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Johne's disease: 2nd in a series Means to an End

To take advantage of certification programs, producers first must test their herds for Johne's disease. But testing can be a complicated process.

by Brad Parker

Conscientious cattlemen want to buy and to sell animals without spreading disease between herds. But Johne's disease — a highly contagious bacterial infection that causes gradual thickening of the intestinal wall, preventing nutrient absorption and resulting in severe diarrhea and emaciation — is frustrating their efforts.

To address the frustration, several states have instituted certification programs by which producers can attest that their animals pose a low risk of carrying Johne's disease. The certifications are based on stringent, ongoing testing.

Kent Smith of Smith Flooring, Mountain View, Mo., says being tested negative for Johne's disease means his customers can feel

safe, knowing with greater certainty that his cattle will not spread the disease to their farms. The Angus seedstock enterprise, now in its second year as a state-certified test-negative herd, also looks at the issue from the buyer's perspective.

"It enables me to go to your production sale or farm and purchase cattle with no fear of huge losses due to disposal of your cattle if they test positive when I bring them home," Smith says.

Judy Stabel, lead scientist of the Johne's disease research project at the U.S. Department of Agriculture (USDA) National Animal Disease Center in Ames, Iowa, says, "There's more of a push these days to assume that responsibility ... and to do the right thing and test [to determine] whether or not you have Johne's disease in your herd."

Stabel admits testing for the disease may carry a negative connotation because other producers might jump to the conclusion that you've had it in your herd and have gotten rid of it. But she believes more cattlemen are becoming proponents of testing.

"The tide is changing," she says. "It may be slow, but it will change."

Mike Collins, a professor of microbiology at the University of Wisconsin School of Veterinary Medicine and a former co-chairman of the National Johne's Working Group (NJWG) subcommittee on certification programs, says only the ill-informed have a negative perception of tested herds.

"I would like to think that producers can promote and advertise that their herd has a test-negative status and that, when it comes time to sell animals, they will get more for their animals because of that," he says.

While a continuing, official certification program offers more prestige and greater levels of confidence, Collins adds that even a single herd test by an accredited veterinarian and an approved laboratory can bring a return on the investment.

"Based on a USDA survey, 92% of U.S. cow-calf operators should get totally negative results by randomly testing 30 animals. So the odds are in their favor," he says. "The cost of testing 30 — including veterinary fees and everything I can think of — is under \$300. That's good insurance you are selling clean stock and not spreading Johne's disease."

"I would like the industry to back this program up," Collins says of testing and certification, explaining there's no need to wait for the government and noting that grassroots disease control has worked in other countries.

Existing options

To take advantage of certification

►Above: Microbiologist Judy Stabel and research associate Jay Ellingson examine an autoradiograph of a *Mycobacterium paratuberculosis*-specific gene cloned at the National Animal Disease Center. The gene is used in an assay to detect the organism that causes Johne's disease.

programs, however, producers first must test their herds for Johne's disease, which can be a complicated process.

There are two basic testing options.

The first is checking for antibodies to the disease in an animal's blood. An enzyme-linked immunosorbent assay (ELISA) can do that in two hours, but you generally can count on a two-day turnaround from you to one of the four USDA-licensed laboratories and back again.

The tests are fairly economical (\$5-\$8/head), but they may produce false positives. Collins says that happens only 1%-2% of the time nationwide, although some herds will have unusually high rates of false positives.

"In using these tests, it's important to use your head," he cautions. "Don't assume that a laboratory test is going to give you yes-or-no, black-and-white answers. ... We need to put affordable tools in the hands of producers, but the tests and disease are complex, so test interpretation requires some expertise."

The second basic option is checking for *Mycobacterium paratuberculosis* — the organism that causes Johne's disease — in fecal samples. Being able to culture the bacteria from an animal's manure is nearly 100% specific.

"We think that the culture, when it's positive, is very rarely wrong," Collins says.

While you can't beat the accuracy, it takes 8-12 weeks to conduct a fecal culture; and, at \$15-\$20/head, it's more expensive than the ELISA. The cost usually precludes it from being used to test an entire herd.

In addition, fecal culture sometimes provides false negatives at the earliest stages of the disease.

