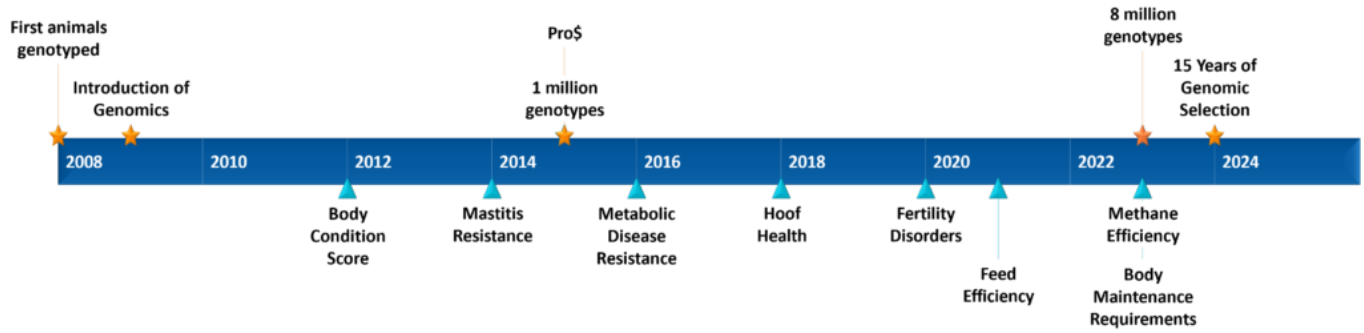
Celebrating 15 Years of Genomic Selection!

- August 13, 2024
- Genetic Progress

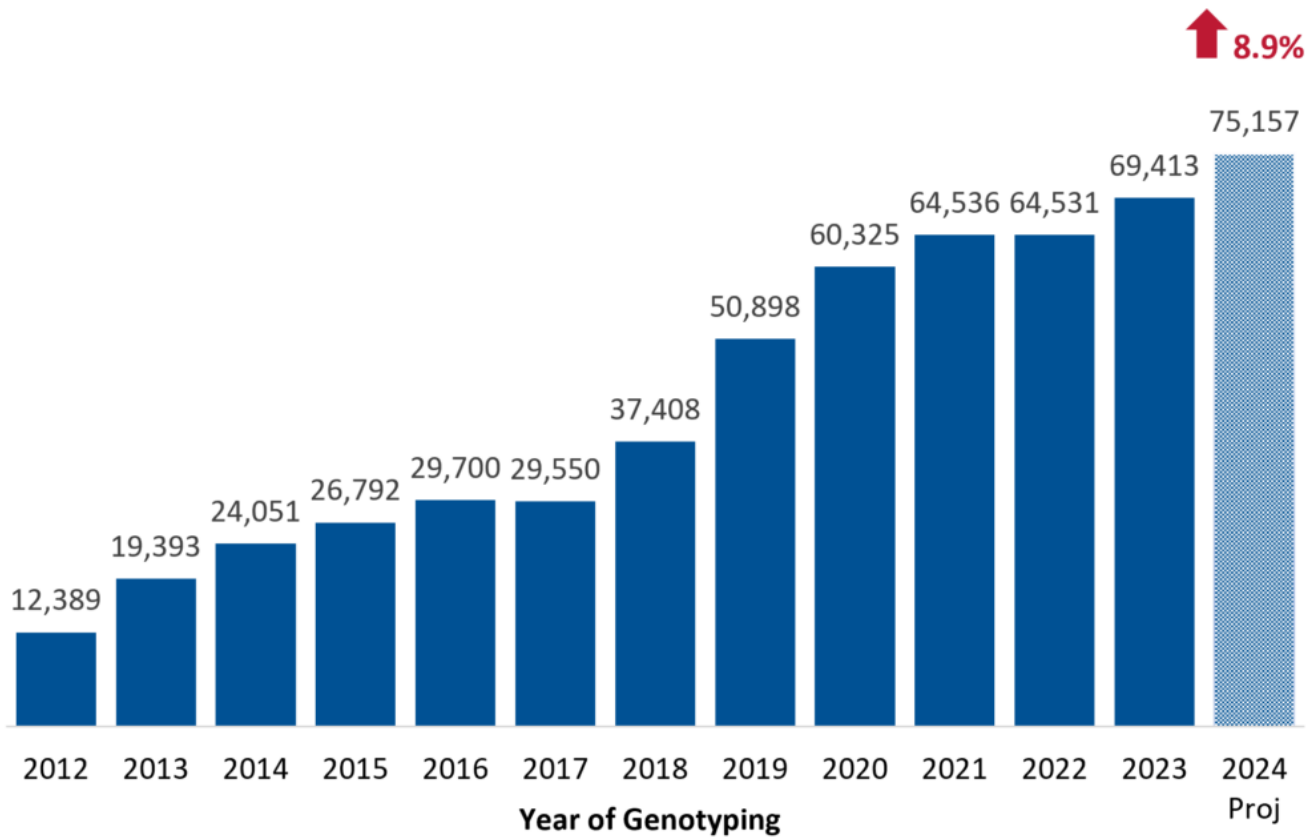
The August 2024 genetic evaluation release marks 15 years of genomics in Canada! Since this advancement to the Canadian dairy industry, breeding strategies have transformed through faster rates of genetic progress, enhanced genetic selection for a wider range of traits, accurate parentage identification, and the effective discovery and management of undesirable genes. Join us as we reflect on the milestones achieved and explore how genomics has shaped individual herds and the dairy industry into what it is today.



