAG (International Standards for Animal Genetics) and is required if genetics (semen/embryo/animal) are being exported. Producers can also use genotyping to learn more about their herds' genetic recessive traits. These traits can be positive or negative and can have an impact on the producer's bottom line.

With the increase in reliability, producers can make more accurate decisions when mating or culling. It's important to genomic test a group of animals within the same age range, as it will aid in mating decisions.

It is best to genotype animals when they are young, as the increase in reliability is most beneficial before making a breeding decision. Based on herd goals and available information, some producers may find it beneficial to genotype their whole herd while others will want to genotype a select population. *Table 1* provides some insight into the percentage of animals you should genotype based on whether pedigree data is available or is missing. Producers who want to test a select population may want to test the animals with the lowest parent average in order to help identify which animals could receive beef semen or possibly be culled from the herd.

Table 1:

Genotyping strategy based on herd goals

Pedigree Data	Percentage to Cull	Percentage to Genotype (lowest group for PA)*
Available	30% or more	100%
	15 to 30%	50%
Missing	About 10%	30%
	More than 10%	100%

Genotyping Services & Prices

Medium Density (MD): $135 Standard SNP panel for genomic testing around the world. Analyzes over 50,000 SNPs to enable genomic enhanced evaluation with higher reliability than a traditional Parent Average.

Low Density (LD): $33 **NEW PRICE** LD Panel (parentage verification and genomic evaluation) is a lower cost testing option than the MD panel. Analyzes SNPs for a fraction of the cost of a MD test with the same increase in reliability.

Low Density Plus (LD Plus): **NEW PRICE** $33 Value-Added SNP Panel. This package includes the LD Panel (parentage verification and genomic evaluation) and diagnostic testing for BLAD, DUMPS and coat colour using one DNA sample.

Want to genotype your animal today?

Complete the Genotyping Request Form available on Holstein Canada's website – **www.holstein.ca** – under the following:

1. Animal Inquiry – open up your animal and the animal number will pre populate when you click genomic testing application; OR
2. Services tab / Genotyping / Genotyping Request Form

THERE ARE 2 SIMPLE WAYS TO SUBMIT A SAMPLE FOR GENOTYPING:

1. Hair by collecting 35 to 50 hair roots/follicles to ensure better test results
2. Tissue Sampling Unit by using the applicator and sample unit to collect a 3mm tissue sample directly from the animal's ear

In the following example, the producer has genotyped all of their animals, which means their genomic results follow a normal, or "bell-shaped" distribution. The highest point of the curve, or the top of the bell, represents the most common genetic values (average), while the other values are equally distributed around the average. This creates a downward-sloping line on each side of the peak representing the outliers of the herd, which have greater or lesser values than their average herd mates.

Image 1 depicts an example of breeding strategies in which the producer has divided their herd into five sections based on genetic metrics/merits. In a herd with a low replacement rate, the producer would want to cull the bottom group of animals as they produce less milk, are less functional and can have additional health and disease issues. If a herd had a high replacement rate, or the producer is expanding the herd, they could breed the bottom group to beef semen. This would allow the animals to produce milk without having offspring enter the herd.

The next lowest group would serve as embryo recipients. They too may cause constraints to the herd, but their breedings would result in an ET calf rather than their own offspring. The below average animals would be bred with conventional semen. These animals would likely have average production and average functional conformation. These animals' offspring would be average performing heifer or bull calves. The heifer calves would remain in the herd.

The above average group would be bred with sexed semen. This will result in more female offspring with high genetic values. These animals should have above average to superior milk production and functional conformation. These are the types of animals producers should strive for. The final group in this example includes animals with extremely high genetic values. If budget permits, the producer may want to flush these animals so their offspring make up a larger percentage of the herd. If flushed, the next generation of the herd will have higher genetic values, be more profitable and have increased longevity.

This strategy can also be applied to non-genotyped animals. Though the reliability of the genetic information will be lower, the genetic information available can be used to apply the same breeding strategy.

There are many benefits to genotyping which include: increased proof reliabilities at a very young age; making more accurate breeding and culling decisions; identifying recessive traits that have a negative impact on an animal's health and performance and parentage verification. It is also important to note that the benefits of increased reliability can only be maintained if producers continue to contribute data to the phenotypic performance collection (Classification & Milk recording). If you're interested in genotyping or learning more about your herd's potential, contact Holstein Canada toll free at 1-855-756-8300 or contact your local field service representative.

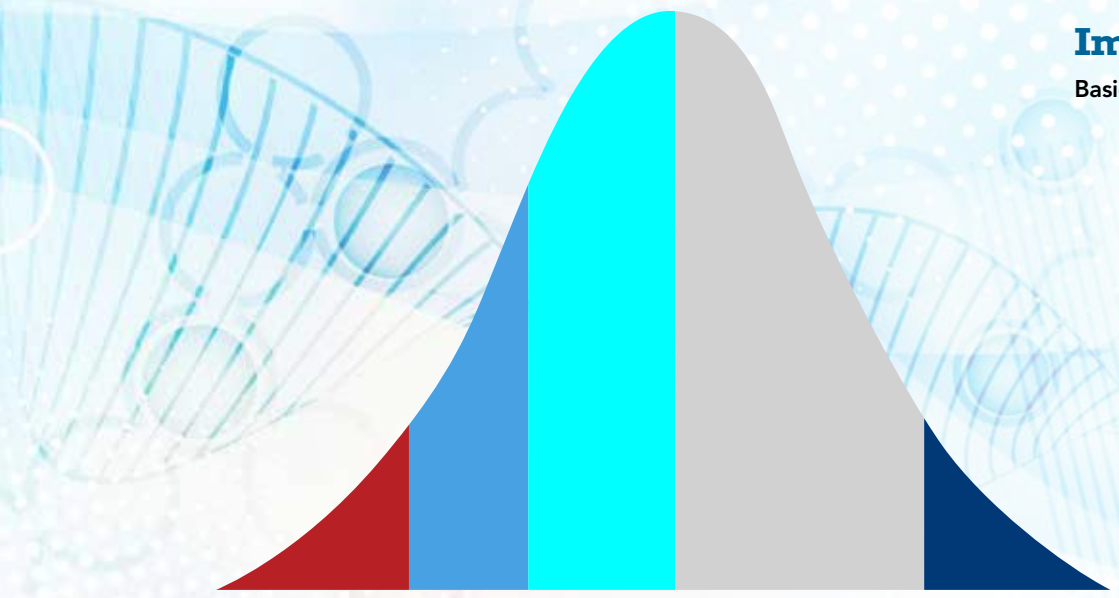


Image 1:

Basic bell-curve strategy

- Non-selected
- Embryo recipients
- Conventional semen
- Sexed semen
- ET or IVF amplification