GENOMICS, WHEN COMBINED WITH ULTRASOUND INSPECTION, could be new tools to combat bovine respiratory disease (BRD) and increase accuracy of predictions.

Genetics could reduce bovine respiratory disease

Bovine respiratory disease hinders calf growth, reduces fertility, and diminishes milk production, but genetic selection could be a new tool to thwart the disease.

by Allison Quick

BOVINE respiratory disease (BRD) is a complex issue that affects many dairy calves. With a wide range of symptoms that often mimic other diseases, proper detection and treatment can be difficult.

Although many farmers are proactive in the management of calves to reduce illnesses, BRD incidence has not changed in the past 20 years. BRD not only has short-term effects on calves such as reduced weight gain, but there are also long-term implications. First-lactation cows that experienced BRD as calves have more fertility issues, delayed age at first calving, and about 1,000 pounds less of milk production. These effects can be costly for the farmer.

Quick

The author is a Ph.D. candidate who works with Kent Weigel at the University of Wisconsin-Madison.

Farmers have plateaued the progress in reducing health events with management and environment strategies alone. So, in recent years, animal scientists have begun focusing on the genetics of health and disease predisposition in cattle.

Closely tracked over 1,000 calves

One of the most recent studies, just completed at the University of Wisconsin-Madison, focused on the genetic analysis of BRD and lung consolidation in dairy calves. The reference population contained 1,107 Holstein heifer calves from six southern Wisconsin dairies. These farms were diligent in their calf care protocols, and most calves had genotypes from genomic tests.

Farm selection was based on the farms' genomic testing of calves and their proximity to the university's campus. At 3 and 6 weeks of age, each calf was assessed for BRD. Timepoints were chosen based on prior knowledge of the window of disease susceptibility in calves, which is between 3 and 5 weeks of age.

Calves were observed for BRD prevalence using clinical and subclinical detection tools. This allowed for analysis of the genetic differences between calves with and without BRD and lung consolidation. Previous BRD genomic studies used producer records, clinical scoring systems, or necropsy of lungs at the time of slaughter to identify BRD prevalence for the development of the reference population. The challenge with BRD is that there is no gold standard in disease detection. That creates conflicting results in genetic analyses.

Ultrasound brought clarity

In the present study, the Wisconsin calf health scoring system was used to score calves clinically; the scoring system breaks down five parameters (eye discharge, nasal discharge, ear droop or head tilt, cough, and rectal temperature) into four levels of severity.

Additionally, a lung ultrasound was performed on each calf, using a standard ultrasound machine with a linear rectal probe. This same device is typically used in reproductive evaluations of cows. Once rubbing alcohol was applied to the calf's rib cage, evaluators scanned the rib spaces to view the lungs, searching for the presence of consolidation on the lung surface. An overall BRD classification was assigned to the calf by combining its clinical scores and lung ultrasound score.

New method prevailed

Among the reference population, 18.9 percent of calves scanned at 3 weeks of age had some form of BRD, whereas 22.9 percent of calves were affected with BRD at 6 weeks of age. Low correlations between lung ultrasound scores and clinical scores of calves clarify the need of ultrasound to better detect pneumonia. In developing a reference population, or monitoring BRD in a herd, lung ultrasound with a clinical scoring system was efficient and objective. A team of two trained evaluators could score 50 to 100 calves per day.

Genome-wide association studies (GWAS) allow for the identification of genomic regions and genes that are associated with a trait. GWAS results for the present study indicated several putative genomic regions that contained genes with functions related to respiration, immunity, and growth.

Although there were no similarities in genomic regions between this study and other GWAS BRD studies, there were similarities in functionality between significant genes (mainly in growth and immunity). Contrasts between studies express the importance of having an accurate and consistent way of detecting BRD, and that BRD is a complex disease that is controlled by many different environmental and genetic factors.

Tops other health traits

With a health trait, heritability estimates are expected to be low, as are already observed in previous studies for calf scours (0.045), calf bloat (0.04), mastitis (0.06), ketosis (0.09), and metritis (0.04). Those estimates are based on research teams led by Henderson et al., 2011; Parker Gaddis et al., 2014; and Marti et al., 2018.

In the present study, heritability estimates were higher at 3 weeks of age (between 0.24 and 0.21) than 6 weeks (between 0.08 and 0.11), which indicates that genetics plays more of a role when the calf is younger in protecting it against BRD.

Although reliabilities of predicted genomic estimated breeding values (GEBVs) were low (29.9 percent for BRD at 3 weeks to 12.4 percent for lung consolidation at 6 weeks), it is to be expected due to low reference population size and the novelty and lack of gold standard of diagnosis for the health trait.

Despite low reliabilities, other researchers have found that selecting for calfhood BRD does not significantly affect production traits and is positively correlated with fertility traits. However, BRD is negatively correlated with conformation traits such as stature. With this knowledge, genetic companies are able to add this trait into a selection index without reducing selection pressure for highly desirable production and fertility traits.

However, expansion of the current reference population to more herds and a wider range of A.I. bulls would be needed to verify genomic analysis results and increase prediction accuracy. Eventually, producers could use GEBVs for BRD as a way to flag calves that are more susceptible and, in turn, tailor the management of those calves.

More work needed

In the long term, it would be advantageous to use the criteria of three-week BRD GEBVs. On the other hand, this is not currently feasible as genomic results cannot be processed and obtained within the calf's first week of life to tailor care for susceptible calves. Further work can be done in expanding the current reference population and following the population animals into first lactation to assess future performance.