Genotyping Adoption

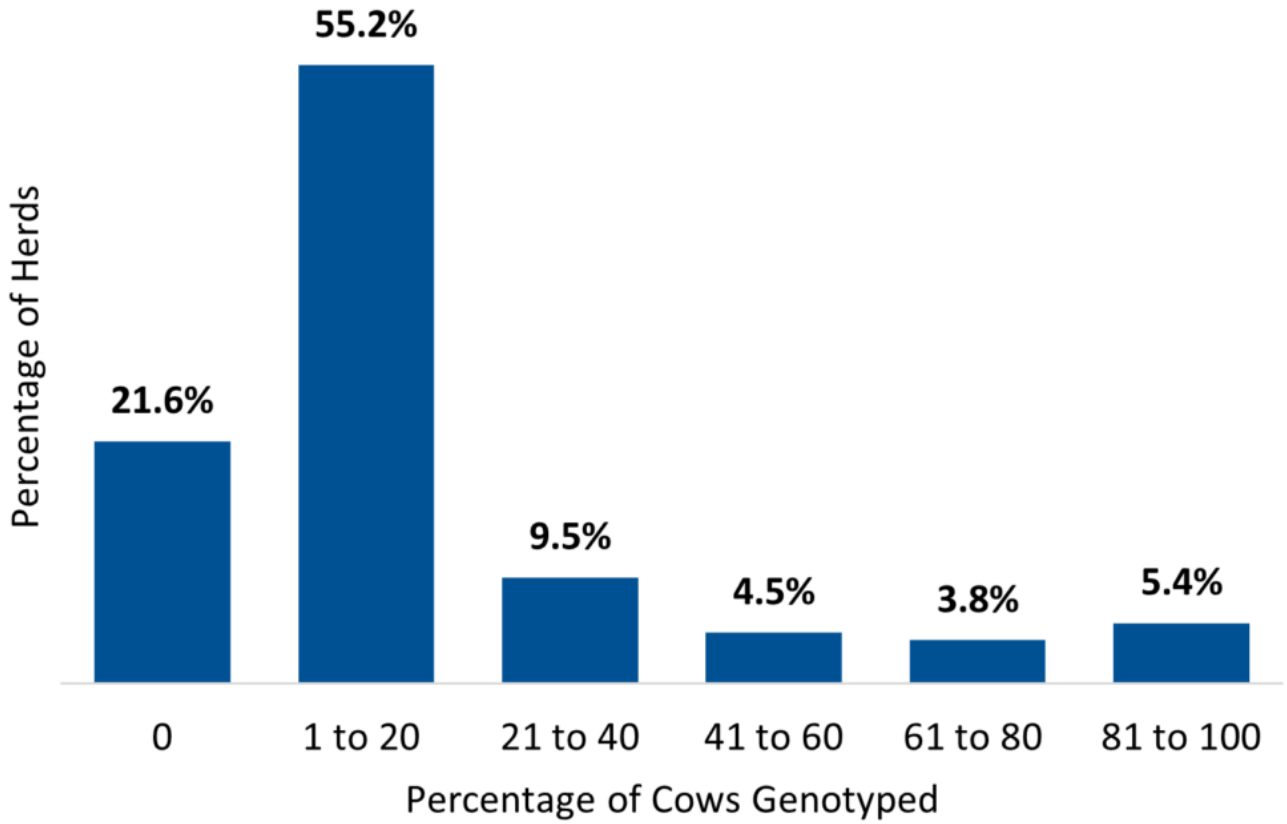
Since the first sires were genotyped in 2008, genotyping has cemented its place across the dairy industry. By 2015, the Lactanet database, which houses both national and international genotypes, reached a milestone of 1 million genotypes including both males and females. This number has continuously grown as genomics has become widely adopted as a selection, mating and herd management tool. Today, the database boasts over 8 million genotypes, a number which continues to grow at a rate of over 1.3 million annually. Looking specifically at the number of Canadian-born females in Figure 1, the genotyping trend has also steadily increased over time with 69,413 females genotyped in 2023. This number is projected to rise by 8.9% in 2024, indicating a growing recognition of the value of genomics in breeding programs. With an ever-growing database containing herd performance data and genotypes, dairy farmers can make more informed breeding decisions with accurate genetic evaluations for bulls and cows.

