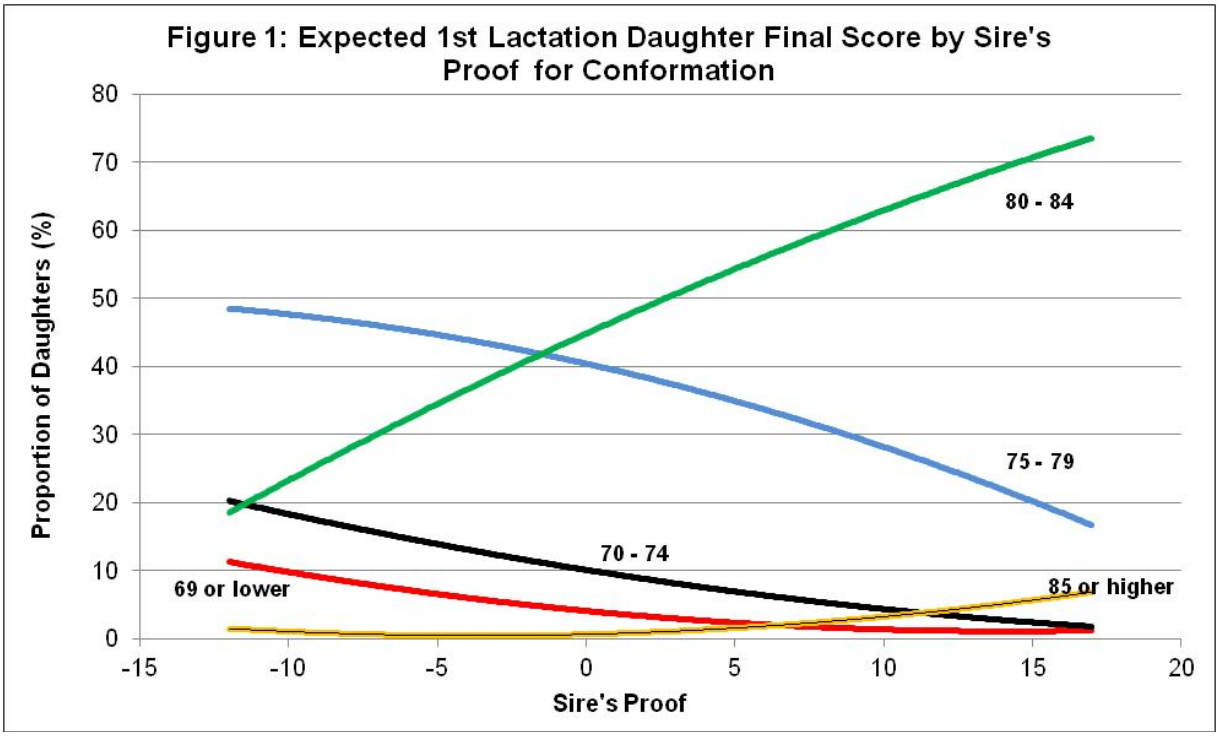
Relating Genetics to Performance for Type Traits

Canadian dairy producers well understand the role of genetics and selection strategies for increasing farm profitability. Investing in genetics, including participation in breed improvement programs such as herdbook registration, milk recording and type classification, have long term benefits that accumulate from generation to generation. The single most important factor affecting the rate of genetic gain in a dairy herd is the selection of sires available for artificial insemination. Using superior sires for traits of importance translates into better performance of their daughters in herds. The purpose of this article is to quantify the expected differences in first lactation classification scores for type traits depending on the genetic evaluation of their sire.

A recent study at Canadian Dairy Network (CDN) examined the average first lactation classification scores for daughters of over 1,600 young bulls that became progeny proven in the last five years. As expected, the Conformation proof for these bulls ranged from very negative to very positive, usually covering the entire scale from -15 to +15 on a trait by trait basis. The analysis was aimed at quantifying the specific difference in average daughter scores from superior sires compared to poorer ones.

Figure 1 depicts the relationship between a sire's genetic evaluation for Conformation and the expected distribution of their daughters when classified in first lactation. In the chart, each line refers to a range in final score, namely 69 or lower, 70-74, 75-79, 80-84 and 85 or higher. As a sire's Conformation proof increases from significantly negative to the elite level of +15 or higher, the proportion of daughters scoring 80 to 84 points (Good Plus) increases from 20 to 70 percent. At the same time, the proportion of daughters scoring 75 to 79 points in first lactation decreases from 50% to below 20%. In general, above average sires (i.e.: proof greater than 0) produce an increasing proportion of daughters scoring Good Plus and Very Good compared to those classifying between 75 and 79 points or lower.



