



“Johne’s Disease” and the Iowa Johne’s Control Program 2008

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Johne’s disease:

What is Johne’s disease?

- First described by a German veterinarian, Dr. Johne, in 1895.
- “Yo-knees” also called Paratuberculosis since cattle with tuberculosis and Johne’s looked similar.
- A contagious, chronic and eventually fatal infection that affects primarily small intestine of ruminants (including cattle, sheep, goats and wild ruminants) and a few reports of nonruminants.
- It is a slow progressive wasting disease (incubation period of usually 2 or more years).

What is the cause of Johne’s disease?

- *Mycobacterium avium ss. paratuberculosis* (MAP) – a bacterium that has a tough waxy cell wall which makes it resistant to disinfectants and the environment.
 - Same genus of bacteria responsible for tuberculosis (TB) and leprosy.
 - Can survive on soil or in water for >1 year.
 - Resistant to heat or disinfection than E. coli.
 - Does not grow outside the animal. Obligate parasite.

What are clinical signs of Johne’s disease in cattle?

- Varies with stage of infection, stress and other factors including:
 1. Age when exposed – calves (especially < 6 months) are most susceptible.
 2. Immune system status.
 3. Dose of exposure – frequency and number of bacteria (~1 million can cause infection in susceptible animal).
 4. Stress, diet, and other management factors.
- May be in apparent or subclinical for several years due to long incubation period.
 - Animals that look clinically normal can shed millions MAP organisms/day!
 - Shed more MAP when stressed (especially before and after calving...)
- Diarrhea – non-responsive to treatment, severe, watery and chronic in later stages.
- Weight loss – generally rapid in later stages (symptoms similar to parasitic/“hardware” cases).
- Normal appetite and usually no fever.
- Drop in milk production - direct correlation with level of shedding (heavy shedder = lower MP).
- Lower calf weaning weights.
- Decreased salvage value/ increased cull rates.
- May affect conception rates and predispose to other diseases.

What are the typical stages of Johne’s disease?

- **Stage I** [Initial] Animal is infected, but no clinical signs and may be shedding but not detectable by routine diagnostic testing.
- **Stage II** [Subclinical] Infection is progressing, still no clinical signs, but is shedding in moderate to high numbers. This stage is may be detectable by fecal culturing but blood tests unreliable.
- **Stage III** [Clinical] Animal is showing early signs of the disease and infection is detected by many diagnostic tests. MAP may cross through to placenta to calf (in utero transmission) and to other organs in this stage. Stress may prompt early clinical signs. Can shed 1 billion organisms/day!
- **Stage IV** [Advanced] Obvious clinical disease and readily detectable by most diagnostic testing.

What is the “**Iceberg Phenomenon**” (*what lies beneath the surface*) involving Stages of Johne’s disease.

- Noticing **one animal with obvious disease in Stage IV** would indicate that there are several **other unnoticeable animals** in the earlier stages of Johne’s infection.

What causes signs of Johne’s disease?

- Bacteria are ingested; invade the Peyer’s patches of ileum and their macrophages.
- The animal’s immune system attacks the bacteria without success and disease slowly develops. Generally takes years to develop clinical signs (long incubation periods of 2-10 yrs.). Infected animal can be shedding before clinical signs or blood titers appear.
- Progressive thickening of the intestinal lining from the chronic inflammation/infection results in poor absorption of nutrients, followed by protein leakage into the gut lumen causing severe diarrhea eventually death.

What are the routes of infection with Johne’s disease?

- Fecal – oral transmission is most common.
- Milk or colostrum from infected/ shedding cows (usually later stages).
- In-utero infection from infected dams in later stages of infection.
- Semen from infected bulls is possible, but unlikely.

What are the most common diagnostic tests available for Johne’s disease?

