NVAP Reference Guide: Johne’s Disease (Control and Eradication)

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Johne’s disease is a contagious, chronic, and usually fatal infection that affects primarily the small intestine of ruminants. Johne’s disease is caused by *Mycobacterium avium* subspecies *paratuberculosis* (*M. avium* subsp. *paratuberculosis*), a hardy bacterium related to the agents of leprosy and TB. Johne’s disease is found worldwide.

Based on the 2007 Dairy NAHMS study, about 68 percent of U.S. dairy herds have at least one cow that tests positive for Johne’s with herd prevalence approaching 100% in large dairy herds. Because few herds have instituted biosecurity programs, infection continues to spread. Although infection seems less widely distributed in beef and goat herds and sheep flocks, Johne’s is nonetheless of critical significance to all producers.

Johne’s disease can have severe economic impacts on infected herds. It is imperative that U.S. herds and flocks employ safeguards against becoming infected. Identifying and protecting noninfected herds and flocks will provide a source of breeding stock and replacement animals for others and help to reduce the national prevalence of the disease.

Clinical Signs and Stages

In cattle, signs of Johne’s disease include weight loss and diarrhea with normal appetite. Several weeks after the onset of diarrhea, a soft swelling may occur under the jaw. This intermandibular edema, or “bottle jaw,” is due to protein loss from the bloodstream into the digestive tract. Animals at this stage of the disease will not live very long—perhaps a few weeks at most.

Signs are rarely evident until 2 or more years after the initial infection, which usually occurs shortly after birth. Animals exposed at an older age, or exposed to a very small dose of bacteria at a young age, are not likely to develop clinical disease until they are much older than 2 years.

In sheep and goats, the clinical sign are harder to spot. 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. In goats, weight loss, poor performance and occasionally clumpy feces are all that is seen. Affected animals usually show sign before they are 1 year of age.

Johne’s Disease is Generally Described as Having Four Stages

Stage I: Silent, subclinical, nondetectable infection

Typically, this stage occurs in calves, heifers, and young stock under 2 years of age or animals exposed at an older age. Current tests (including fecal culture and serological tests) cannot detect infection in animals that young. Research to develop new tests to detect the disease in such animals is ongoing. This stage progresses slowly over many months or years to Stage II. It is possible that some animals recover from this early phase of infection.

Stage II: Subclinical shedders

This stage usually occurs in heifers or older animals. Animals appear healthy but are shedding *M. avium* subsp. *paratuberculosis* in their manure at levels high enough to be detected. Current blood tests are not reliable to detect Johne's in animals at this stage. These animals pose a major but often hidden threat of infection to other animals through contamination of the environment. Stage II animals may or may not progress over time to Stage III.

Stage III: Clinical Johne's disease

Animals in this stage have advanced infection, and clinical signs are often brought on by stress. Clinical signs at this stage include acute or intermittent diarrhea, weight loss despite a normal appetite, and decreased milk production. Some animals appear to recover but often relapse in the next stressful period. Most of these animals are shedding billions of Johne's-causing organisms, and fecal organism detection tests give positive results. Many animals are positive on serologic tests as well. Clinical signs may last days to weeks before the animals progress to Stage IV.

Stage IV: Emaciated animals with fluid diarrhea

This is the terminal stage of the disease in which animals become extremely thin and develop bottle jaw. Animals culled to slaughter in this stage may not pass inspection for human consumption due to disseminated infection.

In the typical herd, for every animal in Stage IV, many other cattle are infected. For every obvious case of Johne's disease (Stage IV) among dairy cattle on the farm, 15 to 25 other animals are likely infected. The clinical case represents only the "tip of the iceberg" of Johne's infection.

In other ruminant species, the progression of the disease may occur more rapidly with weight loss as the only visible sign of infection.

Epidemiology

Johne's disease usually enters a herd when healthy but infected animals (Stage I or II) are introduced. Cattle are most susceptible to the infection in the first year of life. Calves most often become infected by swallowing small amounts of infected manure from the calving environment or udder of the cow. In addition, calves can become infected while in the uterus or by swallowing bacteria passed in milk and colostrum.

Studies have shown that up to 25 percent of calves are infected in utero if the cow is in Stage III of the disease. Calves may become infected by exposure to contaminated manure any time in the first year of life (e.g., from manure splatter to calves raised near adult cows).

Cattle of any age can become infected, though some age resistance does occur. This age resistance can be overcome by high doses of bacteria over time from sources such as manure-contaminated feed bunks or water sources. All ruminants are susceptible to Johne's disease. In addition, all infected animals shed the organism through feces, thereby creating a possible route of exposure.

