Official Genetic Evaluations for Body Condition Score

After years of research and development, Canadian Dairy Network (CDN) is ready to launch official genetic evaluations for Body Condition Score (BCS) in all dairy breeds, effective December 2012. The intent of this article is to outline the calculation methodology, publication criteria and interpretation of bull proofs for Body Condition Score in Canada.

Genetic Evaluation Methodology

In Canada, the multi-breed classification program offered by Holstein Canada for all dairy cattle breeds included the assessment of Body Condition Score starting in June 2006. To-date, this represents a total of over 535,000 first lactation records for Holsteins, over 13,000 for both the Ayrshire and Jersey breeds and proportional counts for the other dairy breeds. Genetic evaluations for BCS are estimated similarly to other traits recorded as part of the Canadian classification system. The genetic evaluation model accounts for the age of the cow when appraised as well as her stage of lactation and the effects of herd, round and classifier. The estimated heritability of BCS is 24% for Holstein, 19% for Ayrshire, 18% for Jersey and similar values for other breeds. Body Condition Score reflects the animal's energy balance status and research has clearly shown its association with improved female fertility, longevity and disease resistance.

Publication Criteria

Genetic evaluations for Body Condition Score will be published for progeny proven sires once they surpass defined publication requirements. For Holsteins, official status is reached once at least 20 first lactation daughters are appraised in at least 10 different herds and the Reliability of the traditional proof, excluding any possible contribution from genomics, is at least 60%. For Ayrshire and Jersey bulls the minimums are 15 daughters, 10 herds and 55% Reliability while for all other breeds they are 10 daughters, 5 herds and 40% Reliability.

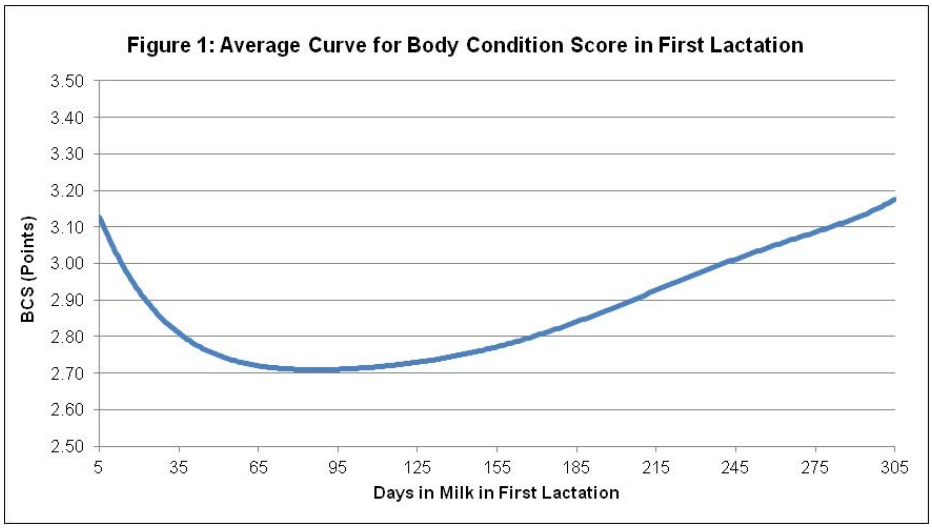
Since recording of BCS commenced in 2006, many older progeny proven sires in Canada will not qualify for receiving an official Body Condition Score proof. For example, in the Holstein breed, of the 8,516 progeny proven bulls with an official LPI in August 2012, a sub-group of 3,354 (39%) qualify for an official BCS proof. Of importance, however is the fact that all Top 100 LPI bulls qualify for an official BCS proof so future selection for this trait is possible.

As will all other evaluated traits in Canada, CDN will also compute and publish genomic evaluations for BCS in the Holstein, Ayrshire, Jersey and Brown Swiss breeds starting with the December 2012 release. Gains in accuracy due to genomics are expected to be lower for BCS compared to other traits given the lower number of progeny proven sires with an official proof for inclusion in the reference group. In addition, MACE evaluations for BCS will become available on the Canadian scale starting April 2013, at which time the reference group for genomic evaluation estimation for BCS could include genotyped foreign sires with a BCS proof in another country.