- Direct or organism-based detection tests: detects the bacteria (are **official Johne’s disease tests**)
 1. Fecal culture – grows organism from manure sample. (~60% sensitivity)
 - “Gold standard” for diagnosis and Liquid culture method more rapid than previous solid culture. (Heavy/Super shedders detected in ~7-10 days)
 - PCR– detects genetic material unique to the bacteria present in feces (~40% to 80% sensitivity). Questionable detection of low shedders with some PCRs.
 - Quick (2-3 days) but expensive. *(one updated PCR version claims >80%)
- Indirect or antibody tests: detects immune response to infection (response may be delayed ~ years and infected animals vary in response).
 1. ELISA : Serum or milk antibody titer test (~30% sensitivity).
 - Fast (hours) and inexpensive but not as sensitive.
 - Issues with false positives & false negatives and vaccination titer differentiation.
 2. Other tests - include CF, AGID, Gamma interferon, and Johnin (PPD) skin tests.

What do test results mean?

- All tests have different “probabilities” of being accurate.
- ELISA tests detect antibodies to MAP but not all animals respond equally and antibody titers may not become detectable until late in course of disease.
- ELISA results are reported in numeric values in regards to S/P ratios (Sample test result compared to the Positive control test result) in short to classify as negative suspect, weak positive, positive and strong positive. This S/P number can be correlated to likelihood ratios, and could be used for culling strategies and correlation to Johne’s prevalence and fecal shedding issues.
- Liquid fecal results can be reported in “Days to Positive” and this has a direct relationship in the differentiation of high, medium and low shedders.
 - A new category of infected animals have been identified as “super shedders”
 - One “**super-shedder**” can shed Johne’s bacteria in amounts equal to:
 - 160 “heavy” shedders or 2000 “moderate” shedders
 - **20,000 “low” shedders!**

*Remember some animals may be shedding MAP with **no** clinical signs and **no** elevated titers.*

In early stages of JD, infected animals may not be readily detectible with ELISA, fecal culture or PCR..

Generally speaking, infected animals will shed fecal organisms before an ELISA titer is detectable.

What if an animal shows **positive** to an ELISA or a fecal test?

- ELISA tests are reported numerically – a **positive ELISA** classifies a program herd as infected, but the ELISA test positive animal is considered a suspect. It is recommended that the suspect animal be confirmed by fecal culture unless the Johne's has already been confirmed on the premises.
- A **positive Fecal** or **PCR** is an organism-based test which is an official Johne's disease (JD) test and designates the affected animal as **infected** and is handled in accordance to state-federal regulations:
 1. A **positive fecal or PCR** is to be reported to the Department of Agriculture and Land Stewardship (IDALS). Johne's disease is a reportable but not a quarantineable disease.
 2. The **infected animal** is **restricted to the premise** it was found.
 3. The infected animal is **identified with a C-punch** in right ear (by district veterinarian)
 4. The infected identified animal can moved for the **purpose of slaughter only** and must be accompanied by an owner-shipper statement delivered to consignee.
 5. An official JD test positive animal's status may be appealed within 30 days of report, but is subjected to additional and extensive testing.

What are the usual methods of Johne's disease control?

- No effective treatment.
- There are three basic parts of a Johne's control program for most herds:
 1. **Management** practices to avoid transmission to herd replacements.
 - the young (especially < 6 months) calf is most susceptible
 - manure and milk/colostrum management is important
 - for known-infected herds; **vaccination** with approval from State Veterinarian
 2. **Testing** to identify the adults most likely to spread the infection and judicial culling.
 3. **Prevention** of Johne's introduction thru outside sources:
 - Introduction of Johne's can occur when a healthy-looking, but infected, animal is brought into a herd (consider purchasing from "low-risk" herd or pre-purchase testing of herd additions).
 - While most cattle get infected as calves, if the dose of MAP is high enough or older animals are stressed, they can become infected.
 - Avoid contamination of feed, water, range, or bedding with MAP containing manure (this could include infected manure from other non-cattle ruminants).

What role does **vaccination** play in management of Johne's?

