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Johne's Disease in Beef Cattle[1]

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Paratuberculosis, also known as Johne's disease (pronounced "Yo-knees"), is an infectious, chronic, and often fatal disease. The disease primarily affects cattle and other ruminants. Johne's disease causes a gradual thickening of the intestines that reduces nutrient absorption and results in weight loss, diarrhea, and eventually death. The disease is named after the German veterinarian H. A. Johne, who first described the disease in 1895. The economic cost of Johne's disease is substantial due to delayed establishment of pregnancy and even failure during the breeding season, reduced weaning weights, and loss or culling of cows before operations have recouped production costs. Beef cattle in the US and specifically in Florida are still at risk of acquiring this disease. Therefore, this publication aims to inform ranchers, ranch workers, Extension agents, cattle owners, livestock-agricultural students, and interested residents about important Johne's disease facts.

USDA survey data (USDA APHIS 2020) suggest that 7.9% of beef cattle herds have one or more positive cows. The survey also found that 92% of beef producers were either unaware of Johne's disease or recognized the name but knew little about it. According to data from the Johne's Testing Center, in 2017, 18% of samples submitted from beef cattle herds tested positive for *Mycobacterium avium* subspecies *paratuberculosis* (MAP). It is believed that Johne's disease is far more common in beef cattle than most people realize, especially considering the lack of updated surveys evaluating the current prevalence of this disease in the US.

Johne's disease is caused by the bacterium *Mycobacterium avium* subspecies *paratuberculosis* (MAP). This bacterium is closely related to bacteria that cause tuberculosis in cattle and humans. Calves, except under unusual circumstances, are infected early in life through exposure to colostrum, milk, or manure from a Johne's disease-infected cow. However, signs of the disease do not become apparent until years later. In the meantime, subclinical cattle (infected animals that do not exhibit clinical signs) are shedding bacteria, primarily in feces, and increasing the risk of disease transmission for other young stock. MAP typically harbors and multiplies in the small intestine. MAP can also be spread to areas outside the intestine, such as the uterus, lymph nodes, udder, and reproductive organs of bulls, and may be shed via milk or semen. While MAP does not multiply outside the host animal, it may survive a year or more in most moderate environments. Ultraviolet, heat, and drying can destroy MAP.

Clinical Signs

Johne's disease-infected cattle usually exhibit clinical signs between 2 and 12 years of age or even later. Because the thickening of the intestinal wall reduces nutrient absorption, the animal develops diarrhea. The diarrhea is mild at first, then becomes severe. Diarrhea may be intermittent at the onset of clinical signs. The animal will start to lose

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significant weight. Infected cattle exhibiting clinical symptoms do not respond to treatment. Increased appetite may occur initially, but it usually progresses to anorexia (lack of appetite). In time, animals become very thin, weak, and lethargic. If not culled, they will become too weak to stand, lie down, and die.

Diagnosis

As with all diagnostic tests, false positive and false negative results can occur; thus, whole-herd testing is strongly recommended if any animal in the herd has been diagnosed with Johne's disease. Diagnostic tests for Johne's disease will identify MAP, or antibodies to MAP, that cause the disease.

Culture tests and polymerase chain reaction (PCR) tests are used to detect the presence of MAP. Culture tests isolate the bacterium from feces, manure, tissue, or environmental samples. PCR looks for MAP's DNA in feces, intestinal content, or tissue samples (including from biopsies, specimens, and/or necropsy).

Culture tests can take up to four months because MAP grows slowly. While samples from heavily shedding animals can be detected more quickly, the laboratory may require additional weeks of incubation before reporting a sample as negative. Manure samples from multiple animals can be pooled to reduce testing costs; however, any positive pools must be tested individually to find the shedding animal. It is highly advised to collect and submit individual samples to the laboratory and discuss the possibilities, benefits, challenges, and appropriate situations for pooling samples before a test.

Due to higher sensitivity (i.e., capacity to identify the true positive animals) and rapid turnaround in the laboratory, direct and pooled PCR has become the test of choice for organism detection. A direct PCR test looks for the MAP genetic material, usually in a fecal sample. This is a much faster test, and results are available in a matter of days. Pooling samples for PCR testing is typically more cost-effective and can be performed only at the laboratory; however, as with culture, any positive pools must be tested individually. The producer, veterinarian, and lab personnel need to discuss whether pooling is appropriate for the herd in question.

There are two types of tests that look for antibodies in the blood of the animal: the enzyme-linked immunosorbent assay (ELISA) and the agar gel immunodiffusion assay (AGID).

