

Johne's Disease in Sheep

Johne's disease (pronounced "yo-nees") is a contagious, chronic, and usually fatal infection that affects primarily the small intestines of ruminants. Johne's disease is caused by a resistant species of bacteria belonging to the same family as tuberculosis and leprosy and is found all over the world.

Concern about Johne's disease among U.S. owners of ruminant livestock is increasing due to the economic impact of the disease on individual producers and the possible impact on international marketing.

Individual Flock Owners Should Be Concerned

Johne's disease can be an economic drain. Sheep flocks with high rates of infection may lose up to 10 percent of their adult ewes due to wasting (loss of body condition). The disease can require early culling of ewes, on average at 2.5 to 4 years of age. Initially, Johne's disease may show up in older ewes, but as the disease becomes more prevalent in the flock, younger animals begin to show clinical signs. The disease can also cause decreased milk and carcass yield and affect sales of replacement and breeding stock.

What Is Johne's Disease?

Johne's disease, or paratuberculosis, is a chronic bacterial infection caused by *Mycobacterium avium* subspecies *paratuberculosis* (MAP). There are several strains of MAP. The agent seems to change depending on the species it infects. For example, the C or cattle strain in bison has different culture requirements, making it grow slower and be more difficult to culture than the same strain from cattle. The S or sheep strain has been very difficult to culture, and an optimal method for detection has yet to be found for U.S. strains in sheep.

In Johne's-infected sheep, the intestines become thick and less efficient at absorbing nutrients. Affected sheep continue to eat but lose weight and "waste away." Although the disease causes diarrhea in cattle, less than 20 percent of sheep show diarrhea. In up to 70 percent of sheep, the disease may remain at subclinical levels, where individual animals never show signs of the disease but shed the agent in their feces and infect other sheep and contaminate the environment.

Johne's Disease and Humans

The *M. avium paratuberculosis* bacteria—sometimes referred to as MAP bacteria—that causes Johne's disease is not currently known to cause disease in humans, but it has been detected in humans with Crohn's disease, as have numerous other bacteria and viruses. The symptoms for Crohn's disease in humans are similar to the signs of Johne's disease in ruminants. However, no definitive evidence is available proving MAP causes Crohn's disease.

Research from the U.S. Department of Agriculture's (USDA) Agricultural Research Service indicates that commercial pasteurization inactivates MAP bacteria in milk. However, some researchers still have concerns about MAP in undercooked meat, unpasteurized milk products, and water as potential sources of exposure. While MAP remains largely an animal health issue, the risk of human exposure through contaminated food sources creates a quality assurance concern in milk and meat products.

Because of the potential public health concerns related to this disease, animal production industries must give Johne's disease more attention. USDA-APHIS has invested over \$99 million since 2000 to research, develop, and maintain a national control program for Johne's disease.

Other Factors That Cause Wasting in Adult Sheep

Johne's disease often mimics other diseases or problems in sheep such as caseous lymphadenitis abscesses, dental disease, ovine progressive pneumonia, scrapie, nutritional problems, parasitism, and chronic infections of the lung, liver, or kidney. In MAP-infected sheep, concurrent infections may occur because of a weakened immune system. For example, if an individual sheep appears to have a parasite problem in a flock with a good deworming program, Johne's should be investigated as the possible underlying infection actually causing the wasting.

How Sheep Get Infected

Johne's disease is a disease producers "buy into." It usually enters flocks via an infected but outwardly healthy animal that is releasing MAP into the environment through its feces. Lambs are more susceptible than adult sheep, but age resistance can be overcome with higher doses or prolonged exposure. In cattle, MAP has been shown to be passed to unborn calves in utero, and MAP can be found in colostrum and milk.

The same is probably true for sheep. MAP is resistant to heat, desiccation, UV light, freezing, and disinfectants, it can survive in manure in pastures and pond water for up to 11 months.

How the Disease Progresses in Infected Sheep

As with many infectious diseases, there are several stages of Johne's disease. Stage I is silent infection. This stage is usually seen in animals less than 1 year old that show no signs of the disease. At this stage, the disease is not detectable by any tests.

Stage II is subclinical disease. Sheep with Stage II Johne's disease show no signs but may be shedding the agent in its feces. Few sheep disclose the disease in this stage.

Stage III is clinical disease. Sheep with Stage III of the disease eat well but lose weight. At this time, a blood test can detect some infected sheep.