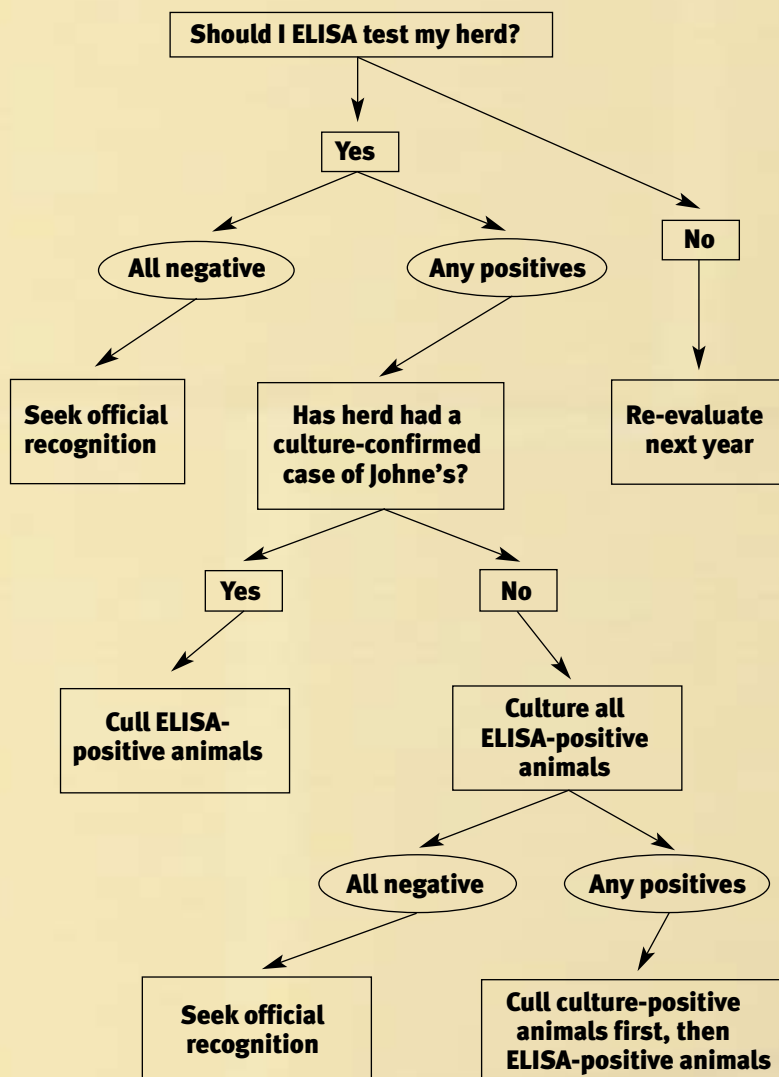
Stabel says the fecal culture probably still is the most definitive test because it can detect subclinically infected animals that are shedding nominal numbers of the bacteria in their feces and also those shedding high numbers. She notes the ELISA only detects animals in the later stages of the disease after it's progressed enough to stimulate an immune response.

Collins adds that the bacteria also can be detected in manure by using a gene probe. That test takes only seven days; but it's even more expensive than, and not as sensitive as, the fecal culture.

Often, the ELISA is used as the preliminary screening tool, followed by fecal culture as a form of confirmation (see Fig. 1). Collins says that program is less than half the cost of doing fecal culture first for most herds.

"Critics will say the testing costs I used (\$10/head for ELISA and \$25/head for culture) are not accurate. It is true that some

Fig. 1: Johne's disease testing options decision tree



Source: www.johnes.org

states heavily subsidize testing. In this case, the comparisons are different," Collins admits. "Other critics will say that the ELISA is missing some fecal shedders, allowing the problem to spread. My counterargument is that culture misses some, too.

"The testing strategy I favor is designed for U.S. beef herds where we believe that 92% are not infected, so the objective is to verify this fact at the least cost.

"Testing options (in known-infected herds) are somewhat different than herd-certification programs. Various combinations of ELISA and culture may be used to control or eliminate the infection from the herd. This is a four- to seven-year effort, and design of the program is unique for each herd.

"The specifics of testing depend heavily

on the herd infection rate, herd-management system, and the level of interest and financial resources of the herd owner. Programs that eliminate the infection faster cost more money. Low-cost programs that may take a little more time are both affordable and effective," he continues, further recommending that only those animals 4 years old or older be tested to help control costs. They're the most likely to be detectable anyway.

Improvements

Those who have been following Johne's disease and the diagnostic tools associated with it may wonder if anything new has been discovered or developed recently.

Society is too accustomed to rapid

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►“The tests we have [for Johne’s disease] are basically as good as the tests we had for tuberculosis and brucellosis,” says Mike Collins, a professor of microbiology at the University of Wisconsin School of Veterinary Medicine.

advancements, Collins believes, blaming the pace set by computer technology.