Diagnosis

In the live animal, fecal organism detection tests (culture and polymerase chain reaction methods (PCR)) are the most accurate diagnostic test. However, on a herd basis only about 40 percent of infected cattle will be disclosed by even the most sensitive fecal culture technique. The sensitivity of fecal culture is low because some infected cattle (Stages I and II) do not shed the agent in their manure or because some animals shed the agent only intermittently and can be missed at testing time.

In addition, *M. avium* subsp. *paratuberculosis* is a slow-growing organism. Fecal culture on solid media requires 12 to 16 weeks for results. New liquid culture systems have reduced this time to as little as 5 weeks. PCR methods can detect the presence of *M. avium* subsp. *paratuberculosis* without its having to be grown. The test has the advantage that it takes less than 3 days and may not be affected by strain variations but has the disadvantages of higher cost and the potential of missing animals shedding only low quantities of bacteria.

Various serologic tests, including ELISA, agar-gel immunodiffusion (AGID), and complement fixation, detect antibody in the serum and can be used on a herdwide basis to screen for infection. Although less accurate than fecal culture, these tests are more rapid and less expensive. Serologic tests also work well to confirm clinical cases.

It is important to note that, as an accredited veterinarian, you should use only the USDA- licensed ELISA tests and USDA-approved laboratories.

In the dead animal, Johne’s disease may be diagnosed by culture and histopathology of the lower small intestine and associated lymph nodes.

Johne’s Disease Control Program

VS’ goal is to curtail the spread of *M. avium* subsp. *paratuberculosis* to noninfected herds and to reduce the disease prevalence in herds currently infected. To accomplish this goal, VS has developed a cooperative Federal–State–Industry program that provides producer assistance by performing risk assessments for *M. avium* subsp. *paratuberculosis* transmission and developing herd-management plans to mitigate those risks.

VS is also working to provide funding for research to develop and validate control measures. Moreover, VS coordinates State activities and monitors current levels of infection in the United States.

State Governments and Tribal Councils participate by providing personnel to conduct risk assessments and aid in the development of herd-management plans. Depending on funding available, these agencies also help producers by supporting testing at reduced fees and underwriting other direct program costs. Industry cooperates by encouraging producers to participate in the program through information provided in industry journals and consultation with APHIS and professional societies.

To work with the Johne’s Disease Control Program as an accredited veterinarian, one must first become a Johne’s Certified Veterinarian. Johne’s Certified Veterinarians have received additional education on the disease and have demonstrated to the State-Designated Johne’s Coordinator that they can

1. Develop approved herd-management plans;
2. Provide appropriate Johne’s disease risk assessments;
3. Understand Johne’s disease epidemiology, testing, and test interpretation;
4. Understand State and Federal program requirements; and
5. Collect and submit fecal, tissue, and blood samples for Johne’s disease testing.

Johne’s Certified Veterinarians must provide Johne’s risk assessments and develop herd- management plans and collect and submit samples according to the program requirements.

For information on Johne’s Certified Veterinarian training in your state, please contact your State animal health official or your APHIS –VS Area Offices.

For further information on the Voluntary Bovine Johne’s Disease Control Program, please go to: Johne's Disease Information

Prevention

For herds that are not infected, managers should take precautions against introduction of Johne’s disease. Such precautions include keeping a closed herd or requiring that replacement animals come from test-negative herds. Some States offer Johne’s certification to test-negative herds. The new Uniform Program Standards for the Voluntary Bovine Johne’s Disease Control Program (APHIS 91–45–014) outline a new, voluntary national Johne’s classification program that helps to identify risk of infection in participating herds.

The Johne’s Program Standards can be found on the Web at: Johne's Program Standards

The key to preventing Johne’s infection is to know that

- Herds get infected only when infected animals are added to the premises;
- Prepurchase testing for Johne’s disease is today’s standard of veterinary practice; and
- Testing the herd of origin is much more reliable than testing only the purchased animals.

Table 2 outlines options (in order of decreasing risk) of buying *M. avium* subsp. *paratuberculosis*-infected animals.

Options	Risk
No testing.	Very risky—>5% percent chance, for each purchased animal of being infected with *M. paratuberculosis*
ELISA-test the individual animal before purchase; do not purchase anything from herds with cows positive by ELISA	Slightly less risky than not testing; more confidence in negative tests on older animals than heifers
Quarantine and test after purchase: ELISA + culture twice at 6-month intervals	Lowers risk and is sound policy for several infectious diseases of cattle

Options	Risk
Partial test on herd of origin: ELISA on 30 2nd lactation or older cows	Low risk of Johne's disease in any animal from such herds but not 0%
Whole-herd ELISA or fecal culture on the herd of origin.	Very low risk of Johne's disease if herd tests 100% ELISA-negative or culture-negative
Purchase only from test-negative status herds (level 2 or higher)	Lowest possible risk for purchase of *M. paratuberculosis*-infected herd replacements

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