Figure 1: Number of Canadian-Born Genotyped Females



From a herd level, 78% percent of the herds enrolled on milk recording and type classification programs have embraced genotyping to some degree. Figure 2 illustrates that most herds have adopted a selective genotyping strategy, genotyping up to 20% of their heifers to better rank their top females and optimize on the return in investment. However, herds that have opted for more of a whole herd genotyping approach are able to replace Parent Averages for their young calves with genomic Parent Averages and eventually genomic Estimated Breeding Values (GEBVs). This can boost the reliability of evaluations by up to 40% leading to more accurate mating decisions and faster rates of genetic improvement. This is evident through the genotyping trends of the herds in the top LPI list. For example, the top 10 LPI Holstein herds in the April 2024 genetic evaluation release have, on average, genotyped 94% of their cows, compared to 15% in August 2009.

Figure 2: Distribution of Herds Based on Percentage of Cows Genotyped



Through heifer genotyping, farmers can not only identify which animals to invest in, but they can also more accurately manage the frequency of known undesirable genes (genetic conditions and haplotypes) within their herd. To date, the dairy industry has collaboratively identified, monitored, and reduced the prevalence of many undesirable genes in the population. This would not have been possible without the widespread adoption of genomic testing, which identifies cows and heifers that are known carriers to help avoid mating them to sires that are also known carriers. Additionally, numerous tools are now available to further manage and control the impact of these negative characteristics including AI mating programs, Compass, and new features in Lactanet's Inbreeding Calculator.

