"An interactive tool to inform Johne's Disease control in beef herds: What test, when and how often"

IMPROVED JOHNE'S MANAGEMENT

PROJECT NO.: ANH.11.18
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BACKGROUND: Johne's disease is a chronic, incurable gastrointestinal disease caused by a bacterium called *Mycobacterium avium* subspecies *paratuberculosis* or MAP. It causes a thickening of the wall of the intestines, reducing nutrient absorption. Generally, calves pick up the infection through colostrum, milk, or contact with manure from an infected cow, but symptoms don't typically show up until years later. Although infected animals may not be showing symptoms, they are often shedding the MAP bacteria in their manure, causing further spread and infecting other animals in the herd. Advanced Johne's manifests as weight loss, chronic diarrhea, and eventually death. Johne's is an animal welfare concern and results in significant economic losses in affected herds. There are no effective vaccines or treatments, and the current diagnostic test do not reliably detect infected animals in the early stages of the disease.

While typically recognized as a problem in the dairy industry, Johne's can and does exist in beef cattle herds in Canada. Prevalence estimates in Alberta in the early 2000s indicated 1.2% of the cows in the provincial herd were infected, with a herd level prevalence of 7.9%. Data from the Western Canadian Cow-Calf Surveillance Network which encompassed sentinel herds in BC, SK, and AB between 2013-2018 indicates prevalence rates of just under 6% of herds and 2% of cows.

OBJECTIVES:

1. Evaluate changes in Johne's prevalence

2. Describe the typical progression of Johne's in infected beef herds and inform control strategies

3. Create a web-based interactive tool to inform Johne's disease testing options in cow-calf herds.

WHAT THEY DID: To examine changes in Johne's prevalence, blood, and fecal samples (n = 3171) were collected from 159 Canadian cow-calf herds. All samples were analyzed using serum ELISA and fecal PCR (in pools of five samples). A subset of 913 fecal samples from positive and negative herds were also tested by individual PCR.

To examine the progression of Johne's in infected beef herds and inform control strategies, positive herds involved in the SK Johne's Disease screening and control program for beef cattle had the option to access additional repeat testing. Prevalence data were collected over a period of seven years from ten

herds and represented a total of 43 annual samples collected from 6119 beef cows, and this data was incorporated into the model.

The creation of the web-based interactive tool to inform Johne's disease testing options in individual cow-calf herds involved incorporating Canadian and regional surveillance and research data into a dynamic risk model. This model simulates different options for managing Johne's disease transmission and control in a particular herd. Differences in test choice (ELISA, PCR, pooled PCR), testing strategies (frequency, number of

animals, etc.), and management practices can be customized to best reflect an individual producer's situation. The interactive tool accounts for the imperfect nature of the current diagnostic tests and the role of chance in disease transmission. In addition, the model can be further adapted and refined as further Johne's data is collected.

WHAT THEY LEARNED: Estimates of true Johne's prevalence vary between eastern and western Canada, with eastern Canada tending to be higher at 3% of animals and 15% of herds, compared to 1% of animals and 10% of herds in western Canada. The ability of the current diagnostic tests to correctly identify infected animals also differs, with individual animal fecal PCR having the highest accuracy, followed by pooled fecal PCR, and finally, serum ELISA.

Perhaps unsurprisingly, cows from herds with dairy cattle on farm, cows with symptoms of Johne's in the past three years, and those with more breeding females were more likely to test positive for Johne's.

The dynamic risk assessment tool created from this project utilizes testing, production, and disease data from Canadian beef herds. The tool allows veterinarians and producers to enter parameters specific to a particular situation and determine how different choices may impact the long-term disease progression and spread, as well as potential costs in terms of disease control, culling and replacement costs. The tool allows the user to customize their herd size and composition, replacement strategy, and starting prevalence of Johne's in the herd. The user can pick what tests they want to use, how often they want to test, what age of animals they want to test and whether they want to target specific risk groups.

More advanced options within the tool provides users with a platform to run the scenarios they want to test multiple times to assess the expected variation in the results due to chance, the variability in how this disease progresses, and the uncertainty related to test performance. It provides graphics to compare the results across different testing and management scenarios. It is also possible to save the inputs and outputs from each model for further analysis.

WHAT IT MEANS: While Johne's prevalence in individual animals seems to be holding fairly steady over the past 20 years, herd prevalence appears to be increasing. This likely means that with time, and without dedicated control efforts, the odds of inadvertently introducing Johne's disease to a clean herd is rising.

The interactive tool provides a means to determine the best control strategy for a particular herd if Johne's is detected.

Learn more about the Johne's Testing Decision Tool

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