

Two Ways to Look at Accuracy for Genomic Young Bulls

Genomic evaluations significantly increase the accuracy of genetic predictions. But are we at a stage where genomic young bulls are equally as reliable as proven sires? Absolutely not! In 2013, usage of genomic young bulls tipped the scale at over 50% nation-wide. While usage of genomic young bulls has increased, confusion about future proof expectations remains. To better understand the accuracy of evaluations for genomic young bulls, let's look at this topic in two different ways, in terms of reliability and confidence ranges.

Reliability

The most common way the accuracy of a genetic evaluation is expressed is in terms of "Reliability," as a percentage. Reliability reflects the amount of information in the genetic prediction and can depend on:

- The Reliability of the evaluation of the parents
- The number of records available for cows or of daughters for sires
- The number of herds from which those records were collected
- The heritability of the trait
- Whether or not the animal has been genotyped

Reliabilities tell us how much confidence should be placed in a genetic prediction. They are also an indication of how much we can expect an evaluation to change over time, with higher reliabilities leading to less change. For example, we can expect the proof of a bull with a prediction of +2000 kg for Milk and Reliability of 95% to change less over time than a bull with the same proof, but a reliability of 70%.

Currently, there are four different groups of A.I. sires available for dairy producers to select. These groups have differing levels of Reliability, therefore, our expectations in terms of evaluation changes should differ for each category. The four groups include:

- 1) Genomic young bulls that are sons of a genomic young bull
- 2) Genomic young bulls that are sons of a progeny proven sire
- 3) Foreign progeny proven sires with a MACE evaluation in Canada
- 4) Sires with an official progeny proof in Canada

As mentioned above, genomic young bulls presently occupy over 50% of the semen market share in Canada. Among these bulls currently being offered, nearly 90% fall into Group 1 above. In other words, the vast majority of genomic young bulls available to producers are sired by genomic young bulls that are not yet progeny proven.

Table 1 reveals the average Reliability by trait for the four different groups of bulls. It comes as no surprise that progeny proven sires have higher reliabilities than genomic young bulls. It is important to note, however, that even within these two categories there are Reliability differences. For example, sires in Group 1 have a lower average Reliability (67% for LPI) than sires in Group 2 (72% for LPI), even though we consider both groups as genomic young bulls. Group 1 has the lowest average Reliability of the four groups meaning we can expect larger proof changes over time.

Also noteworthy is the fact that not all proven sires are equally as reliable. Genotyped foreign proven sires with a GMACE LPI in Canada have an average LPI Reliability of 83% and therefore, they are more likely to experience proof changes over time compared to bulls with an official domestic LPI, which average 90% Reliability for LPI.

Table 1. Average Genetic Evaluation Reliability by Trait - April 2014				
Trait	Genomic Young Bulls		Progeny Proven Sires	
	Group 1: Sire is a Genomic Young Bull	Group 2: Sire is Progeny Proven	Group 3: MACE LPI in Canada	Group 4: Official LPI
LPI	67	72	83	90
LPI - Production	70	76	87	94
LPI - Durability	65	71	81	88
LPI - Health & Fertility	59	66	75	83
Milk	71	76	88	95
Fat	71	76	88	94
Protein	70	76	87	94
Conformation	66	72	82	89
Mammary System	67	73	84	90
Feet & Legs	62	68	78	85
Dairy Strength	66	72	83	90
Rump	62	68	75	89
Herd Life	63	68	77	82
Somatic Cell Score	69	74	86	91
Lactation Persistency	57	64	68	91
Daughter Fertility	58	65	73	83
Milking Speed	56	63	68	85
Milking Temperament	54	61	66	84
Calving Ability	69	73	79	91
Daughter Calving Ability	57	64	72	81
Body Condition Score	62	69	80	90
Average:	64	70	79	89

Confidence Ranges

Another way to convey accuracy, and the associated risk of change, is by using Confidence Ranges as displayed in Table 2. Confidence Ranges are useful because they can provide a realistic expectation of the magnitude of change that may affect a bull's genetic predictions. Again, as we move from left to right among the four groups of bulls, the range of change decreases thanks to higher average Reliability.

Recall the example from above where we had two bulls with the same proof of +2000 kg for Milk, but one with a Reliability of 70% (Bull A) and another with a Reliability of 95% (Bull B). Bull A is from Group 1 and Bull B is from Group 4. According to the Confidence Range table below, we would expect that 90% of the time:

- Bull A's proof will be within ± 680 kg of 2000 kg (between 1320-2680 kg)
- Bull B's proof will be within ± 280 kg of 2000 kg (between 1720-2280 kg)

Table 2. Theoretical 90% Confidence Range by Trait Based on the Average Reliability of the Genetic Evaluation for Different Groups of Sires				
Trait	Genomic Young Bulls		Progeny Proven Sires	
	Group 1: Sire is a Genomic Young Bull	Group 2: Sire is Progeny Proven	Group 3: MACE LPI in Canada	Group 4: Official LPI
LPI	± 375	± 350	± 270	± 210
Milk	± 680	± 620	± 440	± 280
Fat	± 27	± 24	± 17	± 12
Protein	± 20	± 18	± 13	± 9
Somatic Cell Score	$+0.25$	± 0.23	± 0.19	± 0.16
Conformation	± 5	± 5	± 4	± 3
Herd Life / Daughter Fertility	± 5	± 5	± 4	± 3
Calving Ability	± 6	± 5	± 5	± 3

The largest potential change downward is associated with Group 1, while the smallest is associated with Group 4. Likewise, the greatest potential for reward is associated with Group 1. It is for this reason producers are urged to spread their risk by using a team of genomic young

bulls in order to manage the higher risk and larger magnitude of change. In addition, expectations must be realistic – genomic young bulls in Group 1 are going to experience more change than domestic progeny proven sires in Group 4!

As is the case with genomic young bulls worldwide, genomic evaluations tend to be overestimated to some degree. CDN geneticists are actively researching and implementing methods to decrease sources of bias that lead to this overestimation. The goal is to provide Canadian producers with the most accurate and stable evaluations possible. Information presented in this article is intended to help producers understand the risks associated with using different bulls in order to help them have realistic expectations about proof results, and ultimately, help them make the best decisions for the goals of their operation.

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