Novel Trait Advancements

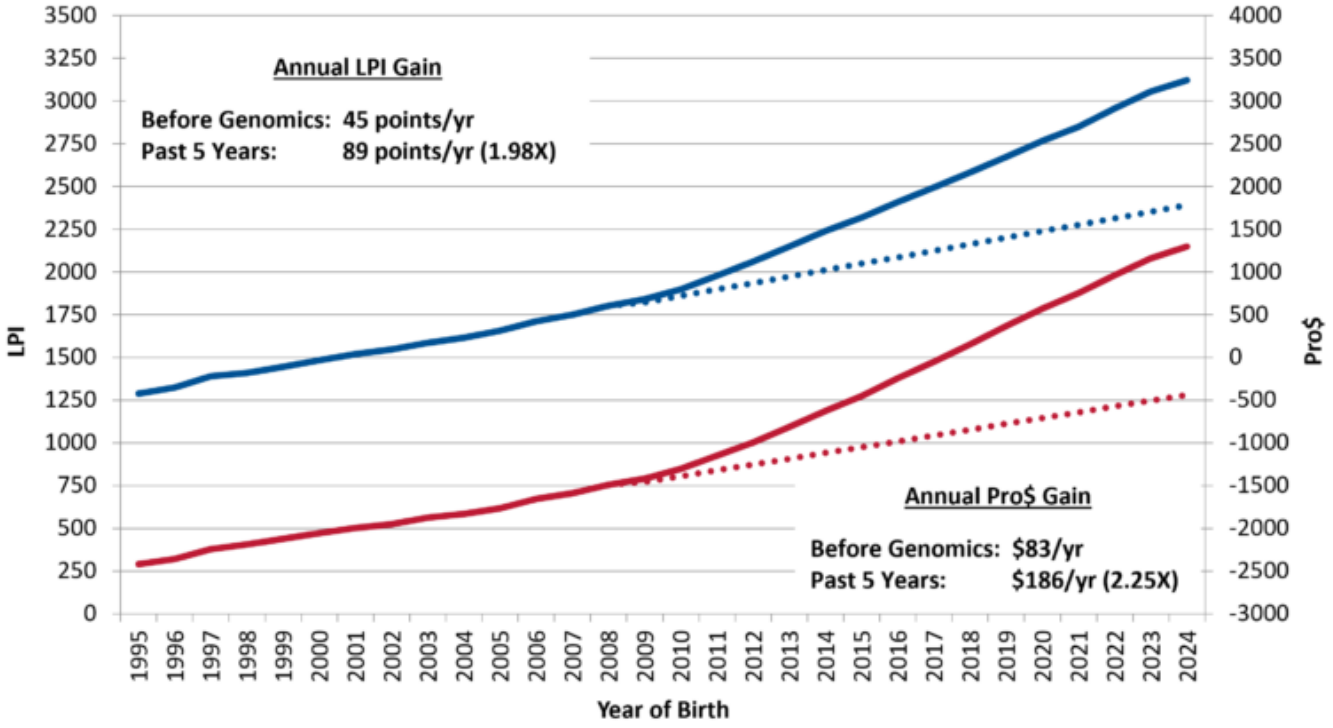
Another significant milestone realized through genomics is the development of genetic evaluations for novel traits including Mastitis

Resistance, Metabolic Disease Resistance, Hoof Health, and Fertility Disorders. With such evaluations we can now not only use genomic testing to breed for cows that produce even more milk, but also ones that excel in health and fertility. More recently, Canada also added Feed Efficiency, Methane Efficiency, and Body Maintenance Requirements to the list, leading to a more profitable and sustainable industry. Prior to genomics, these novel traits were too challenging to be recorded on a large enough scale. Genomics allows us to overcome this obstacle since higher accuracy levels can be achieved through the inclusion of DNA information in addition to daughter performance data. Today, Canadian dairy farmers have a well-balanced list of over 100 traits for identifying and selecting the best animals as parents of the next generation, boosting herd performance and farm profitability. As one might expect, the list will continue to grow as more traits are added, including Calf Health set to launch in 2025.

Genetic Gains

It is also commonly known that with genomics we have seen significant genetic gains in all traits, including the two national selection indexes, Lifetime Performance Index (LPI) and Pro$. As shown in Figure 3, before genomics, the annual gains in LPI and Pro$ for Holstein females was 45 points and $83, respectively. Since 2009, we have seen a consistent increase in the rate of genetic progress and in the past 5 years alone LPI improvements have nearly doubled to 89 points annually, while Pro$ gains have more than doubled reaching $186 per year. As depicted by the dotted line, these gains would not have been possible without the introduction and widespread adoption of genomics. Just think where we will be in the years to come!

Figure 3: Genetic Trends for Holstein Females



The Next Chapter

It is clear 15 years of genomics has brought with it several advancements to the Canadian dairy industry, facilitating faster rates of genetic progress and selection for a wider range of traits. As we celebrate this exciting milestone, we can't help but think what the next 15 years might bring. Whether it's more herd owners investing in genomic testing of their heifers or the introduction of exciting new traits, the continued integration of genomics will undoubtedly drive even greater improvements.

By Hannah Sweett, Ph. D.

Hannah discovered her passion for agriculture during her undergraduate degree at

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