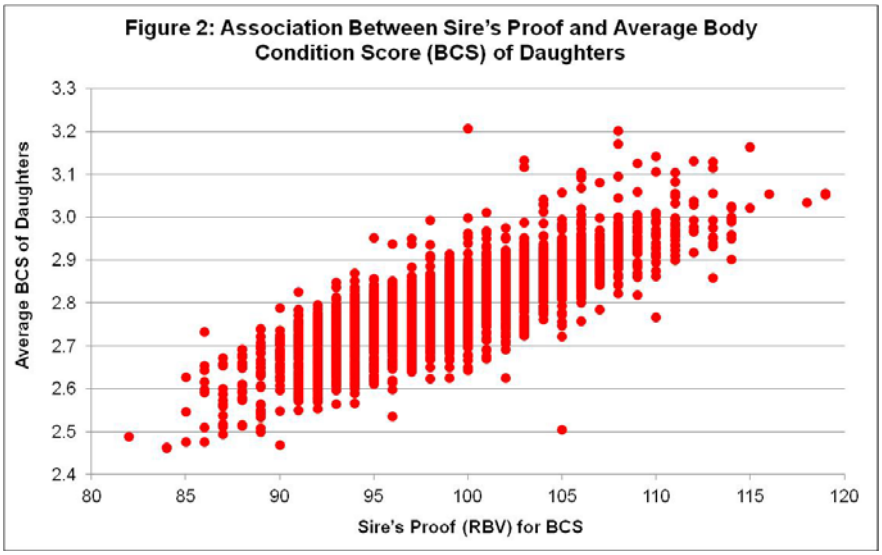
Proof Expression and Interpretation

Figure 1 presents the typical curve for Body Condition Score in first lactation. Cows have more conditioning at the time of calving, which is lost over the course of the first few months in lactation due to a negative energy balance, and then it is gradually built up again as the lactation progresses. Although the shape of this typical BCS curve is biologically desired, research has shown that an upward shift of the entire curve in first lactation is optimal. The availability of bull

proofs for Body Condition Score allows for selection to raise the average BCS at first calving and when they are in peak production. This selection goal is expected to improve fertility, reduce the incidence of disease and lead to a longer productive life.



Since BCS is considered as one of the functional traits published in Canada, genetic evaluations for this trait are expressed as Relative Breeding Values (RBV) and they will be displayed in that manner on the CDN web site. The scale of expression generally varies from 85 for bulls with daughters that generally have very "Low" scores for body condition to 115 or higher for bulls with daughters that have "High" scores. An average bull in any breed will have a rating of 100. In general, since the breeding goal is to increase the average BCS in first lactation, bulls rated over 100 are more desired. Figure 2 shows the relationship between a sire's BCS proof and the average BCS of their daughters.



Given the proof expression as Relative Breeding Values, it is useful to understand how a sire's evaluation translates into expected average daughter appraisals for Body Condition Score, which is provided in Table 1. For a bull with an average proof of 100, daughters are expected to average a score of 2.81 for body condition across the entire lactation. At specific points in the lactation curve, this translates to scores of 3.13, 2.71 and 3.10 at 5, 85 and 280 days in milk (DIM), respectively. As the sire's proof increases towards 115, the average BCS across the lactation and at each specific point through the lactation also increases, while the reverse is true for bulls rated less than 100.

Table 1: Expected Average Body Condition Score (BCS) for Daughters in 1st Lactation and at Specific Days in Milk Based on Sire's Proof				
Sire Proof (RBV)	Expected Average BCS of Daughters			
	1st Lactation	5 days in milk	85 days in milk	280 days in milk
115	3.03	3.35	2.93	3.32
114	3.01	3.33	2.91	3.30
113	3.00	3.32	2.90	3.29
112	2.99	3.30	2.88	3.27
111	2.97	3.29	2.87	3.26
110	2.96	3.27	2.86	3.24
109	2.94	3.26	2.84	3.23
108	2.93	3.24	2.83	3.22
107	2.91	3.23	2.81	3.20
106	2.90	3.22	2.80	3.19
105	2.88	3.20	2.78	3.17
104	2.87	3.19	2.77	3.16
103	2.85	3.17	2.75	3.14
102	2.84	3.16	2.74	3.13
101	2.82	3.14	2.72	3.11
100	2.81	3.13	2.71	3.10
99	2.80	3.11	2.69	3.08
98	2.78	3.10	2.68	3.07
97	2.77	3.08	2.67	3.05
96	2.75	3.07	2.65	3.04
95	2.74	3.05	2.64	3.03
94	2.72	3.04	2.62	3.01
93	2.71	3.03	2.61	3.00
92	2.69	3.01	2.59	2.98
91	2.68	3.00	2.58	2.97
90	2.66	2.98	2.56	2.95
89	2.65	2.97	2.55	2.94
88	2.63	2.95	2.53	2.92
87	2.62	2.94	2.52	2.91
86	2.60	2.92	2.50	2.89
85	2.59	2.91	2.49	2.88

Summary

Canadian Dairy Network (CDN) has been responsible for dairy cattle genetic evaluations in Canada for over 17 years. An associated mandate is the investment of industry funding in research of high priority to benefit Canadian producers and industry partners. In recent years, much effort has been placed in the development and improvement of genomic evaluations for enhanced dairy cattle improvement. Simultaneously, however, it is important to improve traditional genetic evaluation systems and develop new systems for novel traits of importance. After years of research, Canada will have official genetic/genomic evaluations for Body Condition Score in all dairy breeds starting December 2012, which will undoubtedly prove to be a valuable asset in the years ahead.

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Date: November 2012