Stage IV is advanced clinical disease. The Stage IV sheep is weak and emaciated, shedding large numbers of the organism in its feces. Sheep will not survive once the disease has progressed to this stage.

Johne's disease is a herd problem. For every clinical case, there may be 10–15 subclinically infected sheep in the flock. This phenomenon is referred to as the "Johne's iceberg." The number of observed cases is just the tip compared to the number of subclinical (or incubating) animals in the flock.

How To Determine If Your Sheep Are Infected With MAP

To determine whether your sheep are infected with MAP, you will need to combine history, clinical signs, and test results. Tests include:

- **Fecal or tissue culture** (usually from tissues obtained at necropsy). Culture of the sheep strain has been difficult, detecting less than 12 percent of infected sheep. New methods, which use liquid culture media and real-time PCR (polymerase chain reaction), are currently being validated and will greatly improve the sensitivity of cultures.
- **Tissue histology.** The presence of acid-fast bacteria and lesions typical of Johne's disease found on tissues obtained at necropsy can help with the diagnosis.
- **Blood tests.** The agar gel immunodiffusion (AGID) test is currently the blood test of choice for diagnosing Johne's disease in sheep. This test can be used to diagnose disease in individual animals or to screen a flock of sheep for Johne's disease. The test works best in sheep at Stage III and IV (finding 85–100 percent of infected animals) and has a low rate of false-positive reactions. Most of these false positives are cross-reactions due to caseous lymphadenitis infection. Electroimmunosorbent assay

(ELISA) tests for Johne's disease in cattle have been adapted for diagnosing the disease in sheep. However, the use of ELISA tests is also limited due to cross reactivity to caseous lymphadenitis.

Do I Need To Test All My Sheep?

Flock screening using targeted testing can determine if you have a problem in your flock. One-quarter of the flock is tested, beginning with sheep that have the lowest body conditioning scores. Targeted testing saves on costs while involving the animals most likely to be infected.

Sheep positive on the AGID test should have their status confirmed with fecal culture or tissue culture because false-positive AGID reactions can occur. Until fecal culture for sheep strain becomes available in the United States, histology is the definitive or confirmatory test. Alternatively, the AGID could be repeated in 8 to 10 weeks. Most cross-reactive antibodies will disappear in that period of time.

Most MAP-infected AGID-positive sheep do not revert to a negative status. If the AGID test discloses a positive result, confirmation by histology should still be pursued to rule out other sporadic infections, such as *Mycobacterium avium*.

What If I Don't Think My Sheep Have Johne's Disease?

Consider testing your flock, perhaps with the screening method above. If your sheep test negative, take steps to protect your flock's status. Make sure your lambs kept for replacement do not get exposure to adult manure, even at shows and on trailers. Before buying new sheep, inquire about the disease status of the source flock. Ask that the 25 percent of the flock with the lowest body-condition scores be tested before purchasing replacement animals from that flock.

What If My Sheep Do Have Johne's Disease?

There is no treatment for Johne's disease, and a vaccine for sheep is not available in the United States. (Vaccines currently available in other countries do not prevent new infections but do reduce shedding of MAP into the environment.) However, flock-cleanup plans can reduce the prevalence of infection in your flock and eventually eliminate the disease. Work with your flock veterinarian to develop a flock-cleanup plan specific to your operation, abilities, and goals.

Management changes alone can decrease the prevalence of infection in a flock and reduce associated losses. These changes include using milk replacer and reducing exposure of lambs to adult manure. Flock cleanup is often possible with management changes and institution of a test-and-cull program. Prevalence reduction can be achieved in

several years, but complete cleanup may take 7 years or longer due to the chronic nature of the disease and difficulty in diagnosing animals infected at subclinical levels.

Plans to Address Johne's Disease in U.S. Sheep

The U.S. sheep industry is concerned about Johne's disease and has begun to develop a test-negative program through the efforts of the United States Animal Health Association's Small Ruminant Committee. USDA is working with several other agencies and universities to develop and validate the technology to culture the S strain of MAP.

For any Johne's disease-reduction program to be successful, all laboratories testing animals for MAP must be performing at the same level to provide increased confidence in the test results. Laboratories can currently be approved to conduct tests for the disease in cattle by passing a check test from USDA's National Veterinary Services Laboratories (NVSL). NVSL plans to offer such testing for sheep in the future once tests are validated.

For More Information

If you would like to know more about Johne's disease control and prevention, contact:

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