“This is biology, and I don’t think the magic technical breakthrough is going to happen in the near future,” he says. “The tests we have are basically as good as the tests we had for tuberculosis and brucellosis in cattle, and we succeeded very nicely at controlling and eradicating both those diseases.”

Although no big technological breakthroughs have been made in diagnostics, there have been some advances. Collins believes the biggest improvements have been made in lab proficiency.

He says the NJWG initiated a system in which the federal laboratory sends fecal and blood samples to other participating laboratories for testing, then grades them on their results. That has harmonized the methods and the quality of results and has inspired improvement among the laboratories, Collins maintains. A list of the approved labs is available at www.aphis.usda.gov/vs/mvsl/LabCertification/JohnesSerology2001.HTM.

“I think that has given us a good, stable quality control on test results,” he says. “I encourage producers and veterinarians to use the approved laboratories.”

Stabel says the sensitivity of the existing tests also is being improved continually, but those developments aren’t always publicized because they’re so technical in nature. So

don’t think there’s no progress being made. “We’re moving along, but it is a slow process,” she explains.

On the horizon

The main goals of Stabel’s research are to optimize existing diagnostic tools and to develop new ones by studying host immune responses; to study the effects of pasteurization on *M. paratuberculosis*; and to sequence the organism’s genome in hopes of identifying new antigens for use in diagnosing and vaccinating for Johne’s disease. Mapping the genome also may improve the sensitivity and specificity of the existing tests.

Because diarrhea could be a lot of things, the industry needs a chuteside test (one that requires less than 30 minutes to run). Stabel says such a test that detects antibodies to the disease in whole-blood or blood-serum samples has been developed. While it has a higher sensitivity for subclinical cases, it’s not as specific as (in other words, it results in more false positives than) the ELISA.

Another chuteside test still is in the proprietary research phase, so no data for it are available yet, Stabel adds.

Also cresting the horizon is the gamma interferon assay (IFN-g), an immunologically based test that provides an indirect idea of the probability that an animal is infected. The tool could be especially useful in screening calves less than 2 years old and in estimating the probability that they’re infected.

Stabel is a proponent of the IFN-g, a test for which she has been conducting trials. She says the newer assay can detect Johne’s disease in calves as young as 6 months. When compared to culture results, it picked out the same number of infected animals as the ELISA, but they sometimes identified different individuals.

When the IFN-g and ELISA both are used, 70% of the fecal-positive animals can be identified, Stabel says. “Instead of doing the laborious fecal-culture technique, you could go in and effectively screen your herd with both of these serological tests,” she explains.

The turnaround time would be two or three days, and it would cost \$10-\$15/head to run both tests. “I think it would be an effective screening tool alongside the ELISA,” Stabel adds.

The IFN-g isn’t fully licensed in the United States yet. “That’s problematic because diagnostic labs — even if they

want to use it — would have trouble getting ahold of the kit and couldn’t really incorporate it into their regimen right now,” Stabel explains.

She also says several laboratories, including those at Cornell University and the University of Pennsylvania, are testing a new liquid-medium culture system that takes two to three weeks less than traditional solid-medium cultures.

Then there’s a milk ELISA on the market, but it’s being marketed mainly to dairy producers. Its applications for the beef industry probably are limited.

Don’t wait

Collins says he has hope that even bigger breakthroughs are coming, but he emphasizes that producers shouldn’t wait for them.

“Because of the biology of this disease, my bet is that there is no perfect test,” he says.

Stabel concurs: “You need to tackle this problem up front. You can’t wait for another diagnostic test. You may be waiting a long time because there’s never, in my opinion, going to be one test that says an animal is infected with Johne’s.”

Obviously, producers want the one fastest, cheapest test, she admits, but two tests often are necessary. That’s unlikely to change.

“It’s such a defeating process with the way the host immune response reacts to this disease,” Stabel says. “In the early stages of disease, you get the cell-mediated immune response, then in the later stages of disease, you get the humoral (circulating antibodies) response. Which animals are you trying to catch?”

Collins emphasizes that, while producers wait for the “perfect” test, the disease will keep spreading, and the problem will keep getting bigger. “If we use the tools we’ve got creatively, we can reverse this epidemic right now before it gets bad,” he says, “and it’ll be far less costly to the industry.”



Editor’s note: We’ll address how to prevent and control Johne’s disease in the third installment of this series. Until then, you can find more information at www.usaha.org/njwg.