A First Step to Improved Hoof Health: Digital Dermatitis

In December 2017, Canada will join the handful of leading countries worldwide that have national genetic evaluations aimed at directly improving hoof health. This success story has resulted from various research initiatives since 2009 culminated by a national project led by the University of Guelph and then the development of genomic evaluations for Digital Dermatitis in Holsteins.

Collection of Data from Canadian Farms

Dairy producers recognize lameness as the top animal health and welfare issue with an important economic impact at the farm level. In an effort to provide producers with better management information, including genetic evaluations, the Hoof Supervisor System[TM] was selected for hoof trimmers across Canada to collect detailed data related to 19 hoof lesions found in 12 regions on each of the four hoofs. This data collection system includes a flow of data from each hoof trimmer to the national database at Canadian DHI and then to Canadian Dairy Network (CDN).

One of the most important hoof lesions recorded is digital dermatitis, which has an incidence rate of 18% among cows presented to the hoof trimmers and a heritability of 8%. For this reason, CDN has developed a genetic and genomic evaluation system specifically aimed at improving the resistance to digital dermatitis in Holsteins. The first evaluations from Digital Dermatitis (DD) will be officially published in December 2017 based on 300,000 records collected on 125,000 cows in 1,200 herds by 70 hoof trimmers. Producers interested in this new trait for herd management and genetic improvement should encourage their hoof trimmer to contribute data to the national data collection system and work with their representative from CanWest DHI or Valacta to have their herd data flow through to CDN.

Genetic Evaluations

For Digital Dermatitis (DD), CDN introduced a new state-of-the-art methodology to calculate the genetic evaluation for each animal, which is automatically a genomic evaluation for genotyped animals. For sires to receive an official progeny proof for Digital Dermatitis, they must have hoof trimmer data reported for daughters in at least five different herds and a minimum Reliability of 70% after including any genomic information available. Given the volume of data currently available, over 2,500 Holstein sires surpass these requirements. This means that roughly two-thirds of the Top LPI proven sires will initially have an official progeny proof for Digital Dermatitis. On the other hand, every genotyped sire, both progeny proven or not, will receive a genomic evaluation for this trait and the Reliability for most genomic young bulls in A.I. will exceed 60%. Average Reliability values are higher for progeny proven sires, surpassing 80% for those with an official LPI in Canada and averaging 67% for those with a MACE LPI in Canada. All females will also receive an evaluation for Digital Dermatitis and Reliability levels will generally surpass 60% for genotyped heifers and cows.

As for all functional traits, the average DD proof for sires is set to 100. Sires with a higher Relative Breeding Value (RBV) are expected to have a higher proportion of healthy daughters, as shown in Figure 1. On average, sires with a rating of 100 are expected to have 82% of their daughters without any case of digital dermatitis and this percentage increases by 1% for every one point increase in RBV for Digital Dermatitis. With a heritability of 8%, these evaluations provide an opportunity for sire selection to reduce the incidence of digital dermatitis in your herd in conjunction with good herd management practices associated with improved hoof health.

Figure 1: Expected Percentage Healthy Daughters by Sire's Proof for Digital Dermatitis
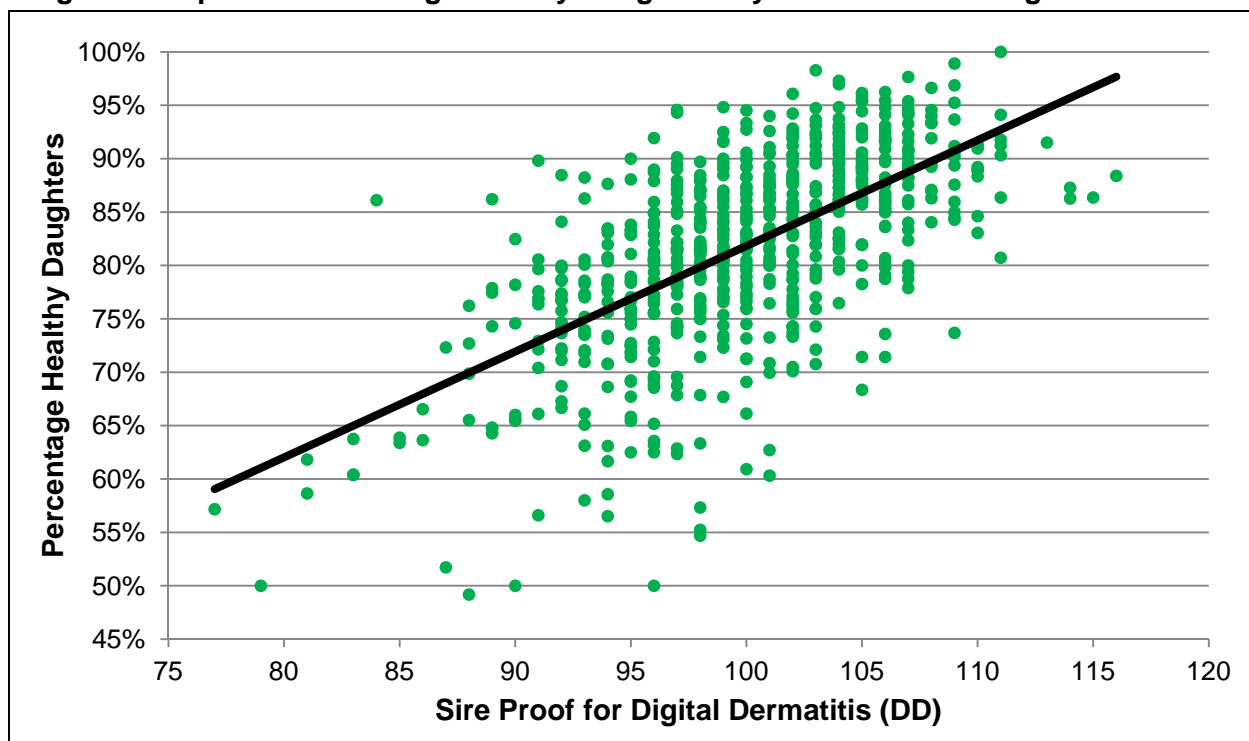
Association with Other Traits

