

## Get Up To Speed - The Status of Genomics in Canada

With all the talk about genomics, it's easy to assume certain things; that the technology's increasing in adoption across breeds, that it improves accuracy, and that more females are being genotyped every year. But you know what they say about assuming! In this article we put data to assumptions to turn them into facts for the four dairy breeds with genomic evaluations in Canada.

### Reference Population and Gain in Reliability

When considering genotypes from both males and females across all breeds, the Canadian Dairy Network (CDN) database surpassed the one million mark in 2015! Genomic evaluations first require genotyped animals as a reference population, which can include proven sires as well as cows. Table 1 outlines the makeup of the December 2015 c reference population used in Canada for the four breeds that currently have genomic evaluations. Continuously adding new genotyped animals with performance data to the reference population maintains, and can even increase, the reliability of genomic evaluations.

Table 1 shows the Holstein reference population is five times larger than the next largest, which is Brown Swiss. The size of the Holstein reference population, combined with a larger amount of historical data on pedigrees and performance recording, allows the Holstein breed to see the largest gains in reliability with genomics (Table 2).

<b>Table 1: Reference Population Details</b>	<b>Holstein</b>	<b>Jersey</b>	<b>Brown Swiss</b>	<b>Ayrshire</b>
Bulls with an official LPI in Canada	8,040	421	224	589
Bulls with a MACE LPI (Foreign Proven)	17,528	3,642	5,584	120
Cows with an official LPI in Canada	N/A	1,270	182	1,839

In effort to increase the size of the Jersey, Ayrshire and Brown Swiss reference populations, genotyped cows are included. This has shown to improve the gain in reliability of genomic evaluations in these breeds. Generally, the rule of thumb is adding five genotyped cows with performance data to a reference population adds the same amount of information as adding one genotyped proven sire. Cows are not included in the same manner in the Holstein breed since research has revealed this only adds "noise" to genomic predictions when a very powerful male reference population already exists.

<b>Table 2: Gains in Reliability for LPI (%)</b>		<b>Holstein</b>	<b>Jersey</b>	<b>Brown Swiss</b>	<b>Ayrshire</b>
<b>Proven Sires</b>	Average Reliability of GLPI	88	76	79	74
	Reliability Gain with Genomics	4	9	4	2
<b>Young Sires</b>	Average Reliability of GPA LPI	66	52	53	44
	Reliability Gain with Genomics	31	22	19	9

At first glance, it's obvious that across all breeds, the gain in reliability with genomics is much greater for young bulls than proven sires (Table 2). As mentioned above, smaller gains in reliability are mainly associated with the size of the breed's reference population, which explains

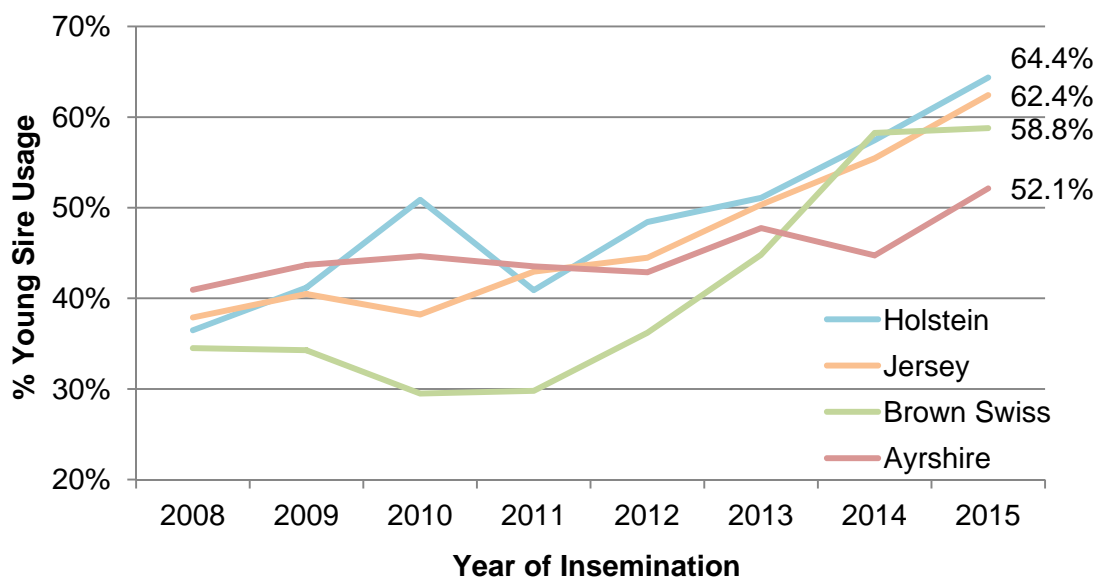
why reliability gains in the Ayrshire breed are the smallest. In addition, genomic evaluations have only been available for Ayrshires since December 2014.