- Vaccination can be a valuable management tool, especially teamed with above elements.
- Vaccination can reduce and help prevent:
 - clinical signs and gross lesions
 - fecal shedding (reduce the number of organisms shed and length of time shedding occurs)
 - infection rates (imparts CMI response necessary in Johne's disease immunity)
- Vaccine is available thru Iowa Department of Agriculture and Land Stewardship:
 - for use in known infected herds (positive organism-based test)
 - approval granted by permission of State Veterinarian
 - whole herd TB test and testing of herd additions is required
 - for use in calves 1 - 35 days of age and administered by an accredited veterinarian
 - vaccinated calves are tattooed and identified (record of vaccination is submitted to IDALS)

Iowa Johne's Disease Control Program:

Three basic components:

1. **EDUCATION:** Provides for education of producers and veterinarians about Johne's disease and risks of JD - Awareness is Key!
2. **MANAGEMENT:** Establishes an individualized management plan for each operation to minimize risks of contracting or spreading JD. An "on-site" Risk Assessment (walk-thru) evaluation of producer's operation is the initial step in determining Johne's exposure and to develop a Herd Management Plan and testing and/ or vaccination strategies.
3. **TESTING and herd classification:** Testing of specified animals to obtain JD prevalence and herd classification level.

- **Voluntary participation**
- **Test results are confidential within limits of Iowa law**

Incentive element* of program:

* **Limited funding is available** for herd owner lab fees at Iowa State University Veterinary Diagnostic Lab as described below, but is affected by Program funding and is subject to change and at the discretion of the Designated Johne's Coordinator.

- The first step is to complete a **free Johne's Risk Assessment/ herd management plan** on your client's operation preformed by your state District veterinarian (certified Johne's veterinarian). Herd veterinarian participation is strongly advised and encouraged.
- Next, if testing is desired, the herd owner may choose from the following three testing options to meet Program standards for herd classification. *The District veterinarian will suggest the testing option that best suits the operation, and discuss testing strategies.* The following Program options available for Herd Status component are:
 1. **Blood ELISA testing** – 30 or more animals (3 yrs. old and older - random sampling)
 2. **Fecal Pooling testing** – 50 animals (3 yrs. old and older – random sampling) ISU will pool.
 3. **Environmental sampling** (*for Dairy herds only and performed by District Vet*) - This type of testing is used only for dairy herds, in order to discover whether there is Johne's disease present in the herd. Manure samples are collected from key areas of the animal housing facilities, and these samples are pooled. This sampling is conducted by the District veterinarian.

Johne's National Herd Status Program: The above testing programs may help to put your client's herd on track for one of USDA's two Johne's Herd Status Programs, if they choose to participate:

- **Test-Negative Herds** - with a negative test the herd could qualify for the Test-Negative Status classification, where annual testing moves the herd toward a recognized higher status level (lower risk for transmission of JD).
- **Test-Positive Herds** - may advance in the Herd Status Program by showing gradual improvement in annual testing results, with the goal of reducing/elimination Johne's in the herd.

Participation in the Johne's Control Program is completely **voluntary** and the **confidentiality** of test results will be maintained within the limits of Iowa law.

Johne's Disease – 10 Key points to remember:

- 1. Johne's disease is a reportable, NOT quarantineable disease!**
- 2. Spread primarily thru:**
 - MANURE
 - Colostrum/milk
 - Placenta to unborn calf
- 3. Chronic progressive disease with a long incubation period**
 - may be hidden for years within herd
 - **'Insidious'** disease: gradual development and becomes a well established infection before clinical signs appear!
- 4. Affects economics of the operation and eventually ends in the animal's death!**
- 5. NO effective treatment!**
- 6. Subclinical animals can shed millions of organisms thru normal-looking manure!**
 - infected "healthy-looking" animal can be shedding before clinical signs or positive testing results appear!
- 7. Younger animals most susceptible (<6 mos. of age).**
- 8. Vaccination can be a valuable management tool in infected herds:**
 - Reduces clinical signs
 - Decreases infection rates
 - Reduces fecal shedding
 - Improves production
- 9. Reduce risk of disease:**
 - Buy low risk bulls and replacements
 - Manure management
 - Use practices to reduce transmission to young calves
 - Test and cull aggressively
- 10. The [Iowa Johne's Disease Control Program](#) is completely voluntary and the confidentiality of the test results will be maintained within the limits of Iowa law.**

* (Incentive payments for lab testing are subject to change and limits of Program funding)

For more information please contact [\(IDALS\) Dr. Randy Wheeler @ 515 - 281- 0866](#)

Sources/ references:

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Dr. Kris Clothier, Iowa State University
 Dr. Mike Collins, University of Wisconsin
 Dr. Franklyn Garry, Colorado State University
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 Dr. Don Hansen, Oregon State University