The adjoining table provides details of the association between a Holstein sire's proof and the expected average classification score of daughters in first lactation for each trait assessed by classifiers in Canada. For example, sires rated +10 for Conformation produce daughters that average 79.9 points and 66% Good Plus & Better when classified in first lactation. Sires with a breed-average proof of 0 yield first lactation daughters averaging 78.1 points with 45% scoring Good Plus & Better.

Expected Average Daughter Classification Scores by Trait Based on Sire's Proof							
	Sire's Proof for Trait of Interest						
	15	**10**	**5**	**0**	**-5**	**-10**	**-15**
OVERALL FINAL SCORE:							
% Good Plus & Better	77	66	56	45	35	25	14
Conformation	80.8	79.9	79.0	78.1	77.2	76.3	75.4
SCORECARD TRAITS:							
Mammary System	81.7	80.6	79.5	78.5	77.4	76.3	75.2
Feet & Legs	80.7	79.7	78.7	77.8	76.8	75.8	74.8
Dairy Strength	82.9	82.0	81.2	80.3	79.4	78.6	77.7
Rump	83.4	82.4	81.4	80.3	79.3	78.2	77.2
LINEAR TRAITS:							
Rump Angle	5.9	5.5	5.2	4.8	4.4	4.0	3.7
Pin Width	6.6	6.2	5.9	5.6	5.3	4.9	4.6
Loin Strength	6.5	6.3	6.0	5.7	5.4	5.2	4.9
Udder Depth	6.2	5.8	5.4	5.0	4.6	4.3	3.9
Udder Texture	6.0	5.8	5.5	5.2	5.0	4.7	4.4
Median Suspensory	6.6	6.3	6.1	5.8	5.6	5.3	5.1
Fore Attachment	5.8	5.5	5.1	4.8	4.5	4.1	3.8
Fore Teat Placement	5.9	5.6	5.3	5.1	4.8	4.5	4.3
Rear Attachment Height	7.3	7.0	6.7	6.4	6.0	5.7	5.4
Rear Attachment Width	5.8	5.5	5.2	4.9	4.6	4.4	4.1
Rear Teat Placement	7.1	6.8	6.6	6.3	6.1	5.9	5.6
Teat Length	5.7	5.5	5.2	5.0	4.7	4.5	4.2
Foot Angle	5.9	5.7	5.5	5.3	5.1	4.9	4.7
Heel Depth	5.7	5.5	5.4	5.2	5.0	4.9	4.7
Bone Quality	6.8	6.4	6.1	5.7	5.4	5.0	4.7
Rear Legs Side View	6.0	5.7	5.5	5.2	5.0	4.7	4.5
Rear Legs Rear View	5.7	5.5	5.2	5.0	4.7	4.5	4.2
Stature	7.0	6.5	6.0	5.5	5.0	4.6	4.1
Height at Front End	5.7	5.5	5.3	5.1	4.9	4.6	4.4
Chest Width	5.7	5.5	5.3	5.0	4.8	4.6	4.4
Body Depth	6.7	6.4	6.1	5.9	5.6	5.3	5.0
Angularity	6.0	5.7	5.5	5.2	4.9	4.7	4.4

The table includes the expected average daughter classification scores for each of 22 linear type traits as well as the major scorecard traits; Mammary System, Feet & Legs, Dairy Strength and Rump. Although genetic evaluations for each trait are standardized to range approximately from -15 to +15, the expected average daughter scores associated with the range in sire proofs can vary substantially across traits. Among the major scorecard traits, the range in expected average daughter classification for sires rated +15 compared to -15 is highest for Mammary System and lowest for Dairy Strength. For linear traits, those that have the largest spread in expected daughter scores for +15 versus -15 sires include Stature (2.9 points), Udder Depth (2.3 points), Rump Angle (2.2 points) and Bone Quality (2.1 points). On the other end of the spectrum, Heel Depth, Foot Angle, Chest Width and Height at Front End have the lowest range in expected daughter performance across the scale of sire proofs, meaning they are more difficult for achieving rapid progress in the herd and/or breed in general.

Summary

Since genetic evaluations for type traits in Canada are expressed on a standardized scale with an approximate range from -15 to +15 and a breed average of 0, it is useful to quantify the expected average daughter performance on a trait by trait basis, depending on the sire's proof. A recent study at CDN achieved this objective and developed a detailed table as a tool for translating sire proofs for type traits into average first lactation classification scores of their daughters.

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