



# Disease control tool

## Selecting cattle identified as having superior overall disease resistance may contribute to fewer and less severe clinical mastitis cases in your herd

**W**hen you select animals identified as having superior overall disease resistance for your dairy herd, you are also likely to have cows that get fewer and less severe cases of clinical mastitis, according to a recent study done in collaboration with the Canadian Bovine Mastitis Network.

For the immune response study, University of Guelph researchers used a tool they had developed to identify cattle that are genetically superior when it comes to resisting disease threats, the patented High Immune Response (HIR) test system. It was developed by Guelph's Dr. Bonnie Mallard and her research team to identify cows less susceptible to disease.

The HIR test was used on 690 cows from 58 herds. Cow, herd and regional differences in immune responsiveness were found. The cows were thus classified based on their immune response.

Using estimated breeding values, cows were classified as high, average or low responders. The HIR cows had a significantly lower clinical mastitis incidence rate compared to other cows in the herd. As well, the HIR cows had 17 cases of mastitis per 100 cows, compared to low responders, which had 31 cases. High immune response cows also had fewer cases of severe mastitis compared to the other cows in the herd. The study demonstrates breeding for HIR in your herd may decrease the occurrence and severity of mastitis.

In addition, positive associations



Cows with optimal immune responses have reduced disease incidence, improved milk and colostrum quality, and better respond to vaccination.

### High immune response cows are naturally immune

Identifying HIR cows in a herd is safe, fast and effective. Other benefits:

- Lower disease occurrence and severity
- Reduced treatment and veterinary costs
- Increased response to vaccines
- Increased colostrum quality
- Calves as young as two months can be tested
- Animals only need to be tested once in a lifetime
- Testing is safe and does not interfere with any other diagnostic testing
- Cost benefit analysis show significant savings to producers who identify HIR cows in their herd

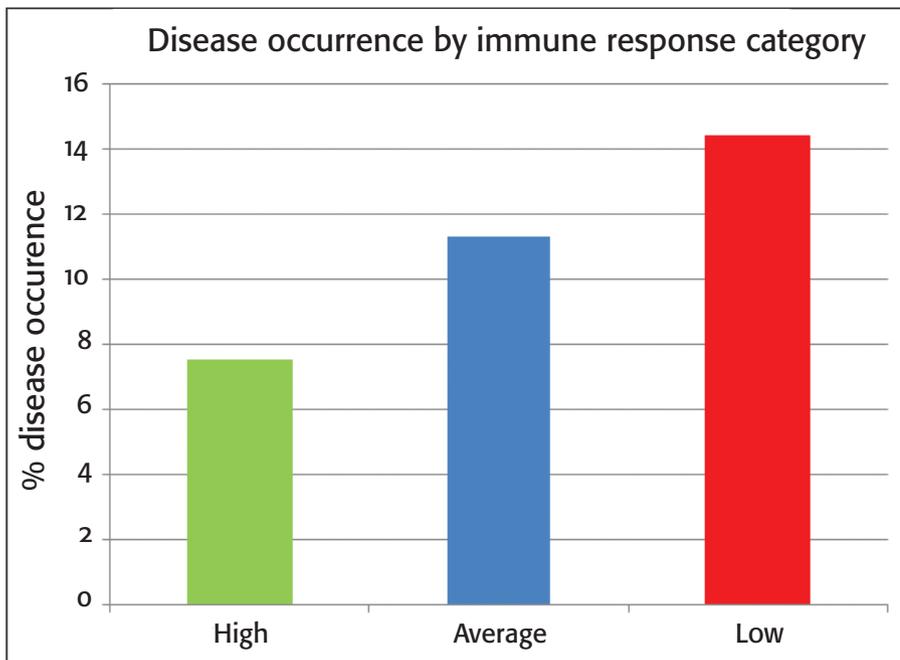
For more information on HIR technology, contact Dr. Bonnie Mallard (519) 829-4120, ext. 54736 or [bmallard@ovc.uoguelph.ca](mailto:bmallard@ovc.uoguelph.ca).

A special thank you to our partners Semex Alliance and CanWest DHI.

were found with frequency of first service to conception and several herd life measures. This may indicate these reproductive and longevity traits would improve with genetic selection for enhanced immune response.

Mallard's team has found cows with optimal immune responses, or HIR cows, have a reduced incidence

of disease, improved milk and colostrum quality, and respond better to vaccination. In fact, HIR cows are 30 to 60 per cent less likely to have mastitis, metritis, displaced abomasums, retained fetal membrane and test positive for Johne's disease. These findings could benefit your herd's health, saving you money in costly disease



Graph shows percentage of cows classified as high, average and low responders.

treatments and management.

The HIR system is a 15-day test that requires three farm visits. Cows are immunized with inert test an-

tigens to measure their ability to mount immune responses to a health threat. The procedure takes about five minutes per cow. The antigens are

certified to not interfere with other diagnostic tests and require no milk withdrawal time. This was done in compliance with Canadian Food Inspection Agency guidelines.

Two blood samples are collected, one on day 0 and another on day 14. A skin test is performed on days 14 and 15. Both immune responses are critical in protecting micro-organisms commonly found in the environment, which could potentially cause disease. Blood samples measure antibody-mediated immune responses (AMIR), while the skin test indicates cell-mediated immune responses (CMIR).

Multiple studies in dairy cows and other species have found the immune response traits are heritable—25 per cent of the variation in AMIR and CMIR is attributed to a cow's genetics. Breeding for overall immune response may protect against many diseases, since AMIR and CMIR also defend against diverse micro-organisms.

The researchers estimate breeding for enhanced immune response to improve broad-based disease resistance may be more effective than breeding for resistance to a particular disease.

The HIR test also was performed on about 300 bulls in Ontario and Quebec. Significant genetic variation in these traits was found, indicating it is possible to identify HIR sires. Using sire genetics to improve immune response is proving beneficial. Since sires, as well as dams and calves, can be tested for these heritable immune response traits, the HIR technology can be used as a breeding and management tool to improve herd health.

### Genomic selection a step forward

Genomics has revolutionized dairy industry breeding practices. Genomic selection has significantly increased the rate of genetic gain and allowed inclusion of new phenotypes, such as immune response, in breeding objectives. Once a substantial reference population with accurate phenotypes and genotypes has been established, it may be possible to estimate a cow's genetic merit based solely on DNA data.

A genome-wide association study

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(GWAS) evaluates statistical associations in a disease or trait using markers spread across the genome. This study helps identify genetic markers that may be strongly linked to disease resistance or susceptibility, or enhanced immune responsiveness. A GWAS was performed using high- and low-responder cows enrolled in the CBMRN national study. Hair follicles were obtained as a DNA source to perform genotyping using the Illumina Bovine SNP50 BeadChip, a proprietary genotyping product. It can be used for genetic evaluation of trait identification and other tests and studies. Significant genetic variation was found with about 200 markers associated with HIR.

Biological pathways associated with immune response were evaluated, and the antigen processing and presentation pathway was identified. This pathway is crucial for helping the immune system recognize and eliminate potential disease-causing micro-organisms. This suggests cows with low immune responses may have an impaired ability to initiate an effective immune response, making them more susceptible to disease.

In the future, it may be possible to include genetic immune response markers in genotyping programs to help select dairy cattle for enhanced immune response and disease resistance in subsequent generations. *mu*

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