The classification program provided by Holstein Canada for all dairy breeds has continuously placed significant emphasis on the Feet & Legs section of the scorecard, currently at 28%. In addition, the importance of each of the descriptive linear traits associated with this section has been primarily determined based on their relationship to mobility and locomotion. Figure 2 shows the proof correlations between the new Digital Dermatitis evaluations and traits associated with feet and legs. While all of these correlations are in the desired direction, it is Heel Depth and Rear Leg Rear View that are the two linear traits most associated with DD, having correlations of 35% and 22% respectively. These traits are also the two most important in terms of their contribution to the overall score for Feet & Legs. Given the correlations in Figure 2, past selection for Feet & Legs and overall Conformation has also indirectly helped to reduce the incidence of digital dermatitis in Canadian dairy herds.

**Figure 2: Proof Correlations with Digital Dermatitis**
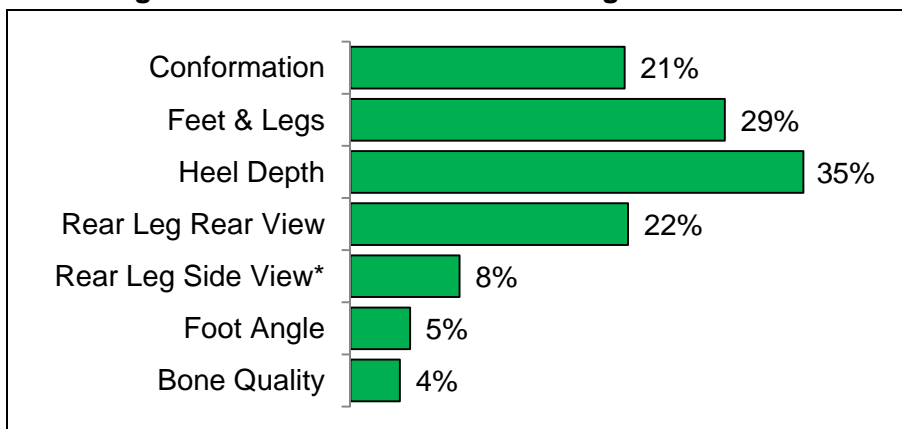
* Rear Leg Side View has an intermediate optimum so this correlation is the square root of the R^2 of the quadratic prediction equation.

Figure 3 includes traits that have a proof correlation with Digital Dermatitis (DD) of at least 10%, with all values being in the desired direction. Of particular interest is the fact that LPI and Pro$

have the highest correlations with DD, exceeding 40%, which means that Canadian breeders have been indirectly selecting for improved hoof health for several years. In terms of specific traits that have the strongest correlation with DD, in addition to those related to feet and legs previously mentioned, it is Fat Yield (36%), Protein Yield (33%), Milk Yield (27%) and Herd Life (27%) that surpass the 25% level. Low Somatic Cell Score evaluations, which are desirable, Lactation Persistency and Conformation also have interesting correlations with DD, just above 20%. Thanks to these positive correlations with traits that have been highly important for genetic improvement in the past, it can be expected that the vast majority of top sires for LPI and Pro$ will also be breed average or better for Digital Dermatitis. Knowing those sires that are below breed average for DD will help make better mating decisions with the aim of continuing to improving hoof health on Canadian dairy farms.