The ELISA test is best used as a herd test. It is a way to test large numbers of samples and keep costs down. This will give an indication of the incidence of infection in a herd. ELISA results are numeric; generally, the higher the number generated by the test, the more likely the animal is infected and shedding. However, ELISA testing can produce false positives that are best confirmed by retesting in a few weeks or confirming with a fecal PCR.

Testing samples should be submitted to a laboratory approved by the National Veterinary Services Laboratories (NVSL) to perform the specific test. When designing a diagnostic strategy for an animal or group of animals, the best procedure is to confer with the laboratory and your veterinarian. Many factors are involved in deciding which diagnostic plan is appropriate. Table 1 outlines recommended test regimens by a consensus of veterinarians published in the *Journal of the American Veterinary Medical Association*.

The Florida Department of Agriculture & Consumer Services Bronson Animal Disease Diagnostic Laboratory (BADDL) offers diagnostic services to Florida beef cattle producers and veterinarians. The lab offers a Johne's disease ELISA test and the Johne's disease individual or pooled PCR test. For additional information on these services, including instructions for sample submission, visit https://fdacs.gov/baddl.

Treatment

There is no cure for Johne's disease. Treatment of livestock may only slightly reduce clinical signs and is cost-prohibitive. To minimize Johne's disease, producers are encouraged to focus on the prevention of this incurable disease.

Prevention

Preventing and reducing Johne's disease transmission requires a combination of management practices to avoid introducing infected cattle, colostrum, or manure into the operation.

For herds that are not infected, beef producers should take precautions to prevent the introduction of Johne's disease to the herd. Such precautions include keeping a closed herd or requiring that replacement animals come from test-negative herds. Limiting the transfer of MAP infection from cows to calves is critical and requires consistency and persistence. MAP is most commonly spread through manure. Therefore, taking measures to avoid manure contamination in feeding

equipment, bunks, and water sources is a best management practice.

Infection occurs only in calves. Calves need to be protected from infection by being born and raised in a clean environment. The MAP organism can live for up to a year in the soil. Tilling the pasture soil prior to calving can destroy the bacteria and reduce the risk of infection at calving. Only allowing MAP test-negative cows into calving pastures will also reduce infection risk.

Producers should work with a trained veterinarian to examine the herd's Johne's disease history, conduct a risk assessment of current management practices related to the spread of MAP, and develop a plan to implement the most appropriate measures to minimize Johne's disease in that particular herd.

Most importantly, producers should cull all cattle that test positive (via bacterial culture and/or PCR, as shown in Table 1) to prevent the spread of the disease, including their calves.

Summary and Conclusion

The presence of Johne's disease in a beef cattle herd can cause substantial economic losses as a result of premature culling, with lower slaughter value, higher replacement costs, reduced weaning weights, reduced feed efficiency, poor fertility, and increased susceptibility to other health problems. Preventing Johne's disease has broad benefits. Management changes that decrease the risk of Johne's disease will also reduce exposure to other, more common calfhood diseases (particularly calf scours), improve the effectiveness of vaccines against calfhood diseases, and improve overall herd health, performance, and efficiency. In conclusion, it is important that beef cattle producers work with their veterinarians to assess infection risk in their herd as well as management strategies to prevent infection.

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Table 1. Recommended test regimen for the detection of Johne's disease (JD) in beef cattle based on herd type and testing purpose.[1]

Testing Purpose	Seedstock	Cow-Calf
Confirm a clinical diagnosis in a herd with no prior confirmed JD cases	Biopsy specimens, necropsy, bacterial culture, or PCR assay—individual animals	Necropsy, bacterial culture, or PCR assay—individual animals
Confirm a clinical diagnosis in a herd with prior confirmed JD cases	Biopsy specimens, necropsy, bacterial culture, or PCR assay—individual animals	ELISA, bacterial culture, or PCR assay—individual animals
Control disease in herd with known infection, high prevalence, and clinical disease; owner is concerned	Bacterial culture or PCR assay—individual animals	ELISA
Surveillance (estimation of biological burden)	Not recommended	Bacterial culture or PCR of clinically suspect animals
Eradication	Bacterial culture or PCR—individual animals	Bacterial culture or PCR—individual animals

[1] "Consensus Recommendations on Diagnostic Testing for the Detection of Paratuberculosis in Cattle in the United States," Michael T. Collins, DVM, PhD, DACVM; Ian A. Gardner, BVSc, MPVM, PhD; Franklyn B. Garry, DVM, MC, DACVIM; Allen J. Roussel, DVM, MC, DACVIM; Scott J. Wells, DVM, PhD, DACVPM; *JAVMA* 229 (12), December 15, 2006.