After Holsteins and Jerseys, it's Brown Swiss young sires and heifers that experience the greatest gains in reliability with genomics. In April 2014, Canada joined the InterGenomics service offered by Interbull, which includes the exchange of genotypes for bulls in most countries with important Brown Swiss populations. Once participation in this service commenced, the Brown Swiss breed realized a major boost in reliability gains. Likewise, Canada and United States have an agreement with Denmark to share Jersey bull genotypes, which was established after the routine genotype exchange for Holstein bulls began between Canada, United States, Italy and United Kingdom. Table 1 indicates the majority of animals in the Holstein, Jersey and Brown Swiss reference populations are foreign proven sires, but they play an important role in the accuracy of the domestic genomic evaluations provided by CDN for these breeds.

## Young Sire Usage

How have gains in accuracy affected young sire usage in the four breeds with genomics? Figure 1 shows the trend in young sire market share since 2008. As expected, young sires are more heavily used in the breeds that have higher reliability genomic evaluations. Inseminations with young sire semen now account for over 60% of all breedings in the Holstein and Jersey breeds with the Brown Swiss breed not far behind at 58.8%. In Ayrshire, young sire usage has traditionally been at the 40-45% level, which has increased to 52.1% after introducing genomics in December 2014.

**Figure 1: Trend in Young Sire Market Share**



In terms of total number of inseminations, the top five most popular young sires in 2015 are listed in Table 3 below. We were please to see in most breeds the majority of the most popular young sires in Canada carry Canadian prefixes!

Table 3: Most Popular Genomic Young Sires in 2015				
	Holstein (>10,000 inseminations)	Jersey (>800 inseminations)	Brown Swiss (>300 inseminations)	Ayrshire (>800 inseminations)
1	Silverridge V Elude	Guimo Joel ET	Lime Rock Seasidebloom	Des Coteaux Revolution-ET
2	Silverridge V Wickham	Vermalar Bruce ET	Lime Rock Toledo	Forever Schoon Perfecter
3	Val-Bisson Doorman	Missiska Mackenzie ET	Scherma Blooming Biver	Kamouraska Bigstar-ET
4	Stantons High Octane	Verjatin Roadrunner ET	Lavage Brooklyn	D'Albanel Craftman-ET
5	Stantons Pulsar	Ahlem Ratcliffe ET	Jo-Dee Nemo Richard ET	Du Petit Bois Animate
6	Stantons Capital Gain	Covington McGee	Cozy Nook Twilight Twin	Marbrae Powerstroke
7	Lindenright Megawatt	Gladale Envoy	Holyland Turbo ET	Guimond Yorktown

## What About Genomic Testing Females?

While virtually all A.I. sires can be considered "genomic" since male testing is so widespread, adoption of female genomic testing has been slower. The number of Canadian females genotyped each year is listed in Table 4. Research projects encouraging the capture of female genotypes can lead to large jumps in a given year. For example, a cow genotyping project in 2013-14 in Ayrshires caused significantly more females to be genotyped than would be expected with natural adoption of the technology.

In the early years of genomic evaluations, the first females to be tested were generally bull dams or elite donor cows. Today most testing, yet still the biggest opportunity for growth, lies in testing heifer calves. Producers are now beginning to use genomic testing as a heifer management and mating strategy. In the future, testing of this segment of the population will certainly only continue to increase.

<b>Table 4: Number of Canadian Females Genotyped</b>				
<b>Year</b>	<b>Holstein</b>	<b>Jersey</b>	<b>Brown Swiss</b>	<b>Ayrshire</b>
2008	544	1		
2009	1,887	13	1	
2010	5,484	418	8	
2011	9,861	432	15	13
2012	11,862	559	38	74
2013	17,928	528	81	900
2014	22,135	659	110	1,325
2015	25,519	592	175	694
<b>Total</b>	<b>95,220</b>	<b>3,202</b>	<b>428</b>	<b>3,006</b>

The facts are in... assume no more! Genomics DOES increase accuracy, young sire usage IS continuing to grow, reference populations ARE experiencing constant expansion and the technology IS being adopted by more producers as a heifer management tool.

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