Figure 3: Traits with a Proof Correlation of at least 10% with Digital Dermatitis
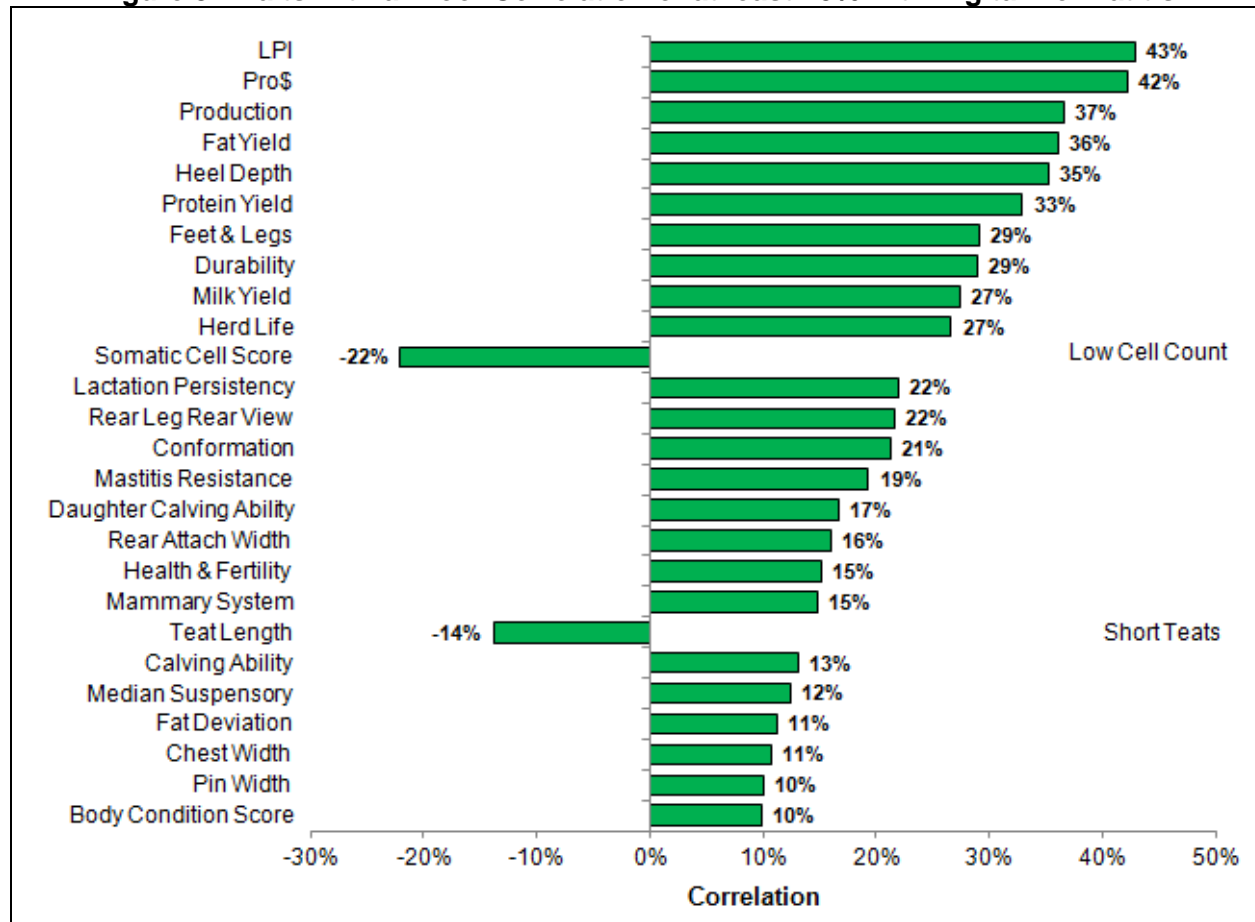
Summary

Canada will have its first genetic and genomic evaluations for Digital Dermatitis (DD) in December 2017, which is the first step towards the direct genetic improvement of hoof health in Canadian Holsteins. Dairy producers across Canada should encourage their hoof trimmer to contribute data for their herds to the national collection system in an effort to have more hoof health data, for digital dermatitis and other hoof lesions of importance, contribute this new genetic improvement tool. The new sire proofs for DD are expressed as Relative Breeding Values (RBV) and each increase of 5 points translates to an expected 5% reduction in the incidence of digital dermatitis. Thanks to positive correlations with LPI, Pro$ and several traits of importance, indirect selection for improved hoof health has already occurred in Canadian dairy herds.

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